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PREFACE

These PROCEEDINGS of the 62nd Annual Meeting of the Southern Weed Science Society contain papers and abstract of presentations made at the joint meeting of the Southern Weed Science Society and Weed Science Society of America in Orlando, FL. A list is also included giving the common and trade or code names, chemical names and manufacturers of all herbicides mentioned in the publication. Other information in these PROCEEDINGS includes: biographical data of recipients of the SWSS Distinguished Service, Outstanding Educator, Outstanding Young Weed Scientist, and Outstanding Graduate Students awards; the RESEARCH REPORT; lists of officers and committee members; minutes of all business meetings; and lists of registrants attending the annual meeting, sustaining members, charter members, and contributors to the SWSS Endowment Foundation.

Only papers presented at the meeting and submitted to the Editor in the prescribed format for printing are included in the PROCEEDINGS. Papers may be up to five pages in length and abstracts are limited to one page. Authors are required to submit an original abstract according to the instructions available in the "Call for Papers" and on the SWSS web site (www.swss.ws). Templates are available in Word and WordPerfect to help ensure an acceptable format was followed. The use of commercial names in the PROCEEDINGS does not constitute an endorsement, nor does the non-use of similar products constitute a criticism, by the Southern Weed Science Society.

This document is also available in PDF format at the SWSS web site (www.swss.ws). For information concerning the availability and cost of other publications of the Southern Weed Science Society (e.g. RESEARCH METHODS IN WEED SCIENCE, 3rd Edition, 1986; or previous PROCEEDINGS AND RESEARCH REPORTS), contact Mr. R. A. Schmidt, Business Manager, Southern Weed Science Society, 1508 West University Avenue, Champaign, IL 61821-3133.

Theodore M. Webster, Editor
Southern Weed Science Society
www.swss.ws

REGULATIONS AND INSTRUCTIONS FOR PAPERS AND ABSTRACTS TO BE PUBLISHED IN THE PROCEEDINGS OF THE SOUTHERN WEED SCIENCE SOCIETY

Regulations

1. Persons wishing to present a paper(s) at the conference must first electronically submit a title to the SWSS web site (http://www.swss.ws/) by the deadline announced in the "Call for Papers".

2. Only papers presented at the annual conference will be published in the Proceedings. An abstract or paper must be submitted electronically to the SWSS web site by the deadline announced at the time of title submissions.

3. Facilities at the conference will be provided for LCD-based presentations only!

4. Terminology in presentations and publications shall generally comply with standards accepted by the Weed Science Society of America. English or metric units of measurement may be used. The approved common names of herbicides as per the latest issue of Weed Science or trade names may be used. Chemical names will no longer be printed in the annual program. If no common name has been assigned, the code name or trade name may be used and the chemical name should be shown in parenthesis if available. Common names of weeds and crops as approved by the Weed Science Society of America should be used.

5. Where visual ratings of crop injury or weed control efficacy are reported, it is suggested that they be reported as a percentage of the untreated check where 0 equals no weed control or crop injury and 100 equals complete weed control or complete crop kill.

6. A person may not serve as senior author for more than two articles in a given year.

7. Papers and abstracts must be prepared in accordance with the instructions and form provided in the "Call for Papers" and on the SWSS web site. Papers not prepared in accordance with these instructions will not be included in the Proceedings.

Instructions to Authors

Instructions for title submissions, and instructions for abstracts and papers will be available in the "Call for Papers" and on the SWSS web site (http://www.swss.ws/) at the time of title or abstract/paper submission. Word and WordPerfect templates will be available on the web to help ensure the proper format is followed. Because a CD ROM containing all electronically submitted abstracts and papers will be the only form of publication available in the Abstract Collections room, it is important that submission deadlines are carefully followed.

Typing Instructions-Format

1. Margins, spacing, etc.: Use 8-1/2 x 11" paper. **Leave 1" margins on all sides.** Use 10 point type with a ragged right margin, **do not justify and do not use hard carriage returns** in the body of the text. Single space with double space between paragraphs and major divisions. **Do not indent paragraphs.**

2. Content:

Abstracts - Title, Author(s), Organization(s) Location, the heading ABSTRACT, text of the Abstract, and Acknowledgments. Use double spacingbefore and after the heading, ABSTRACT.

Papers - Title, Author(s), Organization(s), Location, Abstract, Introduction, Methods and Materials (Procedures), Results and Discussion, Literature Citations, Tables and/or Figures, Acknowledgments.

Each section of an abstract or paper should be clearly defined. The heading of each section should be typed in the center of the page in capital letters with double spacing before and after. Pertinent comments regarding some of these sections are listed below:

Title - All in capital letters and bold. Start at the upper left hand corner leaving a one-inch margin from the top and all sides.

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Example: **WEED CONTROL SYSTEMS IN SPRINKLER-IRRIGATED RICE.** K.H. Akkari, R.F. Talbot, J.A. Ferguson and J.T. Gilmour; Department of Agronomy, University of Arkansas, Fayetteville, AR 72701.

ABSTRACT

First line of abstract begins at left margin. **Do not indent paragraphs.**

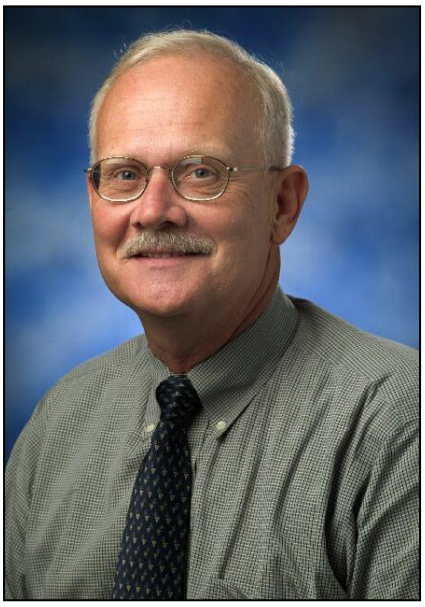
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Literature Citations - Number citations and list separately at the end of the text.

Table and Figures - Place these after literature citations. Single space all tables. Tables should be positioned vertically on the page. Charts and figures must be in black and white.

2009 Distinguished Service Award (Academia)

Tim R. Murphy



Dr. Tim R. Murphy, Professor Emeritus, the University of Georgia, conducted turfgrass, forage and vegetation management weed science research and outreach education programs during his career. He now works part-time for the University of Georgia and is responsible for the forage weed science program. He completed his B.S. degree in Agriculture at Berea College and his M.S. and Ph.D. degrees at Clemson University. He also taught the weed science portion of a Turfgrass Pest Management course at the Athens and Griffin campuses. Tim has served on numerous committees for both the WSSA and SWSS. He served as Associate Editor of Weed Technology from 1997 to 2000 and as the SWSS liaison to WSSA from 2002 to 2005. Tim also chaired the Fellows and Honorary Member Subcommittee from 2003 to 2005. In 2000 he received the WSSA Outstanding Extension Award. Tim is a member of the International Turfgrass Society, the Weed Science Society of America, the Southern Weed Science Society, and the National Association of County Agricultural Agents.

On a personal note, Tim resides in Griffin with his wife and daughter. In his spare time he enjoys fishing, hunting, motorcycle riding and church and family activities.

2009 Distinguished Service Award (Industry)

Bradford W. Minton



Brad Minton received a B.S. in Agronomy in 1986 and a M.S. in Weed Science in 1988 from Mississippi State University. He then began his professional career as a Weed Science Experimentalist with Ciba-Geigy Corporation in Greenville, MS. Brad relocated to Corpus Cristi, TX, two years later and became the R&D Representative for south Texas. As the formation of Novartis Crop Protection, he began a Ph.D. program in Agronomy at Texas A&M University while working as a R&D Representative. He completed his Ph.D. in 2002 and is currently a Senior Research Scientist for Syngenta Crop Protection (formerly Novartis and Ciba-Geigy) covering east and south Texas. He works across a wide range of crops in this area in the development of new crop protection products and GMO traits. Brad has been a member of the southern weed science society since 1987 and has been a judge for several Graduate Student Weed Contests and Student Paper Contests. He has served on the Local Arrangement and Sustaining Membership Committees and on the Board as an Industry Representative. He is also a member of the Weed Science Society of America, the Southwestern Branch of the Entomological Society of America, and the Texas Plant Protection Association and Texas Vegetable Association.

2009 Weed Scientist of the Year

W. Carroll Johnson, III



W. Carroll Johnson, III, is a Research Agronomist (Weed Science) with USDA-ARS at the Coastal Plain Experiment Station in Tifton, GA. Carroll conducts weed science and agronomic research on peanut, vegetable crops (cucurbits, onion, crucifers), and organic crop production. Areas of research include integrated weed management systems, ecology of weeds in the southeastern coastal plain, and use of alternate strategies to manage weeds in certified organic production systems. Carroll is a second generation agronomist - his father Dr. Wiley C. Johnson, Jr. was an agronomist at Auburn University for 35 years. During Carroll's 24-year career, he has published 52 articles in scientific journals, 34 popular press articles, and 11 extension service bulletins. Carroll's research accomplishments were acknowledged by his peers by him receiving the Award for Excellence in Research from the American Peanut Research and Education Society (2002) and the Weed Scientist of the Year award from the Southern Weed Science Society (2009). He is a graduate of Auburn University (1979), North Carolina State University (1981 and 1984) and currently resides in Tifton with his wife of 19 years (June) and 13 year-old twin daughters (Anna and Sara).

2009 Outstanding Educator

William W. Witt



William W. (Bill) Witt is a Professor, Department of Plant and Soil Sciences, University of Kentucky and has been a member of this department since 1974. He received his Ph.D. from North Carolina State University in 1974, and B.S. in 1969 and M.S. in 1971 from Oklahoma State University. He served as the major advisor of 23 M.S. and 20 Ph.D. students in Crop Science and Plant and Soil Science degree programs. Two of his students received the Outstanding Graduate Student Award from WSSA. Additionally, he served on the advisory committee of 39 students among the following disciplines: Crop Science, Plant and Soil Science, Entomology, Forestry, Biological Sciences, Horticulture, Soil Science, and Biosystems and Agricultural Engineering. Additionally, he teaches two to three courses per year pertaining to weed science. His research is focused on weed and herbicide management in agronomic crops and pastures, with particular emphasis on no-tillage cropping systems. He has served on numerous review panels and has give 24 invited presentations to regional, national, and international groups. Dr. Witt has served the SWSS in many capacities. He was first the Editor of the Newsletter from 1978 to 1981; Secretary-Treasurer from 1984 to 1986; Proceedings Editor from 1990 to 1992; Vice-President from 2001 to 2002; President-Elect from 2002 to 2003; and President from 2003 to 2004. He served on the following committees: Student Contest, Research Report, Newsletter Editor, Student Interest, Publications, Resolutions and Necrology, Nominating, Finance, Endowment Fund, Program, Outstanding Young Weed Scientist Award, and External Funding.

He has been honored with: Weed Science Society of America Fellow Award, Weed Science Society of America Outstanding Teaching Award, Distinguished Service Award-Academia by Southern Weed Science Society, Distinguished Service Award-Academia by North Central Weed Science Society, Honorary Member of the North Central Weed Science Society, Outstanding Young Weed Science Society Award by the Southern Weed Science Society. Dr. Witt also was recognized by the Kentucky Chapter of the Gamma Sigma Delta with the George F. Mitchell Outstanding Faculty Award for service to graduate students.

2009 Outstanding Young Weed Scientist

Jason K. Norsworthy



Jason Norsworthy was born in El Dorado, Arkansas. He obtained a B.S. in Plant Science-Agronomy from Louisiana Tech University in 1995, M.S. in Agronomy in 1997 from the University of Arkansas, and Ph.D. in Agronomy in 2000 from the University of Arkansas. Dr. Norsworthy accepted a position with Clemson University as Assistant Professor in 2000 and was promoted to Associate Professor in 2005. In 2006, Dr. Norsworthy accepted a faculty position with the University of Arkansas and was again promoted to Associate Professor in 2007. At Clemson University, Dr. Norsworthy taught one undergraduate course, Introductory Weed Science, and a graduate course, Weed Morphology and Ecology. At the University of Arkansas, he teaches Principles of Weed Control and team teaches a senior level Colloquium. He has directed 2 M.S. degrees, 1 Ph.D. degree, served on several graduate student committees, and is currently advising 3 Ph.D. students. Dr. Norsworthy has authored or co-authored 63 refereed journal publications and over 110 abstracts. His research has been involved in developing integrated weed management strategies that reduce herbicide use, development of methyl bromide alternatives, weed biology, herbicide resistance, and weed management in agronomic and vegetable crops. He has secured over $3 million in grant support with a portion of these funds coming from seven regional or national competitive grants. He has served as coach of the Clemson University Weed Team and co-coach of the University of Arkansas Weed Team. Jason currently serves as Associate Editor for *Weed Technology* and is the SWSS representative on the WSSA Board.

2009 Outstanding Graduate Student Ph.D.

Sarah Lancaster



Sarah Lancaster grew up on a crop and livestock farm near St. Louis, MO. She earned a B.S. degree in plant science from the University of Missouri-Columbia in 2002. Sarah continued her education at North Carolina State University, where she obtained an M.S in crop science in 2004. In 2008, Sarah received a Ph.D. in agronomy from Texas A&M University and joined the faculty in the Plant and Soil Sciences Department at Oklahoma State University. Dr. Lancaster's responsibilities are in the area of undergraduate education and youth development and include teaching PLNT 1213, PLNT 2013, PLNT 3790 and PLNT 4080.

2009 Outstanding Graduate Student M.S.

Ryan Pekarek



Ryan Rekarek was raised on a small row crop and cattle farm in east-central Nebraska. He completed a B.S. with Honors in Horticulture at the University of Nebraska-Lincoln in 2006. While working on his undergraduate degree, Ryan grew vegetables for sale at a local farmer's market to support his undergraduate education. He began his Master of Science program at North Carolina State University in August 2006 under the direction of Dr. David Monks. His thesis project is entitled weed management in bell pepper with cover crop and herbicide combinations. Ryan loves agriculture and farming, and Ryan and his family have recently returned to Nebraska to establish a vegetable farm.

Committee Reports

Minutes - July 19 and 20, 2008

SUMMER BOARD MEETING – SOUTHERN WEED SCIENCE SOCIETY - ORLANDO, FL

Saturday July 19, 2008 - Meeting called to order by President Ann Thurston.

Secretary Treasure Todd Baughman provided minutes from the January meeting. Minutes approved.

Business Manager's Report from Bob Schmidt and presented by Todd Baughman. Discussion about need to consider future plans in regards to the Business Managers position. Need to develop a plan to fill this need upon Bob's retirement. Postponed acceptance of Business Managers report until other budget items resolved.

Lee Van Wychen – Science Policy Director, presented update on science liaison. Discussed a need for actual what real results we get from this position.

Jason Norsworthy presented WSSA report. Indicate some issues with Weed Technology, specifically that visual ratings might be considered unacceptable. Scott Senseman agreed to develop a letter indicating that SWSS Board supported use of visual evaluations as acceptable scientific data.

Dan Reynolds presented a webmaster updated. This dealt with issues in regards to registration, title submission, and abstract submission. This will be handled through WSSA for the 2009 joint meeting.

Dan Reynolds presented an update on where we are with publications from Mike Defelice. Continue to allow Mike to investigate potential options for increased publication sales.

David Monks discussed role of program chair responsibilities. Discussed how this varies based on program chair. Program chair should rely on section chairs to help with development of program. Also update on long range planning committee. Discussed need to try to do better of job of inviting local extension agents and consultants at meetings. Also discussed need to make sure that meeting is advertised locally.

Scott Senseman discussed current issues within CAST and current reports that will be coming out.

Ann Thurston presented issues with Standard Operating Procedures for John Byrd. First issue was in regards to Outstanding Graduate Student Award it was suggested that student must have received the degree for which they are nominated since the previous SWSS Annual meeting. This proposal was not accepted. Discussed at length honoring individuals for the award.

Meeting Adjourned.

Saturday July 19, 2008 - Meeting called to order by President Ann Thurston.

Continued discussion on outstanding graduate student award. It was agreed that the award would be presented in honor of two individuals that have made outstanding contributions to SWSS during their career. The award would not be named after them but would be presented in honor of them. It was not agreed that the individuals had to be deceased. It was also suggested where possible select a local individual(s).

Met with WSSA to get update on how the program would work.

Finalized Budget Manager's Report. Report approved.

Meeting Adjourned

Minutes of Executive Board Meeting
Sunday, February 08, 2009
Orlando, FL

Present: Ann Thurston (President), Dan Reynolds (President-Elect), David Monks (Past-President), Tom Holt (Vice-President), Todd Baughman (Secretary-Treasurer), Ted Webster (Editor), John Byrd (Constitution Policy), Scott Senseman (CAST Rep.), Jason Norsworthy (WSSA Rep), Bob Scott (Member-at-Large), Tony Driver (Member-at-Large), Brad Minton (Member-at-Large), Bob Schmidt (Business Manager) via teleconference

President Ann Thurston called meeting to order.

Todd Baughman presented minutes from summer board meeting. Minutes approved.

David Monks presented report for Nominating Committee. The membership voted (148 voted) and selected Barry Brecke as Vice-President, Steve Kelly as Industry Representative, and David Jordan for Endowment Trustee. Report approved.

David Monks presented report for Awards Committee. Weed Scientist of the Year – Carroll Johnson, Outstanding Young Weed Scientist – Jason Norsworthy, Outstanding PhD Student – Sarah Lancaster, Outstanding M.S. Student – Ryan Pekarek, Distinguished Service Award – Tim Murphy, Academia and Brad Minton, Industry, Outstanding Educator Award – Bill Witt. Awards Committee is asked to develop guidelines for naming awards and possibility of a Lifetime Achievement Award. Need to consider guidelines for Outstanding Educator and how extension fits in this award.

Dan Reynolds updated board on 2009 program. Met room block.

Discussed potential to develop relationships with other societies. Long Range Planning Committee to contact these other organizations and see about possible joint meeting arrangements in the future.

Tom Holt updated board on 2010 program.

Scott Senseman presented CAST report. Concerns about future of CAST, membership issues, etc. Scott questioned the need for SWSS to continue membership especially if WSSA is already there.

Jason Norsworthy presented WSSA report. Will accept papers with visual estimates. Accepting papers as notes rather than actual paper in Weed Technology now. Need letter from Regional Society and all individuals in support of continued registration of 2,4-D.

Dick Oliver gave update on local arrangements for 2010 meeting at Peabody hotel in Little Rock. Discussed possibility of 2011 meeting in Puerto Rico, Biloxi, Mobile, Louisville, Lexington, and Cruise Ship.

Walt Mullins presented information on Southern Row Crop Society. Multi-disciplinary society based on applied agricultural information. Add a day to the meeting. Have a joint meeting in 2010.

Bob Schmidt presented business mangers report. Look for alternate management alternatives pending his retirement. Would take care of society through Little Rock meeting in 2010. Put out a request for proposals to be presented at the summer board meeting and have a joint transition at the Annual Meeting in 2010. Materials in warehouse: Research Proceedings – 25 copies, Weed ID Guide – 30 copies (37.95+shipping), Research Methods, Bound Volumes of Research Reports and Proceedings. Rental Warehouse - $3500/year. Approximately 40 Weed DVD's left (64.95). Weeds of the South Book and DVD is already approved and paid

Ted Webster presented editors report. Has all the WSSA and SWSS abstracts in a text file.

John Byrd presented Endowment Foundation Report for Alan York.

Lee Van Wychen – legislative affairs and director of science policy report. White paper being developed on weed resistance.

Continued discussion on 2011 meeting was decided to visit with the membership between San Juan Puerto Rico and Mobile AL.

Greg McDonald provided local arrangements report. Everything is on scheduled.

Mike DeFelice provided update on sales coordination/weed id report. Weeds of the South has been sent off for printing. Cost of the book is $39.95. We get author royalty on books sold (8%). Interactive Encyclopedia of North American Weeds DVD has been delayed one year due to other projects. Hopefully, be available by fall of 2009. This will cost be between $3,500 and $4,000. Weeds of the Central United States and Cananda is being developed. SWSS and NCWSS have already committed $8000 ea. For this publication. UGA Press has indicated that it will require $40,000 upfront to print the book. NCWSS has committed to trying to raise the additional $24,000. 358 weeds with approximately 220 coming out of the Weeds of the South. Could be available by fall of 2010.

Trent Irby presented Graduate Student Organization report.

Meeting Adjourned

January 30, 2009

Southern Weed Science Society
Business Manager's Report

Membership as of December 31

	2008	2007	2006	2005
Members and Sustaining Members	302	338	349	376
Students	93	72	81	85
Totals	395	420	430	461

Weed Identifications Guides Final

Expenses $488,106 Income $802,365

Forest Plants of the Southeast royalty

2006	$1,139
2007	2,274
2008	2,729

Weed DVD

Expenses $7,519 Income $45,508

have only about 40 left

SWSS Net Worth, May 31

2008	$223,878
2007	$232,661
2006	$236,115
2005	$212,836
2004	$221,243
2003	$267,635
2002	$237,402
2001	$223,340
2000	$253,820
1999	$324,919
1998	$279,925
1997	$289,105
1996	$293,453
1995	$302,303
1994	$272,351
1993	$271,436
1992	$253,927
1991	$212,096
1990	$155,328
1989	$144,333
1988	$134,670
1987	$100,395
1986	$105,280
1985	$103,878
1984	$ 88,587
1983	$ 67,892
1982	$ 65,681
1981	$ 69,404

Committee: 102

Committee Name: AWARDS COMMITTEE PARENT (STANDING)

Summary of Progress: Awards Committee (made up of subcommittees and their chair, Submitted by David Monks chair of the Awards Committee)

The activities of this committee centered around finding nominees for various awards. Overall a good selection of members who were active in the society were nominated and selected. Below are the awards, the number of members nominated and the awardees.

Award	**No. nominated**	**Awardee**
Weed Scientist of the Year	2 nominated	Carroll Johnson
Outstanding Young Weed Scientist	3 people nominated	Jason Norsworthy
Outstanding PhD student	5 students were nominated	Sarah Lancaster
Outstanding M.S. Student	1 student nominated	Ryan Pekarek
Dinstinguished Service Award	2 nominated	Tim Murphy (university) Brad Minton (industry)
Outstanding Educator Award	5 nominated	Bill Witt

Committee: 113

Committee Name: NOMINATING COMMITTEE (STANDING)

Report of the Nominating Committee (T. Baughman, Scott McElroy, T. Teuton, C. Medlin, J. Norsworthy, E. Webster and S. Culpepper, David Monks - Chair).

Summary of Progress: The nomination committee was solicited for candidates for vice president, industry representative on SWSS Board and trustee of the endowment.

We had 3 candidates for vice president and industry representative on the board. The committee ranked the candidates to select two. The membership voted (148 voted) and selected Barry Brecke as Vice president and Steve Kelly as industry rep on SWSS board. David Jordan was selected for endowment trustee.

Candidates were:

Barry Brecke and Ken Smith for Vice-president.

Steve Kelly and Jeff Smith for industry rep.

David Jordan and Larry Steckel for trustee.

Southern Weed Science Society Endowment Foundation
Board of Trustees Report
February 8, 2009

The audit of the Southern Weed Science Society (SWSS) Endowment Foundation by Lafferty and Associates of Champaign, IL was conducted for fiscal year 2008 (October 1, 2007 to September 30, 2008). The findings indicated that the financial statements are in conformity with the tax accounting principles of the IRS code, rules and regulations.

Accumulated donations since inception totaled $232,834, and accumulated interest since inception totaled $101,132.99. Contributions, interest, and expenses during the past fiscal year totaled $1,137.10, $11,798.99, and $6,622.03, respectively. Recent events in the stock market and banking industry illustrate the merit of our historically conservative investment philosophy.

Eighty-two copies of *Forest Plants of the Southeast and Their Wildlife Uses* were purchased and mailed to the 2008 student presenters at total cost (books, mailers and postage) of $3291.03. A total of $2,250 was spent on awards for the outstanding MS Graduate Student Award and for the winners of the paper and poster contests. Assuming availability in Summer, 2009, the Foundation will provide a copy of the new SWSS Weed ID Guide to all students who participated in the 2009 SWSS paper or poster contests.

Discussions are continuing among the Trustees and some SWSS members regarding the use of Foundation funds in the future to support student educational experiences. Previous discussions among the Trustees and the SWSS Board support the notion that it would be appropriate for students receiving the grants to make a presentation on their experience. Discussions are also taking place regarding ways to increase contributions from current and former SWSS members and former student members. One idea which is being explored is to obtain the list of former student contest winners and their current addresses so that a letter from the SWSS Board of Trustees (or other appropriate SWSS officer) to appeal for contributions.

The Board of Trustees for the upcoming year are:

Frank Carey – President – 2011
John Byrd – Vice President – 2012
Stanley Culpepper – Secretary – 2013
David Jordan – 2014
Neil Rhodes – Past President - 2010

Committee: 100a

Committee Name: Editor's Report

Summary of Progress:

The 2008 Proceedings contained 315 pages, which is down from 325 in 2006 and 363 in 2005 and 521 in 2004 Proceedings, respectively. The decrease is due to fewer participants and presentations at the meeting and fewer presenters submitting abstracts. I have noticed that many presenters who are not traditional members of the society do not submit abstracts (e.g. invited symposia speakers and industry presenters from outside of SWSS). Due to changes at OmniPress, the 2007 Proceedings were available online instead of a CD format. The online format provides the same content as the CD did with easier access and reduced cost to the society. The online version has the old proceedings going back to 1999. The 2008 Proceedings contained all executive board minutes, committee reports, business manager's report, award winners, and research reports that were submitted as well as abstracts and full papers. The abstracts and full papers are available via the web from the SWSS home page (www.swss.ws). Following is the distribution of number of presentations and number of pages.

Section	Number of Pages
Minutes of Executive Board, Committee Reports, etc	91
Weed Management – Agronomic Crops	95
Weed Management - Turfgrass	27
Weed Management – Pastures & Rangelands	13
Weed Management – Horticultural Crops	18
Vegetation Management - Forestry	8
Vegetation Management – Rights-of-Ways	6
Physiological & Biological Aspects of Weed Control	15
Educational & Regulatory Aspects	2
Invasive Species	9
Industry Updates	1
Soil & Environmental Aspects of Weed Control	6
New Technologies	7
Symposia – Invasive Vines: A Climbing Problem	4
Symposia – Palmer Amaranth Resistance: A Dilemma in Dixie	6
Symposia – Vegetative Management in Wildlife Habitat and Natural Areas	2
Symposia – New Innovations for Organically Produced Crops	8
Symposia – Rights of Way Management in the South	2
Symposia – Graduate Students	2
Weed Survey (Most Common & Most Troublesome)	12
State Weed Control Publications - 2005	19
Herbicide Names (common, chemical, and trade)	5
Registrants of 2005 Annual Meeting	25
Sustaining Members for 2005	1

Objective(s) for Next Year:
To get the final copy of the Proceedings to membership earlier and to find ways to streamline the process. I will be working with the new editor, Ted Webster and with the WSSA Abstract editor for the joint meeting in 2009.
Recommendation or Request for Board Action:
To drop the password protection to the online proceedings. The password protection was added after the 2007 SWSS Executive Board meeting to prevent non-members from accessing the proceedings. It seems to cause confusion amongst the members.

Finances (in any) Requested: $500 for secretarial assistance.

Respectively submitted;

William K. Vencill, Editor

Report to SWSS Board of Directors, January 27, 2008

Council of Agricultural Science and Technology (CAST)
Scott Senseman – SWSS CAST Representative
CAST Spring 2009 Board of Directors' Meeting
Taken from report submitted by Linda M. Chimenti, Director of Council Operations

Beginning on March 18, 2009, members of the CAST Board of Directors gathered at the Doubletree Hotel in Washington, D.C. for their spring meeting. Board members participated in 2 ½ days of general sessions, work group and committee breakouts, and shared meals. A number of publication proposals were discussed, and several proposals will move forward in the coming weeks through e-mail ballots. Guest speakers addressed the group at several meals, and the Charles A. Black Communications Award was presented to Dr. Wayne Skaggs at an evening reception. Dr. Richard Reynnells, an individual who has shown outstanding support for CAST, was honored with the CAST Champion Award. The Executive Committee met in special session for two days before the start of the general session, and their report to board members was the focus of discussion in many work group and committee breakout sessions.

Guest Speakers

Gale Buchanan, who recently served as the U.S. Department of Agriculture's Undersecretary for Research, Education, and Economics, was the keynote speaker. Dr. Buchanan is a past president of CAST. In his remarks to the board, he emphasized the importance of conveying credible scientific information and educating the general public on scientific issues. He stated his support for the CAST process, but encouraged CAST to develop a way to provide even more timely communications on emerging issues. He listed a wide range of important challenges for agriculture including global climate change and carbon credits, water quality and availability, achieving energy security, food safety and security, animal rights and animal welfare, and biotechnology and cloning. Dr. Buchanan encouraged board members to take an active role in communicating the importance of CAST to their policymakers and legislators.

Fran Boyd, Senior Vice President of Meyers & Associates, a Washington-based government relations/business consulting firm, stated that a major strength of CAST is that it deals in consensus—producing publications that contain information written and reviewed by a collection of scientific experts. He said that CAST information is especially valuable to people in the legislative branch of government, and he stressed the importance of using electronic media for communications. Mr. Boyd suggested that CAST members interested in producing timely, relevant publications should try to forecast key issues by studying the Farm Bill and listening to statements by cabinet appointees in the new administration. Among the issues he views as important in future legislative discussions are food safety, renewable energy, climate change and carbon sequestration, water quality, animal welfare, public lands, and taxation on greenhouse gases.

Mark B. Halverson, Staff Director/Chief Counsel for the Senate Agriculture, Nutrition and Forestry Committee from the office of Senator Tom Harkin, spoke to the CAST Board of Directors at a noon luncheon. He stated that CAST's work has been helpful on issues regarding the interface of science with public policy. He listed several topics that will be the focus of D.C. discussions in the coming months: food safety, products regulated by the Food and Drug Administration, climate change, energy in agriculture, biofuels, and issues in biotechnology. Mr. Halverson answered several questions from the audience at the end of his presentation, including how CAST can package its communications to have the greatest impact.

Richard Reynnells, National Program Leader for Animal Production Systems at the USDA Cooperative State Research, Education, and Extension Service, shared his personal thoughts about CAST at a morning breakfast meeting. Dr. Reynnells said that the comments he hears regarding CAST publications are favorable, but he suggested that CAST should strive to increase the amount of its output to reach a wider audience. Agriculture, he said, needs a teamwork approach to address issues, and CAST is in the process of becoming part of that team.

Ephraim King, Director of the Office of Science and Technology, U.S. Environmental Protection Agency, focused on four areas of interest to the EPA in his after-lunch presentation to the board:

1. Water quality and its relationship to agriculture. Nutrient pollution from agricultural sources is a growing and expanding problem, and science needs to find ways to reduce nutrient loading on the nation's water systems.

2. The effects on water from pesticide applications. The EPA is trying to work with the agricultural community to balance environmental concerns with those of agricultural producers.
3. Concentrated animal feeding operations (CAFO). There are many issues surrounding CAFOs and the permits required to operate them, and there are interested parties on both sides of the issues.
4. The Farm, Ranch, and Rural Communities Federal Advisory Committee. This group was established in 2007 to advise the EPA Administrator on issues such as climate change, renewable fuels, livestock and poultry inspection, and other emerging issues.

Charles A. Black Communications Award

At an evening reception on March 18th, CAST honored Dr. Richard W. Skaggs, William Neal Reynolds Professor and Distinguished University Professor in the Biological and Agricultural Engineering Department at North Carolina State University, by presenting him with the 2009 Charles A. Black Communications Award. The award was presented by CAST President Dr. Henry L. Shands. The audience included members of the CAST Board of Directors, Washington, D.C. agency personnel, and family and friends of Dr. Skaggs.

Work Group Actions

The **Animal Sciences Work Group** met with two guests during one of the breakout sessions. Their discussions focused on possible opportunities for CAST to partner with other organizations in hosting conferences, symposia, or other professional gatherings. The work group spent a lot of time discussing the issues identified by the Executive Committee regarding CAST governance and the need to increase funding support. One new publication proposal, on the topic of humane mass depopulation in animal disease emergencies, was considered briefly. The group agreed to hold more frequent conference calls to conduct business in between the CAST board meetings.

The **Food Science and Agricultural Technology Work Group** was pleased to welcome two new board members to its breakout sessions. In addition, one guest met with the group and they discussed possible partnering opportunities. Members reviewed the composition and scope of the work group and agreed that it was logical for food science to work with agricultural engineering/technology, but they acknowledged the need to share and collaborate with other work groups. The group heard from staff about the progress of the fresh produce commentary currently in progress, and they reviewed topics under consideration from the previous meeting. New topics identified for possible development into proposals included toxic compounds in seafood, the potential for formation of one government agency to oversee food safety, and food-based allergies.

The **Plant Protection Sciences Work Group** reviewed an existing proposal on pest resistance management and moved this item into a suite of papers on sustainability for which funding will be sought. A proposal for a commentary on bee colony collapse was approved by the work group and referred to the Executive Committee. A proposal for a commentary on sustainable agriculture was approved by the work group and moved on to the Executive Committee. The group is developing a proposal for a series of issue papers on sustainable agriculture using the commentary as the kick-off. They are seeking a coalition for support and are suggesting a sustainability symposium with all working groups contributing speakers as part of the agenda. Work group members endorsed the idea of developing partnerships with publishers. The group also discussed ideas for restructuring CAST work groups and committees. A proposal on water quality and agriculture is under development.

The **Plant, Soil, and Environmental Sciences Work Group** reviewed the status of projects already underway and several on hold from past meetings. Three proposals were developed, approved by the group, and moved on to the National Concerns Committee: the impact of fertilizers in urban areas, the technology of nitrogen use efficiency, and another commentary in the Convergence of Agriculture and Energy series. Ideas for possible new publications included green chemistry of bio-based products, product labeling to show the amount of energy used in product delivery, and the impact of climate change on pest development. The group discussed the concerns raised by the Executive Committee, and they suggested that ad hoc work groups might be a way to address emerging issues that span several areas of agriculture. They also discussed possible ways of making CAST information more accessible to a wider audience, including youth.

Committee Actions

The **Budget, Finance, and Investment Committee** reported that a letter will be sent from CAST to university deans asking them to support their faculty members who volunteer their time to work for CAST. After serious

discussion, this committee voted to disband in its current form and recommended that governance and finance issues be handled by the Executive Committee. They did agree that three members from this committee, on a rotating basis, would assist the Treasurer on an annual audit review; the Treasurer would then report to the Executive Committee.

The **Editorial and Publications Committee** considered a recommendation to get CAST in front of the public using the web but without increasing the staff workload. They also reviewed the protocols for the publication process and endorsed the current process as being robust and transparent, not needing to be changed. Along with staff, the committee held an extensive discussion of new media methods and opportunities. Several proposals were considered and approved: seeking a publisher for bundling and sales of existing CAST publications, negotiating a partnership with publishers to publish proceedings of CAST-sponsored conferences, and drafting a protocol for a rapid release communication process.

The **Membership and Marketing Committee** discussed possible changes to the dues structure for CAST member societies and reviewed the current process for travel reimbursement to board members who attend the CAST board meetings. The committee endorsed the idea of assessing a late payment fee on unpaid renewals, but did not recommend specific amounts. They approved the proposal to hold only one in-person board meeting per year, and stated that all board members should help with recruiting of new members and sponsors for CAST.

The **National Concerns Committee** focused on ways this committee can be proactive in suggesting ideas for future CAST projects and publications. The committee considered several proposals during their breakout sessions: a commentary on sustainable agriculture; a series of issue papers and/or special publications on aspects of sustainable agriculture; a commentary on bee colony collapse disorder; the impact of fertilizers in urban areas; the technology of nitrogen use efficiency; and another commentary in the Convergence of Agriculture and Energy series.

General Session Action Items

During its final General Session, the board approved the following actions.

- **Motion from the Budget, Finance & Investment Committee:** Keep member society dues at the 2009 levels for 2010; discontinue travel reimbursement payments in 2010 for board members; allow travel reimbursement by CAST for Executive Committee members. Motion passed.

- **Motion from the Budget, Finance & Investment Committee:** Beginning in 2010, hold only one in-person CAST Board Meeting per year. The Executive Committee may hold additional in-person meetings. Motion passed.

- **Motion from the Budget, Finance & Investment Committee:** The Budget, Finance & Investment Committee will disband as of the end of this meeting; responsibility for CAST financial matters remains with the Treasurer who will report to the Executive Committee; twice a year the Treasurer will send financial information to the full Board of Directors; there will be an annual review of the audit by the Treasurer and three board members. Motion passed.

- **Motion from the Editorial & Publications Committee:** The Executive Committee has the authority to explore the possibility of working with a commercial publisher to publish existing CAST documents in book format. Motion passed.

- **Motion from the Editorial & Publications Committee:** The Executive Committee has the authority to consider plans for an external meeting, possibly in partnership with one or more other organizations, and to publish the proceedings from that meeting using a commercial publisher. Motion passed.

- **Motion from the Editorial & Publications Committee:** The committee presented a protocol outlining the process for CAST to prepare and distribute a "rapid response" to an occurrence of inaccurate information; the response will be formulated by experts identified by CAST and will be based on existing CAST information. The protocol details were read to the board. Motion passed.

- **Motion from the Membership & Marketing Committee:** The board authorizes the Executive Committee to decide on the details of a "late payment process" but recommends assessing a flat fee rather than a percentage for invoices not paid on time. Motion passed.

- **Motion from the Executive Committee:** Based on discussions of the National Concerns Committee and the Animal Sciences Work Group, the Executive Committee asked the board to authorize the EC to explore and implement opportunities for a conference in the Fall of 2010. This action would include partnering with another organization to present a conference on an issue of critical importance to agriculture; CAST would be responsible for publishing the conference proceedings. Motion passed.

Report to the Southern Weed Science Society on Activities of the Weed Science Society of America
Summer Board Meeting, July 19-20
Orlando, Florida
Submitted by Jason Norsworthy

The following items were highlighted in the April Newsletter by president Jeffrey Derr.

- There were 309 presentations (107 posters, 157 oral talks, and 45 symposium presentations) and approximately 450 attendees at the WSSA meeting in Chicago.

- WSSA's new journal Invasive Plant Science and Management was launched at the annual meeting in Chicago. Joe DiTomaso will serve as editor of the new journal.

- Del Delfosse will leave the position of National Program Leader for Weed Science at ARS to chair the Entomology Department at Michigan State.

- Weed Science Editor Robert Blackshaw will be stepping down, and WSSA is looking to fill this position.

- WSSA has decided not to hire a website editor for 2008. Ed Luschi can be contacted if funds are needed to hire part-time help to complete a website project. David Kruger will continue to work as the webmaster and plans to redesign the homepage.

- The education and extension committee is working to place all XID photos collected by WSSA members on the website.

- The following items were highlighted in the April Newsletter by president Jeffrey Derr.

    - WSSA is diligently working to ensure that the national program leader position for weed science, last occupied by Del Delfosse, is replaced with a weed scientist. WSSA has sought support for this position from the regional societies. Jeff Derr, Jill Schroeder, Mike Barrett, and Lee Van Wychen, among others, attended the USDA/ARS Customer Workshop for National Program 304 - Crop Protection and Quarantine in Miami, FL, on May 21-23 to represent WSSA.

    - WSSA has recently published its second issue of Invasive Plant Science and Management. Syngenta has agreed to sponsor the outstanding paper for the journal each year.

    - WSSA had 20 proposals submitted for the position of Executive Secretary and Meeting Management, which is currently contracted with Allen Press and will expire in 2009. The board will review proposals at the summer Board meeting.

    - WSSA is soliciting applicants for the EPA liason position currently held by Steve Dewey.

    - The Public Awareness Committee, chaired by Janis McFarland, has been working to increase the number and quality of press releases the on the WSSA website under "Press Room". One that recently was placed on the website is entitled, "Weed Science Society of America Warns Glyphosate Resistance Increasing." This document is in layman terms and discusses the value of glyphosate to agriculture and the evolution of glyphosate resistance over the past 12 years.

    - The board will be spending a day on tactical planning at the summer board meeting. The current tactical and strategic plans are available on the WSSA website.

- Below are additional WSSA activities that are of interest to the SWSS Board and its members.
    - WSSA will met jointly with the Society of Range Management on Feb. 9-16, 2010 in Denver, Colorado.

- Neil Harker, editor of Weed Technology, is considering making changes to the directions for contributors to Weed Technology. The BOD discussed this issue on February 8 in Chicago. The current directions for contributors reads, "Progress reports, nonreplicated experiments, and simple observational information are not acceptable. Visual estimates of percentage weed control and of crop injury are acceptable in evaluating weed control efficacy and in supporting objective measurements of response." The proposed change would read as follows: "Progress reports, nonreplicated experiments, and simple observational information are not acceptable. Visual estimates of percentage weed control and of crop injury are acceptable when supported by other objective measurements of response." The BOD has not made a decision on this suggested change, and there was much discussion concerning the pros and cons of making this change.

Report to the Southern Weed Science Society on Activities of the Weed Science Society of America
Winter Board Meeting, Feb. 8, 2009
Orlando, Florida
Submitted by Jason Norsworthy

The following items were highlighted in the July and October 2008 and January 2009 Newsletters by president Jeffrey Derr.

- Dr. Edward Knipling, administer for USDA-ARS, will be the keynote speaker at the joint WSSA/SWSS meeting.

- Beginning with the upcoming meeting, WSSA will begin sponsoring student travel grants to the annual meeting to encourage student participation in the society. In 2009, six students will have the partial travel expenses paid to the meeting.

- WSSA's Public Awareness committee, chaired by Janice MacFarland, has been actively involved in producing press releases. Visit the WSSA website at wssa.net to view some of the recent articles.

- Bill Vencil was unanimously approved by the WSSA Board of Directors as the new Editor for Weed Science. His term will begin at the annual meeting in February.

- The tenth annual National Invasive Weed Awareness Week will be held February 22-27, 2009.

- Dr. Jill Schoeder replaced Dr. Steve Dewey in January 2009 as Academic Subject Matter Expert, which is a liaison position in Washington, DC through a partnership between WSSA and the EPA.

- WSSA (50th meeting) will met jointly with the Society of Range Management (63rd meeting) on Feb. 7-11, 2010 in Denver, Colorado.

- Invasive Plant Science and Management reached its goal of 90 submitted articles in 2008.

- Additional activities of interest to SWSS
    - Contracts have been signed with hotels for the WSSA annual meetings in 2011, 2012, and 2013
      2011 - Hilton Portland & Executive Tower, Oregon; Feb. 7-10
      2012 - Hilton Waikoloa Village, Big Island, Hawaii; Feb. 6-9
      2013 - Hilton Baltimore, Maryland; Feb. 4-7

Committee: 121
Committee Name: SOUTHERN WEED CONTEST COMMITTEE (STANDING)

Summary of Progress:
2008 Weed contest was hosted by Greg MacDonald and Jay Ferrell of the University of Florida in Gainesville, FL. The contest was an excellent educational program. Due to the absence of the Univ. of Florida students, the attendance (34) was slightly down from 2007. However, attendance over the past three years has been higher than previous years.

I (Trey Koger) will be stepping down as the chairman of this committee during the committee meeting the week of February 9th in Orlando. It is time to let someone bring new ideas and fresh thoughts into the contest committee. I feel it is important to keep the contest fresh and a truly educational experience for everyone involved. I have thoroughly enjoyed my tenure as chair of this committee. I just hope the society, students, and everyone involved with the contest as gained a fraction of the positive rewards and experiences that I have gained during my tenure as chairman of the weed contest committee. Thank you and respectively yours, Trey Koger.

Objective(s) for Next Year:
The 2009 SWSS weed contest will be hosted by Eric Prostko and Stanley Culpepper in Georgia. Eric Prostko attended the 2008 contest in FL to gain ideas on how he and Stanley are planning on structuring and conducting their contest this year.

Recommendation or Request for Board Action:

Finances (in any) Requested:
Current fund balance for the weed contest is $16,551.56. The contest typically costs approximately $9,000.00. Financially, the weed contest is good standing. More funds should be solicited from chemical and seed company as well as other historic funding sources this year to ensure good financial standing for future (2010, 2011,…..) contests.
Respectively submitted;

Trey Koger, Chairperson

Committee: 124 **Committee Name:** Weed Identification Committee (STANDING)

Summary of Progress:

The galley proofs for *Weeds of the South* have been approved and sent off for printing. The University of Georgia Press (UGA Press) has posted the book into the US distribution system and announced retail availability of June 25th, 2009. In fact, as of this writing the book can currently be pre-ordered on Amazon.com for a 34% discount. The suggested retail price is $39.95. It is also noted that a significant grant from the Wormsloe Foundation of Georgia provided the additional funding needed by UGA Press to publish the book. This was in addition to the funds provided by the SWSS and other sponsors. Organizations wishing to make large purchases can contact UGA Press directly and get up to a 50% discount on bulk purchases. The UGA Press has provided advertising flyers for this meeting that offer attendees a 30% discount on book pre-orders sent directly to UGA Press. These are being distributed and we are also presenting a poster that announces the book and shows example pages.

Objective(s) for Next Year:

Version 4.0 of the *Interactive Encyclopedia of North American Weeds* DVD has been delayed one year. We photographed so many new weed species that it has taken additional time to complete all of them. The DVD is now expected to have over 650 species as compared to the 447 species in Version 3.0. We expect to release the DVD for sale in late fall of 2009 in time for availability at the NCWSS. We will re-submit our request for funds to manufacture the DVD at the summer 2009 board meeting. The cost should be similar to last summer's estimate of $3,500.00 to $4,000.00.

The UGA Press has asked Charles and I to write a book to be entitled *Weeds of the Central United States and Canada*. We will use the descriptions written by the committee for the *Weeds of the South* and DVD. Arlyn Evans has again granted us permission to use his photographs. In addition, we will be using a significant number of photographs from Michael DeFelice for many of the Midwestern species, and a small number of photos from other members. The book has passed recommendation from two outside reviewers and is about to be presented to the UGA Press board for final approval. A contract will then be drawn up between the UGA Press and the SWSS. SWSS will be the official entity, but the contract will specify that the author royalties will be split evenly between the SWSS and NCWSS. The SWSS and NCWSS boards have each already approved $8,000.00 in financial support to the UGA Press for the book. However, UGA Press has informed us it will take a minimum of $40,000.00 to publish the book. The Industry committee of the NCWSS has committed to try to raise the other additional $24,000.00 needed. It will likely be a challenge under current economic conditions. If we have not met the $40,000.00 amount by late spring we will request the SWSS and/or NCWSS to donate the difference. The NCWSS board has indicated a willingness to do this if needed.

Seven extension weed scientists in the Midwest and one in Canada have been polled for the weed species to be included in the book. We have settled on 358 species that will be included. Charles and I are scheduled to submit a completed manuscript to UGA Press by April 1, 2009. The book will be identical in format to *Weeds of the South*, and we will be able to transfer a significant amount of the work in *Weeds of the South* to the new book.

Recommendation or Request for Board Action:

The Weed ID Committee requests that the SWSS Board accept and sign the contract from UGA Press for publishing *Weeds of the Central United States and Canada* after review of the terms. We anticipate the contract will be submitted to the SWSS by the end of February.

UGA Press has also created a two-slide PowerPoint presentation to distribute to the membership to use in grower and customer meetings to promote the book. We would like permission to send this PowerPoint presentation via email to the membership after the meeting.

Finances (in any) Requested:

The SWSS board approved an $8,000.00 donation to UGA Press last year to support *Weeds of the Central United States and Canada*. The Weed ID Committee requests that these funds be paid to UGA Press immediately after the contract has been signed.

Respectively submitted;

S. Askew
M. Blair
N. Burgos
J. Boyd
V. Maddox
C. Smith
T. Webster
S. Bangarwa (Student representative)
C. Bryson, Vice Chairperson
M. DeFelice, Chairperson

Minutes of SWSS Herbicide Resistant Weed Committee
Feb. 11, Orlando, FL

Nilda Burgos called the meeting to order at 6:30 am.

Indicated she would complete her term as committee chair at the end of the meeting and Ken Smith would assume chair responsibilities.

Minutes of previous meeting was circulated for viewing. Minutes had previously been distributed and approved by email vote following last year's meeting.

Members of the committee were introduced and new members welcomed.

Larry Steckel was confirmed as Secretary for 2009.

Meeting agenda was distributed, Mike Chandler moved to approve as distributed; William Vencill seconded. Motion passed.

Some discussion of committee structure: Doug Sammons moved to have members at large with no rotation, but have officers rotate on three year terms. Chad Brewer seconded. Motion passed. At the 2010 meeting in Little Rock, a new secretary should be elected. Following that meeting, the current secretary will assume the chair responsibilities.

Nilda informed us that the SWSS board had moved the Herbicide Resistant Weed Committee from "Special Committee" status to "Standing Committee" status.

There was some discussion of criteria for reporting resistance. Ken Smith pointed out the number of weeds reported by state on the WSSA/Heap website was not consistent with the number of weeds reported by states in other reports. It was agreed that although some clarification was needed as to what type of tests should be completed prior to declaring resistance, we should all make every effort to keep the website as current as possible. Doug Sammons discussed the need to use labeled rates comparisons vs LD50 rate comparisons. Some feeling that labeled rates on some herbicides would be unrealistic and could move due to label revisions.

It was noted that resistance issues usually start in the field and are confirmed in the greenhouse. It was stated that solid field data be coupled with greenhouse evaluations prior to declaring resistance. It was not as important whether the field data preceded or followed the greenhouse work.

Jason Norsworthy indicated that SWSS is interested in revising the methods book. (Protocols for resistance, enzyme assays, etc.) Nilda asked if this committee would like to develop protocol for developing response curves. This led to some discussion about using LD_{50} or LD_{90} as the benchmark for comparisons. Norsworthy felt that we should stick with LD_{50}. Ginger Light asked about techniques for reporting segregating populations.

John Soteres suggested developing protocol and publishing it in scientific journal in order to provide a citation. After some discussion, he asks if subgroup could be put together to develop a draft of protocol that would be reviewed then published for testing dose response, including deviations such as segregating populations. He suggested listing when to use LD_{50} and/or LD_{90}.

Norsworthy suggested we consider a review article on resistance to publish in Weed Tech with emphasis on what has been done wrong and right.

Nilda asks for volunteers: Ginger Light volunteered to head up the effort; Doug Sammons and Nick Polge agreed to help. They were charged with the task of developing a common protocol for SWSS handbook and a review article for Weed Tech.

Ken Smith encouraged updating the HRAC website and John Soteres encouraged members to pass along suggestions for improving the website.

With no other business to report, meeting was adjourned.

Those attending the meeting:

Name	Email
Ken Smith	smithken@uamont.edu
Chad Brewer	chad.brewer@pioneer.com
Daniel Stephenson	dstephenson@agcenter.lsu.edu
Mike Chandler	jm-chandler@tamu.edu
Dearl Sanders	dsanders@agcenter.lsu.edu
R.L. Nichols	bnicholds@cottoninc.com
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Alan York	alan.york@monsanto.com
John Soteres	john.k.soteres@monsanto.com
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Nilda Burgos	nburgos@uark.edu
Larry Steckel	lsteckel@utk.edu
J.D. Green	jdreen@uky.edu
Doug Sammons	rdsamm@monsanto.com

EFFICACY OF BIOLOGICAL CONTROL OF GRASSY WEEDS USING *CURVULARIA ERAGROSTIDIS* IN THE FIELD TRIAL. Y. Zhu, T. Gao, J. Wang, Y. Lu, S. Qiang*; Nanjing Agricultural University, Nanjing, China

ABSTRACT

Curvularia eragrostidis is being developed as part of a biologically based weed management tactic for control of grassy weeds in China. A large number of field trials were conducted between 2004 and 2008 on two NJAU research field sites near Nanjing to determine efficacy of the fungus, in varying applications, for control of large crabgrass (*Digitaria sanguinalis*) under different field conditions. Treatments included different rates of fungal conidia, reduced rates of herbicides, and mixtures of the fungus with herbicides at reduced rates. The fungus applied at 5×10^5 conidia /ml and 700 L/ha generally achieved significant weed suppression (> 50% weed mortality) under a range of field conditions. Weather conditions as well as growth stage of the weed influenced the efficacy of the fungus; under favorable weather conditions such as frequent rain during the growing season in 2006, the fungus controlled large crabgrass at the 2.0-3.0 leaf stage by up to 90% when compared to untreated controls. Biocontrol efficacy and consistency was improved by adding adjuvants or humectants in spray formulations. When *C. eragrostidis* (5×10^5 conidia/ml) was tank-mixed with nicosulfuron at reduced rates (0.2X or 0.1X recommended rate), the fungus interacted synergistically with the herbicide and controlled large crabgrass consistently by 75% in soybean and corn fields even under dew-free conditions. The mixture was significantly more effective than either single-agent treatment. These results indicate that *C. eragrostidis* is a promising mycoherbicide agent for control of large crabgrass. Herbicides at substantially reduced rates may be used with the fungus as a synergizer to enhance the efficacy and consistency of weed control while decrease the chemical load in the environment.

EVALUATION OF BIOHERBICIDAL CONTROL OF TROPICAL SIGNALGRASS, *UROCHLOA SUBQUADRIPARA*.
Y.M. Shabana*,[1] C. Stiles,[2] R. Charudattan,[1] A. Abou Tabl,[1] J. White[1]; [1]University of Florida, Gainesville, FL, [2]Valdosta State University, Valdosta, GA

ABSTRACT

Tropical signalgrass (TSG), aka alexandergrass causes serious problems for sod production and turf maintenance in Florida. Other grasses such as crabgrass (*Digitaria sanguinalis*; CG), smut grass (*Sporobolus indicus*, SG), thin paspalum (*Paspalum setaceum*, TP), and torpedograss (*Panicum repens*, TG) can also be problematic. In an attempt to develop a bioherbicide for these grasses, the foliar fungal pathogen *Drechslera gigantea* (Dg), which has been reported as a promising biocontrol agent for several grass weeds, was evaluated. Formulations composed of Dg mycelium and/or Dg culture filtrate, both produced in a liquid broth, and Sunspray 6E oil were tested with or without ammonium sulfate (a foliar desiccant and fungal nutrient) or pelargonic acid (N-nonanoic acid; a natural product and a registered biorational herbicide) in greenhouse and field trials. Two solid formulations composed of Dg mycelium entrapped in natural hydrophilic polymers or wheat gluten and kaolin were also tested in greenhouse trials. A 30% Sunspray 6E oil formulation containing Dg mycelium (10 g), Dg culture filtrate (70 ml), and 4.5 g ammonium sulfate caused 88% to 100% damage on TSG, CG, SG, and TG in greenhouse trials. The damage from this formulation was the result of disease as well as phytotoxicity from the culture filtrate, oil, and ammonium sulfate. Compared to the emulsion formulations, the solid formulations did not provide satisfactory results. An emulsion formulation containing 30% Sunspray 6E oil and 70% culture filtrate free of Dg mycelium to which was added 2% (v/v) pelargonic acid caused 100% damage to SG 2 weeks after application. Grasses treated with Dg formulations containing ammonium sulfate or pelargonic acid and without exposure to a dew period showed higher levels of damage compared to those treated with the same formulations and given a 24-h dew period. Formulations containing Dg mycelium, Dg culture filtrate, and ammonium sulfate or pelargonic acid are effective and promising for control of weedy grasses. Further evaluation of these formulations under field conditions is justified.

SCREENING FUNGAL PATHOGENS OF *MICROSTEGIUM VIMINEUM* AS POTENTIAL BIOCONTROL AGENTS. L.C. Walker*, J.C. Neal, L.P. Tredway; North Carolina State University, Raleigh, NC

ABSTRACT

Japanese stiltgrass (*Microstegium vimineum*) is an invasive summer annual grass of the eastern United States. Control with herbicides is possible, however many of the invaded sites are riparian or similar wet ecosystems; in such systems, control options are limited. In 2003 and 2004, a pathogen was observed on Japanese stiltgrass seedlings in North Carolina that caused zonate leaf spots, leaf tip necrosis, and eventual plant death. In 2005 and 2006, samples collected from these sites were identified as *Drechslera gigantea*. In 2008, samples from diseased seedlings from the same sites demonstrating similar symptoms were collected and the fungi isolated in culture. Five isolates were collected in 2007 and seven were collected in 2008; however, most of these were determined to be non-pathogenic. Two greenhouse trials were conducted to screen the isolates for pathogenicity on seedling Japanese stiltgrass. Of the isolates recovered in 2008, three were determined to be pathogenic and cause symptoms similar to those observed in the field. These isolates were identified as *Curvularia* (two isolates) and *Drechslera*. No *D. gigantea* was recovered in 2008. Efforts are continuing to identify these isolates to species and evaluate their potential as biological control agents for Japanese stiltgrass.

THE MODEL OF CONIDIA PRODUCTION IN *HELMINTHOSPORIUM* SPP., BIOLOGICAL AGENTS FOR GRASSY WEEDS CONTROL. K. Yamaguchi*; Minami Kyushu University, Takanabe-cho, Japan

ABSTRACT

Several fungal isolates of *Helminthosporium* species have been reported as promising biocontrol agents against grassy weeds. *Exserohilum rostratum* which shows herbicidal activity against red sprangletop (*Leptochloa chinensis*) can produce conidia only in the air, not in any liquid medium. The methods of a two-phase system, using sponge matrix and via mycelial pellets, were examined for conidia production of this fungus. In the first phase, quantitatively sufficient mycelia were obtained in submerged liquid culture. In the second phase, abundant conidia were formed when the mycelia was exposed to the air. The two-phase system both using sponge matrix and via mycelial pellets consistently produced over 10^8 conidia L^{-1}. In addition, the conidia were more uniform in size, and showed higher percentage of germination, than those produced by plate culture. These results suggested the two-phase system described in this study could be a prototype of mass-production of a bioherbicide based on *Helminthosporium* species.

A SEARCH FOR A ROOT-PATHOGEN OF *CIRSIUM ARVENSE* IN NEW ZEALAND. G.W. Bourdot*,[1] B. Skipp,[2] G. Hurrell,[3] D. Saville[4]; [1]AgResearch Limited, Private Bag 4749, Christchurch 8140, New Zealand, [2]AgResearch Limited, Private Bag 11008, Palmerston North 4442, New Zealand, [3]AgResearch Limited, Christchurch, New Zealand, [4]Saville Statistical Consulting Limited, 147 Bells Rd, West Melton, No. 1 R.D., Christchurch 7671, New Zealand

ABSTRACT

The plant pathogenic fungus, *Verticillium dahliae*, is geographically widespread in pasture populations of *Cirsium arvense* in New Zealand, occurring in diseased shoots collected on 42% of randomly sampled farms in a national survey in 2005-06. Its life history suggests it could be the cause of the demise of *C. arvense* populations when they are mown in the rain (a phenomemon reported by farmers). This hypothesis is being tested in field experiments.

ROOT COLONIZATION AND ENVIRONMENTAL FATE OF THE BIOHERBICIDE *PSEUDOMONAS FLUORESCENS* BRG100. S.M. Boyetchko*,[1] C. Hanson,[1] R.K. Hynes,[1] D. Korber[2]; [1]Agriculture and Agri-Food Canada, Saskatoon, SK, Canada, [2]University of Saskatchewan, Saskatoon, SK, Canada

ABSTRACT

Pseudomonas fluorescens BRG100 is a bacterial strain which is being developed as a pre-emergent soil-applied bioherbicide for control of the annual grass weeds wild oat, *Avena fatua*, and green foxtail, *Setaria viridis*. The green fluorescence protein gene was introduced into *P. fluorescens* BRG100 from *E. coli* λS17-1 carrying suicide vector pAG408 in order to permit the visualization and monitoring of root colonization and environmental fate when introduced into soils under various environmental conditions. Colony morphology, growth rate, weed biocontrol efficacy (plant growth pouch), carbon utilization (Biolog GN) and root colonization of green foxtail by several *P. fluorescens* BRG100*gfp* transformants were very similar to that of the wild type. *P. fluorescens* BRG*gfp*-15 was found to be most similar to the wild-type in all of the above characteristics and was chosen for subsequent experiments. It was determined by population dynamics per section of root from plating on culture medium, fluorescence microscopy and confocal microscopy that *P. fluorescens* BRG*gfp* colonized all areas of the root, but showed a preference for the proximal 1/3 section and the seed, when applied as a liquid inoculum or as the pesta granular formulation. Confocal microscopy revealed that the root hairs, root tip, and ventral portion of the seed were all areas of heavy root colonization. Survival of *P. fluorescens* BRG*gfp* was investigated by conducting a study using a thermogradient plate apparatus in two soil types under three temperature and three moisture levels typical of environmental conditions prevalent in the Canadian prairies during the early spring, summer and early fall. The experiment was set up as a factorial randomized complete block design that included the following treatments: three 12 hour diurnal temperature regimes: 5-15ºC, 15-25ºC, and 25-35ºC and three moisture levels: 25, 50 and 75% of field capacity. Sampling was carried out at 0, 14, 28 and 42 days. The highest numbers of viable bacteria were found in the pesta granules in soil subjected to the lowest diurnal temperature regime and moisture content. The lowest numbers of viable bacteria were found in the pesta subjected to the highest diurnal temperature and moisture, suggesting the release and dissemination of BRG*gfp* from pesta granules is greater at higher temperatures and moisture levels.

HERBICIDE- DELETERIOUS RHIZOBACTERIAL INTERACTIONS IN VELVETLEAF WEED CONTROL. R. Zdor*; Andrews University, Berrien Springs, MI

ABSTRACT

Previous work by other researchers has shown that herbicide treatment can increase plant vulnerability to microbes. The use of biological agents to augment herbicide-based weed control was examined in this study. Specifically two rhizobacterial isolates were studied: Pseudomonas putida ATH2-1RI/9 and Acidovorax delafieldii ATH2-2RS/1. These organisms were originally isolated from the roots of velvetleaf and show modest growth reductions in velvetleaf assays (Soil Biol. Biochem. 33:801). In this current study, velvetleaf plants were grown in soil inoculated with either bacterium (10^9 cells) in the presence or absence of sublethal levels of atrazine & metolachlor (0.28 Î¼g active ingredient/g soil). Plant survival and weight were scored after 4 weeks. Plant survival in the absence of herbicide was over 90% regardless of the presence of bacteria. Approximately 78% of the plants survived when treated with the herbicide alone. However dramatic decreases in plant survival were obtained in plants exposed to both herbicide and A. delafieldii ATH2-2RS/1. This synergy was not seen in plants exposed to herbicide and P. putida ATH2-1RI/9. Plants that survived the herbicide/A. delafieldii ATH2-2RS/1 treatment had shoot weights that were 53% of plants exposed to herbicide alone. This data suggests that certain microbes have the ability to act synergistically with herbicides opening the possibility for weed control strategies that involve reduced levels of herbicide. Further work with these particular microbes needs to be done in the field to confirm efficacy.

USING GENE FUSIONS TO STUDY CYANOGENESIS IN A WEED DELETERIOUS RHIZOBACTERIUM. M.M. Biswas*, R. Zdor, C. Miller; Andrews University, Berrien Springs, MI

ABSTRACT

Previous work with weed deleterious rhizobacteria (WDR) has implicated the production of hydrogen cyanide in the ability to suppress plant growth. This current study examines factors that influence cyanogenesis in Pseudomonas putida ATH2-IRI/9, a WDR that colonizes velvetleaf roots resulting in cyanide in the rhizosphere and reduced plant growth (Soil Biol. Biochem. 33:801). The effects of oxygen and iron on cyanogenesis in P. putida ATH2-IRI/9 pure cultures were tested using 2 techniques. In the first method cyanide recovered from both early and late stage cultures growing in the presence/absence of iron &/or oxygen was quantified using a colorimetric assay. Secondly a gene fusion method was used as a reporter of cyanide production under the same culture conditions. In this method a promoterless luciferase gene (luxAB) (J. Bacteriol. 179: 5241) is inserted into the hcnABC operon of P. putida ATH2-IRI/9 which encodes HCN synthase, the enzyme responsible for hydrogen cyanide production. Culture conditions that influence expression of the hcnABC operon and thus cyanogenesis are then studied by measuring light production by the gene fusion-bearing bacteria in culture. The results from both techniques consistently showed that the presence of iron (under microaerophilic conditions) for both early and late growth stage cultures was the main variable that stimulated cyanogenesis resulting in cyanide and light levels approximately 5 times greater than levels from cells grown in the absence of iron. These results support similar findings obtained with the plant-associated bacterium Pseudomonas fluorescens CHA0 (Microbiology 16:2417). Further work must be done to test the effect of iron in promoting cyanogenesis in the rhizosphere and its possible role in optimizing weed control strategies that involve cyanogenic WDR.

BIOHERBICIDAL POTENTIAL OF VOLATILE OIL FROM REDSTEM WORMWOOD (*ARTEMISIA SCOPARIA*) AGAINST COFFEE WEED (*CASSIA OCCIDENTALIS*) AND SLENDER AMARANTH (*AMARANTHUS VIRIDIS*). S. Mittal*, H.P. Singh, R.K. Kohli, D.R. Batish; Panjab Univ., Chandigarh, India

ABSTRACT

The hydrodistilled volatile oil from *Artemisia scoparia* was investigated for its phytotoxic and bioherbicidal potential against two wasteland weeds viz. coffee weed and slender amaranth. The results indicate that vapours of volatile oil from the plant artemisia significantly inhibited seed germination, seedling length, and dry weight of the test plants. In laboratory bioassay, chlorophyll content and cellular respiratory ability of test seedlings decreased significantly with increase in concentration of artemisia oil from 0.14 to 0.70 mg/ml. The effect was observed to be more on the slender amaranth as compared to coffee weed. Further under green house studies, the spray treatment of 2.0, 4.0 and 6.0 % (w/v) oil emulsion on the 4-week-old mature plants of coffee weed and slender amaranth adversely affected the chlorophyll content and cellular respiration of plants. Visible injury to plants was noted in terms of curling of leaves, wilting, chlorotic spots and necrosis of plant tissue after 1, 7 and 15 days of spray treatment. Fifteen days after the spray, complete mortality was observed in plants of slender amaranth treated with 4.0 and 6.0 % (w/v) of oil emulsion. However, in coffee weed plants treated with similar concentrations of artemisia oil, mortality was exhibited by only 35 and 50% plants, respectively. The above studies indicate that volatile oils from *A. scoparia* possess weed-suppressing ability and it can be explored further for its bioherbicidal potential.

FUNGAL TOXINS AND OTHER NATURAL METABOLITES FOR MANAGEMENT OF PARASITIC WEEDS. M. Vurro*, A. Boari; National Research Council, Bari, Italy

ABSTRACT

Difficulties in controlling parasitic weeds are due to their physiological traits, i.e., among others: the production of large amounts of seeds, that can remain viable for many years; the germination of seeds, that occurs only by stimulation with host root exudates; the production of a germ tube, that develops a haustorium penetrating the root and forms a tubercle if it attaches to the host root; the long underground damaging phase, with the parasitic withdrawal of water, nutrients and photosynthates from the host. Preventing seed germination and host attachment could be a strategic and successful interference with the parasite for its management. Natural compounds which are able to inhibit seed germination or, on the opposite, to stimulate it in absence of the host plant, could be attractive and environmentally friendly tools to reach that objective. Our research was focused in particular on: a) fungal toxins having inhibitory activity on seed germination; b) amino acids inhibiting seed germination and tubercle development; and c) fungal metabolites stimulating the "suicidal" germination. The target parasitic weed was mainly *Orobanche ramosa* L. (commonly named broomrape), a very aggressive parasite of many crop species, and to a lesser extend *Striga hermonthica* (Del.) Benth (witchweed) and *Cuscuta campestris* Yuncker (dodder), two other very dangerous parasitic weeds. With regard to the use of fungal metabolites, several compounds were assayed choosing among: 1) already known microbial compounds produced by *Fusarium* species and available commercially or at laboratorial level; 2) compounds obtained from the cultures of potential biocontrol agents of *O. ramosa*; 3) novel phytotoxins recently isolated and chemically characterized in our labs from the cultures of fungi pathogens of weeds other then parasitic ones. With regard to the possible use of amino acids, this approach was based on the mechanism of action of the so called "Frenching disease", a physiological disorder of tobacco caused by saprophytic bacteria growing on the roots, overproducing isoleucine. Shortly, the idea was to supply high or unbalanced amounts of essential amino acids to cause disorders in the metabolic processes that occur during the germination of seeds, then inhibiting the process of germination or the elongation of the germ tube. This is the same final results of some chemical herbicides that inhibit single biosynthetic enzymes in plants, making treated plants incapable of producing metabolites essential for plant growth. The promising results obtained by using both fungal metabolites and natural amino acids will be shown and discussed.

PATHOGENIC MECHANISMS OF VULCULIC ACID PRODUCED BY *NIMBYA ALTERNANTHERAE*.

M. Xiang*,[1] L. Fan,[1] Z. Jiang,[2] Y. Zeng[1]; [1]Zhongkai University of Agriculture and Engineering, Guangzhou, China, [2]South China Agricultural University, Guangzhou, China

ABSTRACT

Vulculic acid was a kind of toxin from the filtrate of *Nimbya alternantherae* and could cause leaf blight and withering of alligator weed. In order to prove the pathogenic mechanisms of vulculic acid and establish a foundation for the development of it, the effect of the toxin on the ultrastructure of leaf and root tip tissues of alligator weed was studied. The purified toxin was diluted into concentrations of 50 and 100 mg/ml with double-distilled water and the roots and mature leaves of healthy alligator weed were treated with the toxin solutions for 12 and 24h, respectively. The samples were fixed with 2.5% glutaraldehyde, then with 1% osmic acid. After being dehydrated using a standard method, the samples were embedded in Epon 812. Microtome sections were dyed with uranium acetate, then lead citrate and observed through FEI-Tecnai 12 transmission electron microscope. The results showed that the damages were disruption of plasma membrane, digestion of the membrane of chloroplast and mitochondria, disorder of chloroplast lamellae and digestion of mitochondria ridge in leaf tissue, and disruption of plasma membrane, digestion of mitochondria membrane and ridge and vacuolation and shrinking of meristematic and epidermal cells in root tip tissue. The severity of damages was increased along with the increasing of toxin concentration and treated time. However, the lamellae of chloroplast swelled and mitochondria vacuolated then membrane disruption appeared in both of chloroplast and mitochondria at the lower concentration (50μg/mL), while disruption of membrane and swelling of chloroplast lamellae and digestion of mitochondria ridge occurred at the same time or the former was prior to the latter two at the higher concentration (100μg/mL). The ultrastructure changes of treated root tip tissue with the toxin were similar. These results suggest that the initial sites for the toxin action may be on chloroplast and mitochondria.

SURFACTANTS AFFECT THE EFFICACY OF ALTERNARIA CASSIAE CONTROLLING SICKLEPOD SEEDLINGS. R.A. Pitelli*, C.F. Franco, F.M. Claudia; University of State of Sao Paulo, Jaboticabal, Brazil

ABSTRACT

A Brazilian isolate of *Alternaria cassiae* was collected in Brasília, Brazil, from seedlings showing symptoms of necrotic lesions on leaves and petioles. Several studies done in Brazil and USA showed that this fungus has very good potential as bioherbicide candidate. For field applications, some spraying technology development is necessary. So, the objective of this research was to evaluate (i) the effects of the surfactant Energic (0.1 and 0.2%), Agral (0.025 and 0.05%), Herbitensil ((0.1 and 0.2%) and Citowett (0.1 and 0.2%) on *A. cassiae* conidia germination and (ii) the effects of spores concentrations (10^4 and 10^5 spores/mL), surfactants (same products and concentrations) and dew period (0, 6, 12 and 24 hours) on disease development and control of sicklepod plants. The spore suspension was disposed over water-agar media enriched with the surfactants treatments. Conidia germination was not affected by surfactants at the tested doses. The effects of surfactants only were significant in the lower spore concentration. Citowett and Agral promoted faster disease development when compared with the other two surfactants. Energic (0,2%) reduced the sicklepod control sprayed with 10^4 spores/mL. Dew periods of 8, 12 and 24 hours promoted 100% plant mortality while the absence of artificial induced dew period the sicklepod control was only 20%.

NATIVE PHYTOPATHOGENS AS BIOCONTROL AGENTS: PROBLEMS AND POTENTIAL IN THE MANAGEMENT OF INVASIVE EXOTIC SPECIES. K. Jayachandran*, K.G. Shetty; Florida International University, Miami, FL

ABSTRACT

The fragile natural ecosystems in Florida are being threatened by exotic invasive plant species. In addition to the environmental cost there is a huge economic cost associated with the expanding threat of exotic invasive plant species. Biological control using natural enemies is one of the environmentally compatible tools that are being used along with other control methods for the management of invasive species. Biological control of exotic invasive plant species has been predominantly oriented towards re-association of co-evolved natural enemies by introduction of selected natural enemies primarily insects from different countries. Introduction of another non-native biological agent into an ecosystem is fraught with unknown risks. At present many of the natural and agricultural ecosystems in Florida are being invaded by a long list of exotic plant species. The situation calls for the development of new capabilities to counter this growing threat. One option is to discover and develop additional biocontrol agents that can be integrated with the existing control methods. Native plant pathogen induced diseases on exotic plant species is not uncommon. Using native pathogens for biocontrol does not involve the introduction of any new organism and may also prove to be valuable for integrating with other control methods. Surveys of *Lygodium microphyllum* (old world climbing fern) and *Schinus terebinthifolius* (Brazilian pepper) infested sites in South Florida indicated occurrence of diseases caused by native plant pathogens. However, there are considerable challenges to be overcome before further development and deployment of effective native biocontrol agents can be made. Isolated and scattered efforts will have limited success, in order to fully realize the benefits of native pathogens, a collaborative and coordinated multi-institution/agency effort is very critical.

POTENTIAL MYCOHERBICIDE FUNGI COLLECTED ON ARROWHEAD (*SAGGITARIA MONTEVIDENSIS*) IN BRAZIL. D.J. Soares, R.W. Barreto*, B.V. Lima; Universidade Federal de Viçosa, Viçosa, MG, Brazil

ABSTRACT

Sagittaria montevidensis (arrowhead) is among the worst weeds of irrigated rice in Brazil, Australia and other parts of the world. The problem with infestations by this weed is worsening as infestations of irrigated rice by populations of this weed, which are resistant to ALS-inhibiting herbicides, are becoming widespread. Arrowhead is considered to be native from Brazil and work performed at UNESP Jaboticabal indicated that a fungus provisionally identified as *Cylindrocarpon* sp. might have potential as a mycoherbicide. Recently, a detailed survey of fungi attacking this aquatic weed in south and southeastern Brazil was completed and yielded nine fungal species, namely: the anamorphic hiphomycetes - *Alternaria alternata* (leaf spot), *Botrytis cinerea* (leaf blight), *Cercospora apii* (leaf spot), *Cercospora sagittariae* (leaf spot), *Colletotrichum gloeosporioides* (antracnose), *Plectosporium alismatis* (leaf spot) and a new species of *Pseudocercospora* (leaf spot); and two smut fungi, *Doassansiopsis deformans* and *Narasimhania alismatis*. All of them represent new host records or new geographic localities for occurrences of these fungi. Preliminary observations of the fungi in the field and in culture suggests that additionally to *Cylindrocarpon* sp. four species have potential for use as biocontrol agents against *S. montevidensis*, namely: *C. sagittariae*, *C. gloeosporioides*, *P. alismatis* and *Pseudocercospora.* All of these combine the conditions of being able to cause a severe disease in field conditions, growing well and sporulating abundantly in culture and belonging to groups of fungi that often show an adequate level of host-specificity or, in the case of *C. gloeosporioides*, include infra-specific taxa at the level of forma specialis that can be highly host-specific. Other fungi should be rejected at this stage of evaluation for the following reasons: *A. alternata* and *B. cinerea* - probably not host-specific and depending on injuries for infection; *C. apii* - known to be polyphagous and seemingly only weakly damaging to arrowhead; *D. deformans* and *N. alismatis* - found only occasionally and attacking few plants in each area and not showing significant impact on weed populations. Prospects appear very good for mycoherbicide development against arrowhead.

STATUS OF *PHOMA MACROSTOMA*, A BIOHERBICIDE FOR BROADLEAVED WEED CONTROL IN TURFGRASS. K.L. Bailey*,[1] S. Falk,[2] S. Lombardo[2]; [1]Agriculture & Agri-Food Canada, Saskatoon, SK, Canada, [2]The Scotts Company, Marysville, OH

ABSTRACT

Phoma macrostoma is a fungus that was isolated from Canada thistle (*Cirsium arvense*) plants growing in several provinces in Canada. When applied to the soil, the fungus caused the Canada thistle plants to turn white and die. Host range testing showed that several dicotyledonous plants were susceptible but monocotyledonous plants were resistant. Dandelion (*Taraxacum officinale*) is another weed species that was highly susceptible to the fungus in preliminary greenhouse tests where emerging weed seedlings were killed more quickly than established plants. The objective of this study was to determine the least effective rate of the bioherbicide as a pre-emergent weed control for dandelion in turfgrass. *Phoma macrostoma* was grown using a solid state fermentation process and formulated as a granule for broadcast application as a pre-emergent bioherbicide. A mixture of grass seed (2.84 g/ m^2) and dandelion seed (0.3 g/m^2) were broadcast to 0.25 m^2 plots where the soil had been tilled, raked, and lightly packed. The bioherbicide was applied at sowing at rates ranging from 4X, 2X, 1X, ½X, ¼X, 1/8X, and 0X. The experiments were conducted as a RCBD with 4 replications at five sites in Canada and one in the USA. Three trials were conducted for estimating dose response, six trials were conducted to obtain information comparing field formulations at various rates, and six other trials were used to evaluate crop tolerance to the bioherbicide. Data were collected on symptom expression (0-5 scale) and the percentage weed control using the Abbotts's transformation to express treated plots relative to the untreated control. At rates greater than 1X, 100% weed control was attained in all trials and there was no harm to the grass. At the 1X rate, there was 80-100% weed control in 67% of the trials applying this rate, 60-80% control in 24% of the trials, and less than 60% control in 9% trials. At the 1/2X rate, there was 80-100% weed control in 29% of the trials, 60-80% control in 41% of the trials and less than 60% control in 30% of the trials. At the lower rates, there was less than 60% weed control in about 80% of the trials. The rate at which control was obtained over the season depended on the year and location. The maximum level of control was usually obtained by 28 days after application in 12 of 15 trials. In 3 trials, the maximum control was achieved by 42-56 days after applications. Control of emerging seedlings lasted throughout the season. For consistent pre-emergent weed control over multiple environments and years, the 1X application is recommended. The pre-emergent application would be suitable for preventing weed establishment and eliminating seeds germinating from the weed seed bank.

WEED MANAGEMENT PRACTICES USED IN BLUEBERRY PRODUCTION: A SURVEY OF NORTH CAROLINA BLUEBERRY GROWERS. M.M. Roberts*, K.M. Jennings, D.W. Monks; North Carolina State University, Raleigh, NC

ABSTRACT

A grower survey was conducted in North Carolina in 2008 to determine the weed management practices used by blueberry growers in North Carolina. The majority of growers (41.5%) participating in the survey grow rabbiteye blueberries and 21% grow highbush. The variety 'Croatan' was the most frequently planted highbush variety in total ha as well as the most frequently planted variety by year and the variety 'Premier' was the most frequently planted rabbiteye variety in total ha. Of those growers who responded that certain weed species are no longer causing problems, 22% reported that Canada goldenrod is the most common species todecrease in severity in recent years. Among those species that have increased in severity, 19% of growers responded that greenbriar spp. are increasingly problematic. Of the weeds that growers believe cause the greatest loss in yield, 41% reported annual and perennial grasses, 31% reported annual and perennial sedges, 20% reported broadleaf weeds, and 7% reported woody perennials to be problesm. Twelve growers (21%) reported using mechanical cultivation to control weeds at an average estimated cost of $445/ha. Thirty growers (52%) reported using hand removal as a method of weed control at an average estimated cost of $1193/ha. Thirty growers (52%) reported utilizing herbicides to control weeds at an average estimated cost of $1182/ha. The most commonly applied herbicide in non-bearing blueberries is sethoxydim, which accounts for 324 ha (24%) of total ha treated with herbicides as reported in the survey. Hexazinone is the most commonly applied herbicide in bearing bushes and is applied to 513 ha (39%) of the total ha reported in the survey. Glyphosate was the second most common herbicide applied in both non-bearing and bearing bushes, for a total of 17% of the non-bearing ha and 31% of the bearing blueberry ha.

SORGHUM TOLERANCE AND WEED MANAGEMENT WITH KIXOR. B.A. Brown*,[1] J.W. Keeling,[2] P.A. Dotray[2]; [1]Texas AgriLife Research/Texas Tech University, Lubbock, TX, [2]Texas AgriLife Research, Lubbock, TX

ABSTRACT

Kixor (BAS 800), a new herbicide developed by BASF, is a protoporphyrinogen IX oxidase (PPO) inhibitor and belongs to the pyrimidinedione class of herbicides. Initial studies were conducted in 2008 near Lubbock, TX to evaluate sorghum (*Sorghum bicolor*) tolerance and weed control following preplant burndown and preemergence (PRE) treatments of Kixor or Kixor + dimethenamid (BAS 781). Kixor was applied at rates ranging from 0.04 to 0.16 lb/A PRE. BAS 781 (Kixor + demethenamid) was applied at 0.39 to 1.57 lb/A in the crop tolerance trial. In the preplant burndown trial, Kixor and BAS 781 were applied alone or in combination with glyphosate 14 days before sorghum planting. Kixor and BAS 781 were applied PRE alone or combined with atrazine for Palmer amaranth (*Amaranthus palmeri*) and ivyleaf morningglory (*Ipomoea hederacea*) control. All treatments were applied at 10 GPA using a CO_2 backpack sprayer. Crop oil concentrate and ammonium sulfate were added to treatments applied for preplant burndown of Russian thistle (*Salsola iberica*) and Kochia (*Kochia scoparia*). The soil type at this location was an Acuff loam. Furrow irrigation was applied during the season to ensure normal sorghum growth and yield. Two sorghum varieties, Dekalb 44-20 and Pioneer 85G01, were planted May 12 and PRE treatments were applied in the tolerance trials. At 14 days after planting (DAP), sorghum injury in the Dekalb ranged from 0 to 5% with Kixor PRE variety, and 0 to 24% with the Pioneer variety. Injury symptoms declined to less than 2% at 28 DAP. No treatments affected sorghum yields for either variety. Kixor and BAS 781 treatments applied 14 days before planting (DBP) controlled Russian thistle and Kochia 99 to 100% compared to 87 to 90% control achieved with glyphosate. Residual Palmer amaranth control (28 DAP) ranged from 17 to 55% with greater Kixor rates, and 59 to 94% with BAS 781. Sorghum injury ranged from 3 to 26% with greater rates of Kixor. Palmer amaranth control 28 DAP with Kixor and BAS 781 PRE ranged from 96 to 98% and 98 to 100%, respectively. Ivyleaf morningglory was controlled 74 to 81% with Kixor PRE and 85 to 89% with BAS 781 at 28 DAP. These initial results suggest that Kixor or BAS 781 can effectively control emerged Russian thistle and kochia as a preplant burndown treatment and Palmer amaranth and ivyleaf morningglory with PRE applications. Crop safety may vary with sorghum cultivar. Sorghum was adversely affected more by preplant (14 DBP) than by preemergence Kixor treatments.

SURVEY OF NATURALLY OCCURRING DISEASES OF *LYGODIUM MICROPHYLLUM* IN SOUTH FLORIDA NATURAL AREAS: PREVALENCE AND POTENTIAL FOR BIOCONTROL AGENTS.

B. Pandey*,[1] K.G. Shetty,[1] S. Miao,[2] K. Jayachandran[1]; [1]Florida International University, Miami, FL, [2]South Florida Water Management District, West Palm Beach, FL

ABSTRACT

Invasive exotic plants species are becoming a major threat to the South Florida's fragile native ecosystems. An aggressive exotic invasive weed that is of serious concern is the Old World Climbing Fern, *Lygodium microphyllum* (Cav.) R. Br. (Lygodiaceae). The rapid spread and colonization of *Lygodium* within the South Florida's native ecosystem is disrupting the flora and fauna at an alarming rate, hence the control and management of *Lygodium* is very critical. *Lygodium* control methods involve prescribed burning, biological controls, mechanical removal and use of herbicides. In a situation where particular dominant invasive exotic species need to be controlled without harming native species, biological control may be more cost effective and environmentally friendly compared to the other methods. However, currently employed biological control method, using biological agents from other parts of the world in not cost effective and there is an uncertainty about the potential hazards they might pose to the native ecosystem in the future. Occurrence of disease on introduced species by native phytopathogens is found to be common. Since *Lygodium* has been present in the South Florida for decades it is possible that native phytopathogens must have been able to form new association with the new host. By selecting and developing native phytopathogens of *Lygodium* as biological control agents the potential hazards associated with the introduced biocontrol agents could be avoided. The research in the area of new association of native pathogens with *Lygodium* has remained unexplored. The objectives of this study were to conduct field surveys and sample collection in the *Lygodium* infested natural habitats of South Florida and isolate native phytopathogens of *Lygodium*. We conducted monthly field surveys inside the selected *Lygodium* infested natural areas within the Martin and Palm Beach counties. During the survey we observed *Lygodium* plants displaying disease symptoms ranging from mild leaf spot symptoms to severe blight and necrosis symptoms. In most cases the disease symptoms were limited to a section of the plant cover. However, in few cases seedling death due to necrosis and severe symptoms on larger sections of the plant cover were observed. The presence of native pathogens capable of inciting severe symptoms on *L. microphyllum* under natural conditions offers support for developing additional strategies for management of *Lygodium* using native biocontrol agents.

APICAL DOMINANCE AND PLANTING DENSITY EFFECTS ON WEED SUPPRESSION BY SUNN HEMP. A.H. Cho*, C.A. Chase, D.D. Treadwell, R.L. Koenig; University of Florida, Gainesville, FL

ABSTRACT

Sunn hemp (*Crotalaria juncea*) is a tropical leguminous fiber crop that is also used as a cover crop. Sunn hemp provides the benefits of a cover crop by suppressing weed populations, minimizing soil erosion while fixing nitrogen. Adoption of sunn hemp in the US has been hindered because seed is imported, which results in limited and uncertain availability and high seed cost. The commonly available cultivar 'Tropic Sun' often fails to set seed or has low seed yields even when grown in the Southeastern US. Previous research shows that cutting sunn hemp to break apical dominance leads to more branching and thereby more flowering, suggesting a potential for more seed yield by breaking apical dominance. The objective of our study was to evaluate how cutting the main stem to break apical dominance affects weed suppression and seed yield. The experimental design was a randomized complete block with a factorial arrangement of the treatments. The study was conducted at a seed production seeding rate of 11.2 kg/ha, a cover crop seeding rate of 44.8 kg/ha, and an intermediate seeding rate of 28 kg/ha. Seeds were sown in rows spaced 45.7 cm apart on May 15, 2008. Main stems were either left uncut or were cut at 3, 4, and 5 weeks after planting (WAP). Leaf area index (LAI) and photosynthetically active radiation were measured using an AccuPAR model LP-80 Ceptometer to evaluate canopy closure. Cutting date did not significantly influence weed populations, while seeding rate did. The highest seed rate (44.8 kg/ha) resulted in the lowest weed populations. The other two seeding rates (11.2 and 28 kg/ha) had effective weed suppression, but were not significantly different from one another. Cutting did not significantly influence the number of flowers per plant, but cutting (at 3, 4, 5 WAP) did induce branching, while the control (uncut) plots showed no branching. The number of branches per plant was not significantly different among the three cutting dates, with a mean of 1.45 branches per plant. At 6 WAP seeding rate significantly influenced the LAI and percent sunlight penetrating the canopy. The LAI with the 11.2 kg/ha seeding rate was significantly less than with the 28 and 44.8 kg/ha seeding rates. Breaking apical dominance significantly influenced canopy closure at 9 and 12 WAP. The uncut treatment had significantly lower LAI and a greater percentage of sunlight penetrating the canopy than treatments with cutting. Seeding rate had no significant impact on the canopy closure by 9 and 12 WAP. The high and intermediate seeding rates resulted in fewer flowers than the lowest seeding rate. Although flowering was profuse seed set was minimal and may be due to an absence of appropriate pollinators.

QUANTIFICATION OF WARM-SEASON TURFGRASS PHYTOTOXICITY FROM BROADLEAF CONTROL HERBICIDES. M.L. Flessner*, J.S. McElroy, R.H. Walker; Auburn Univ., Auburn, AL

ABSTRACT

Synthetic auxin herbicides effectively control broadleaf weeds in many turfgrass species; however, phytotoxicity to warm-season turfgrasses has been observed. Injury quantification related to herbicide rate is necessary to determine the cause and extent of phytotoxicity to warm-season turfgrasses from auxinic herbicides. Research was conducted quantifying injury from triclopyr and DPX-KJM44-044 (aminocyclopyrachlor; proposed common name), which is a synthetic auxin type herbicide being developed by the el du Pont de Nemours and Company (Dupont Company; Wilmington, DE) for right-of-way and non-crop broadleaf weed control. Aminocyclopyrachlor and triclopyr were applied to 'Tifsport' bermudagrass (*Cynodon dactylon* x *C. transvaalensis*), 'Palmetto' St. Augustinegrass (*Stenotaphrum secundatum*), and 'Emerald' zoysiagrass (*Zoysia japonica* x *Z. tenuifolia*). Two inch plugs were taken from mature turfgrass stands at the Auburn University Turfgrass Research Unit in Auburn, Alabama. Turfgrass plugs were placed in 3.5 inch diameter pots with native soil in the greenhouse and allowed to adjust and acclimate to the greenhouse environment for 4 weeks. Grasses were then treated via a single Tee Jet 8002EV nozzle in a spray chamber using compressed air as propellant and calibrated at 90 GPA. Pots were arranged in a randomized complete block design with 4 replications. Grasses were mowed with a rotary mower at a height of 1.75 inches two times per week. Ratings (visual, fluorometric, and digital images) were taken at 3 days after treatment, 1, 2, 3, 4, 6, and 8 weeks after treatment (WAT). Treatments included triclopyr (Turflon Ester 4EC, Dow AgroSciences, Indianapolis, IN) at 0.375, 0.75, 1.5, 3.0, 6.0, 12.0, and 24.0 lb ai/A and aminocyclopyrachlor (80% WDG) at 0.3, 0.6, 1.2, 2.4, 4.8, 9.6, and 19.2 oz ai/A in addition to a nontreated check. Fluorometer (fv/fm) measurements were used to determine photosystem II efficiency of the treated turfgrasses. Efficiency of 60-70% is considered peak efficiency, corresponding to healthy turfgrass. Efficiency of less than 50% is characteristic of a damaged photosystem. Visual turf quality ratings were based on a scale of 1-9 with 1 corresponding to dead or non-existent turfgrass, 7 corresponding to optimal, healthy turfgrass, and 9 corresponding to superior turfgrass. A quality rating of ≤5 is considered unacceptable. Digital images were taken to determine percent cover of the treated turfgrasses. Images were taken in a controlled lighting environment and evaluated for percent green cover using Sigma Scan software (http://www.aspiresoftwareintl.com/html/sigmascan_pro.html; http://turf.uark.edu/turfmacro/). Any reduction in percent green cover is considered unacceptable. Data was subjected to ANOVA treatment with means separated by LSD at the 0.05 significance level. Turf quality, green cover, and photochemical efficiency decreased as herbicide rate increased. Aminocyclopyrachlor ≥0.6 oz ai/A and ≥1.2 oz ai/A reduced St. Augustinegrass and bermudagrass turf quality unacceptably (<5) at 4 WAT. Aminocyclopyrachlor ≥2.4 oz ai/A reduced zoysiagrass turf quality to <5 at 6 WAT. Aminocyclopyrachlor reduced green cover of St. Augustinegrass unacceptably at all rates, bermudagrass at ≥0.6 oz ai/A, and zoysiagrass at ≥4.8 oz ai/A at 4 WAT. Aminocyclopyrachlor at 0.6 oz ai/A and 4.8 oz ai/A reduced St. Augustinegrass green cover to 23% and zoysiagrass green cover to 65% at 4 WAT. Aminocyclopyrachlor ≥0.6 oz ai/A reduced St. Augustinegrass photochemical efficiency from 73% in the control to 50% at 4 WAT. Aminocyclopyrachlor ≤2.4 oz ai/A did not decrease bermudagrass photochemical efficiency at all rating dates. Aminocyclopyrachlor at 19.2 oz ai/A reduced zoysiagrass photochemcial efficiency to <40% from 70% in the control at 6 WAT. Triclopyr at all rates caused unacceptable St. Augustinegrass and bermudagrass turf quality reduction at 4 WAT. Triclopyr ≥3.0 lb ai/A caused zoysiagrass turf quality to be reduced to 5 at 6 WAT. Triclopyr at all rates reduced St. Augustinegrass and bermudagrass green cover at 4 WAT. Triclopyr ≥3.0 lb ai/A reduced percent green cover of zoysiagrass by 20% at 4 WAT. Triclopyr at all rates reduced St. Augustinegrass and bermudagrass photochemcial efficiency at 4 WAT. Triclopyr ≥12.0 lb ai/A reduced zoysiagrass photochemical efficiency by 20% at 6 WAT. Bermudagrass was the only turfgrass tested to recover during the study; percent green cover recovery was observed at 6 and 8 WAT from aminocyclopyrachlor ≤6.0 oz ai/A and from triclopyr ≤0.75 lb ai/A. Overall, zoysiagrass is the most tolerant to the herbicides tested. St. Augustinegrass and bermudagrass were similarly tolerant to triclopyr. St. Augustinegrass was the least tolerant of aminocyclopyrachlor. Triclopyr was more injurious than aminocyclopyrachlor to warm-season turfgrasses - as comparing relative label use rates.

TRICLOPYR ENHANCES METAMIFOP AND CLODINAFOP CONTROL OF BERMUDAGRASS AND REDUCES ZOYSIAGRASS INJURY. M.C. Doroh*, J.S. McElroy, E.A. Guertal; Auburn Univ., Auburn, AL

ABSTRACT

Zoysiagrass (*Zoysia* spp.) is a popular warm-season turfgrass used on golf courses in the southern United States. However, zoysiagrass contaminated with bermudagrass (*Cynodon dactlyon* (L.) Pers.) results in an undesirable turfgrass stand due to differences in color, texture, and growth habit. Bermudagrass is a difficult weed to control in zoysiagrass due to its aggressive growth habit and similarity as a C_4 warm-season grass. Aryloxyphenoxypropionate (AOPP) herbicides have traditionally been used to suppress bermudagrass but at the detriment of excessive injury to zoysiagrass. Previous research indicates that tank-mixing AOPP herbicides with triclopyr increased bermudagrass control and decreased zoysiagrass injury. Research was conducted to evaluate other AOPP herbicides tank-mixed with triclopyr for their zoysiagrass safety and efficacy of bermudagrass control. Field studies were conducted in 2008 at the Auburn University Turfgrass Research Unit (TGRU) in Auburn, AL. Treatments were initiated to 'Zorro' zoysiagrass (*Zoysia matrella* (L.) Merr.) and 'Tifway' bermudagrass (*Cynodon dactylon* (L.) Pers. *X Cynodon transvaalensis* Burtt-Davy*)* on July 25, 2008. Treatments included clodinafop (0.07 kg ai/ha); triclopyr (1.12 kg ai/ha); clodinafop plus triclopyr (0.07 kg ai/ha + 1.12 kg ai/ha); fenoxaprop (0.10 kg ai/ha); fenoxaprop plus triclopyr (0.10 kg ai/ha + 1.12 kg ai/ha); metamifop (0.40 kg ai/ha); and metamifop plus triclopyr (0.40 kg ai/ha + 1.12 kg ai/ha). All treatments were applied with 0.25% v/v nonionic surfactant (NIS). Three applications were made at 21-day intervals. Zoysiagrass injury and bermudagrass control were visually rated weekly utilizing a 0-100% scale (0% = no visible turfgrass injury/control; 100% = complete turfgrass death; Injury >20% and bermudagrass control < 80% was deemed unacceptable). Digital images were taken 14 days after each application utilizing a light box equipped with a digital camera and analyzed using SigmaScan Pro (SPSS Inc., Chicago, IL.) for percent green cover, hue, saturation, and brightness. Each treatment was replicated 3 times in a randomized complete block design. Experimental units were 1.2 by 2.4 meters (4 by 8 feet). Herbicides were applied in a water carrier volume of 280 L/ha (30 GPA) with a CO_2 pressurized sprayer and a 101.6 cm (40 inch) boom with a pressure of 125 kPa (18 PSI) equipped with four Tee Jet 8002 type nozzles at 25.4 cm (10 inch) spacing. Data were subjected to ANOVA (P = 0.05). Means were separated using Fisher's protected LSD (P = 0.05). Zoysiagrass injury, cover reduction, and bermudagrass control data discussed here were taken 62 days after initial treatment. Clodinafop injured zoysiagrass 45% and severely reduced cover to 55%; however, when tank-mixed with triclopyr, 0% injury and 98% cover was achieved. Clodinafop alone controlled bermudagrass 70%, but tank-mixed with triclopyr increased bermudagrass control to 93%. Fenoxaprop alone injured zoysiagrass 35% and reduced cover to 61%, but tank-mixed with triclopyr resulted in 0% injury and 97% cover. Fenoxaprop alone controlled bermudagrass 32%, but 95% control was achieved when fenoxaprop was tank-mixed with triclopyr. Metamifop moderately injured zoysiagrass 17% and reduced cover to 87%, but tank-mixed with triclopyr 0% injury and 97% cover was achieved. Metamifop was the only herbicide evaluated that did not cause unacceptable injury when applied alone to 'Zorro' zoysiagrass. Metamifop alone controlled bermudagrass 40%, but tank-mixed with triclopyr 95% control was achieved. Triclopyr alone caused no visual injury to zoysiagrass and maintained cover at 97%. Triclopyr controlled bermudagrass 51% and reduced cover to 27%. These data indicate that triclopyr safens the use of clodinafop, fenxoaprop, and metamifop when applied to 'Zorro' zoysiagrass and enhances bermudagrass control.

CONTINUED EVALUATION OF POLLEN DISPERSAL FROM PALMER AMARANTH IN NORTH CAROLINA. A. Stark*,[1] S. Hoyle,[1] L. Wang,[1] M. Burton,[2] R. Richardson,[1] D. Jordan[1]; [1]NC State Unversity, Raleigh, NC, [2]Missouri State University, Springfield, MO

ABSTRACT

Glyphosate resistant Palmer amaranth (*Amaranthus palmeri*) has currently been confirmed in at least 10 counties in Georgia and in 11 counties in North Carolina. Given that the hectacreage of land infested with resistant Palmer amaranth has doubled since 2005, weed scientists, cotton, soybean, and vegetable growers continue to be concerned about its spread. Given the ability of the glyphosate resistant germplasm to spread via pollination, it is important to understand the dynamics of Palmer amaranth pollen dispersal in order to effectively manage resistance. This study outlines the continued investigation into modeling Palmer amaranth pollen dispersal with the BREEZE ISC GIS PRO dispersion modeling software package. The preliminary study conducted in 2007 indicated that the pollen settling traps must be distributed over a wider range of heights and distances in order to provide appropriately detailed empirical data for modeling. It was also determined that continuous on-site monitoring of air speed, direction, temperature, and relative humidity were needed to apply real-time corrections of modeling parameters. On six dates during the summer of 2008, Palmer amaranth pollen emissions were captured from a point source population of male individuals transplanted into a field in Goldsboro, NC. Traps captured settling pollen on greased microscope slides for the duration of pollen emission each day (approximately 8am to 10am). Initially, the 2008 trap arrangement was restructured into a 200 m diameter circular trapping area surrounding the pollen source. This circle size was determined to be too large of a sample area to manage the pollen traps. Subsequently, the sampling area was reduced to a 100 meter diameter circle. Pollen traps were arranged in a compass rose array with eight spokes surrounding the point source at distances of 1m, 2m, 10m, 25m and 50m. Pollen traps were placed at heights of 1m (crop canopy height), 2m, 3m, 4m, and 5m to total 165 traps. Continuous weather data was taken during all 2008 pollen sampling times. Palmer amaranth pollen has been observed in samples at trap heights ranging from crop canopy height to four meters above canopy and at distances from the point source that span the entire scope of the trap array. Samples are currently being processed and further modeling with the BREEZE software package is pending.

EVALUATION OF HORSENETTLE (*SOLANUM CAROLINENSE*) CONTROL WITH QUADRAT AND LINE TRANSECT TECHNIQUES. J.A. Tolson*, D.M. Fryman, W.W. Witt; University of Kentucky, Lexington, KY

ABSTRACT

Horsenettle (*Solanum carolinense* L.) is a problematic weed in cool-season grass hayfields and pastures in Kentucky. The spines on the stems and petioles inhibit grazing around the plant and reduce forage quality. This experiment evaluated horsenettle control and comparisons between two counting techniques in an orchardgrass hayfield. Forefront R&P (aminopyralid at 69 g a.e./ha + 2,4-D at 0.6 kg a.e./ha and aminopyralid at 92 g a.e./ha + 2,4-D at 0.7 kg a.e./ha) at 1.5 pt/A and 2 pt/A, Dow Agro Sciences GF-2050 (aminopyralid at 5 g a.e./ha + metsulfuron at 10 g a.e./ ha, aminopyralid at 74 g a.e./ha + metsulfuron at 13 g a.e./ ha, and aminopyralid at 93 g a.e./ha + metsulfuron at 16 g a.e./ha) 1.5, 2, and 2.5 oz/A, Weedmaster (dicamba at 0.3 kg a.e./ha +2,4-D at 0.8 kg a.e./ha) at 2pt/A, Weedmaster with Cimarron (dicamba at 0.1 kg a.e./ha + 2,4-D at 0.4 kg a.e./ha and metsulfuron at 8 g a.e./ha) at 1 pt/A and .25 oz/A, Cimarron Plus (metsulfuron at 8 g a.e./ha + chlorsulfuron at 3 g a.e./ha) at .25 oz/A, and Cimarron Plus (metsulfuron at 17 g a.e./ha + chlorsulfuron at 5 g a.e./ha) at .50 oz/A were applied July 2 and July 25, 2008. All treatments contained a non ionic surfactant at 0.25% v/v. Horsenettle plants in plots were counted using a line transect, a 1 m^2 quadrat, and a total horsenettle count of all plants in each plot for the evaluation of counting technique. Plots were 3 m x 9 m with line transects in the center of each plot. Transect counts were made in the center 6 m of each plot. Three m^2 counts were conducted within each plot for comparison. The quadrat was randomly assigned to the center of each plot and horsenettle plants counted. Analysis of quadrat counts and total horsenettle plants revealed a correlation of 88% at $p < .01$. The line transect counts were not highly correlated with the total horsenettle plants. GF-2050 at 1.5 and 2.5 oz/A, and Weedmaster at 2 pt/A significantly reduced horsenettle population.

CLOVER RESPONSE TO SOIL CONCENTRATIONS OF PASTURE HERBICIDES. M.E. Edwards*, W.W. Witt, J.D. Green; University of Kentucky, Lexington, KY

ABSTRACT

Clovers are a valuable component of grass-legume based forages in beef cattle pastures within Kentucky and the surrounding region. Unfortunately, most herbicides available for grass pastures destroy clovers when applied foliarly or they persist in soil and reduce clover population. A greenhouse study conducted in 2008 evaluated the response of red clover (*Trifolium pretense*) and white clover (*Trifolium repens*) to an array of concentrations of aminopyralid, 2,4-D ester, dicamba and aminocyclopyrachlor. Dicamba and 2,4-D concentrations were 0, 5, 10, 20, 40, 80, 160, and 320 ppb; 2,4-D was also applied at 640 ppb. Aminopyralid and aminocyclopyrachlor concentrations were 0, 0.005, 0.05, 0.5 and 5 ppb; aminocyclopyrachlor was also applied at 50 ppb. Herbicide treated soil was placed into cups (450 g/cup), seeded with either red clover or white clover and irrigated as needed. Plant height, fresh weight and dry weight measurements were recorded 22 days after seeding. The experimental design was a randomized complete block with four replications. An effective dose that inhibited clover growth 50 percent (ED_{50}) was calculated for each herbicide and growth parameter. Plant height was a more consistent indicator of the estimated effective dose among the four herbicides. The ED_{50} for red clover relative to plant height were 62, 518, 5, and 2 ppb for dicamba, 2,4-D, aminopyralid, and aminocyclopyrachlor, respectively. The ED_{50} for white clover relative to plant height were 93, 582 and 0.6 ppb for dicamba, 2,4-D, and aminocyclopyrachlor, respectively.

FOMESAFEN FOR PALMER AMARANTH CONTROL IN PEANUT. M.H. Dobrow*, J.A. Ferrell, G.E. MacDonald, B.J. Brecke; University of Florida, Gainesville, FL

ABSTRACT

Fomesafen has been documented to control Palmer amaranth in cotton and soybeans but is not registered for use in peanut. Therefore, experiments were conducted in 2008 to document the control of Palmer amaranth in peanut with fomesafen. It was observed that at-crack (AC) applications of fomesafen at 0.19 and 0.25 lb ai/A provided effective control of Palmer amaranth 3 weeks after treatment (WAT) but declined under 90 % control by 4 WAT. The rate of 0.38 lb ai/A extended acceptable levels of control (greater than 90%) up to 5 WAT. Additionally, fomesafen applied AC at 0.50 lb ai/A provided control up to 8 WAT. Palmer amaranth plants were less than 1 inch in height at the AC application. Post application rates of 0.19, 0.25, 0.38 lb ai/A, 21 days after planting, did not provide acceptable levels of control as Palmer amaranth plants were 6 to 8 inches tall at time of application. However, a post application of 0.50 lb ai/A maintained acceptable levels of Palmer amaranth control up to 4 WAT. From these data, extended control of Palmer amaranth can be achieved with the use of fomesafen if applied AC with a use rate greater than 0.25 lb ai/A or post application use rate of 0.50 lb ai/A. Additionally, these same application rates, applied in a weed-free trial, resulted in less than 20% injury and no yield reduction.

GIANT RAGWEED CONTROL IN SOYBEANS. B. Waggoner*,[1] L.E. Steckel,[1] T. Mueller[2]; [1]University of Tennessee, Jackson, TN, [2]University of Tennessee, Knoxville, TN

ABSTRACT

Giant ragweed has become an increasingly significant problem in soybean, perhaps due to over-reliance on glyphosate for control. The objective of this study was to determine weed control from glyphosate-only systems and examine alternate control strategies as needed. Research was conducted at multiple locations in Tennessee; with some susceptible and some putative resistant sites. At a susceptible site, all glyphosate treatments provided complete control (> 90%). At a non-susceptible location, glyphosate alone did not control giant ragweed (<60% control). Adding other modes of action, such as ALS or PPO increased the level of control to >80%, although control diminished later in the season. Other PRE modes of action also were investigated and provided good control soon after application. This research strongly indicates that giant ragweed with reduced sensitivity to glyphosate is present in Tennessee and that effective control will require tank mix partners to provide adequate control.

SPATIAL MOVEMENT OF GLYPHOSATE-RESISTANT PALMER AMARANTH IN COTTON. G.M. Griffith*, J.K. Norsworthy, K.L. Smith, V. Skinner; University of Arkansas, Fayetteville, AR

ABSTRACT

There are now five confirmed glyphosate resistant weed species in Arkansas. Of particular concern to many producers and researchers is how fast these populations will spread. It has long been known that weed seeds can spread short or long distances by wind, water, animals, and humans. Short-distance weed seed spread is responsible for the local distributions and densities of natural weed populations in a cropping system. Prior to the evolution of glyphosate-resistant weeds such as Palmer amaranth, these natural populations were easily controlled with glyphosate. It is believed that multiple factors contribute to in-field expansion of Palmer amaranth, but it is the objective of this research to determine the collective impact of dispersing agents on the rate of expansion in an enhanced, glyphosate-resistant cotton field (Roundup Ready® Flex) where the crop is managed in a manner similar to that by producers. Glyphosate-resistant Palmer amaranth from Lincoln County, AR, was sown at 20,000 seeds into a single circular 1-m^2 area in four 0.6- to 1.2-ha fields at the Main Experiment Station of the University of AR at Fayetteville in February 2008. The center and edge of these initial 1-m^2 patches were georeferenced (±4 cm). This initial introduction was intended to represent seed production from a single glyphosate-resistant plant that survived to maturity. These fields do not contain a natural infestation of Palmer amaranth based on observations taken in the fields over the past 2 years. Roundup Ready® Flex cotton was planted May 19, 2008 in 1-m-wide rows in each field. Glyphosate was applied at 0.84 kg ae/ha (normal use rate) over-the-top of cotton on May 20, June 11, and July 16, 2008 to control existing weeds. Relative elevation has been measured in the fields because the rate of patch expansion is believed to be associated with water flow during rainfall events and irrigation. The perimeter of each Palmer amaranth patch was mapped at the end of the season in relation to the center point of the initial patch using a GPS. Additionally, the density of Palmer amaranth was taken 2 weeks after each glyphosate application using a 1.0-m^2 grid until no Palmer amaranth was found for at least 10 m. Spatial seed cotton yields were taken using a yield monitor and GPS receiver. Preliminary results indicate the majority of seed movement in each field in the longitudinal direction, the general slope of the field (North). Several factors are likely responsible, including but not limited to: tillage, planting, fertilization, wind, rainfall, and irrigation. Palmer amaranth seed moved as far as 114 m downslope (north) from the source in one field. It is suspected that movement this far from the source occurred in early spring when intense rainfall was sustained over short periods of time. For instance, over 28 cm of rain fell in the month of March alone. In the same field, two other Palmer amaranth plants were found at 109 m and 102 m; however, in all other fields Palmer amaranth moved less than 17 m longitudinally. Lateral movement occurred to a lesser extent in all fields, up to 4 m. In only 1 year from their time of introduction, Palmer amaranth patches increased in size from the initial 1-m^2 to a total infested area in each field of 26 to 36 m^2.

CAN PALMER AMARANTH TOLERANCE TO GLYPHOSATE BE INCREASED WITH LOW GLYPHOSATE DOSES? L.E. Estorninos*, J.K. Norsworthy, S. Bangarwa, G.M. Griffith, J.A. Still; University of Arkansas, Fayetteville, AR

ABSTRACT

The evolution of glyphosate-resistant Palmer amaranth has been reported to be the result of over-reliance on glyphosate for weed control in herbicide-resistant crops. A study was conducted in the greenhouse of the University of Arkansas in Fayetteville from 2006 to 2008 to evaluate the increase in tolerance of progenies of Palmer amaranth from plants that had been treated with increasing rates of glyphosate at each generation. The spray applications were made inside a spray chamber with a 2-nozzle boom and calibrated to deliver 10 gal/acre. Plant death (live or death) was determined 21 d after treatment of each generation. Three hundred seedlings of a known susceptible Palmer amaranth biotype that had never been previously treated with glyphosate were sprayed with glyphosate at 0.105 kg ha-1 at the 8-leaf stage. Alive plants that survived the glyphosate (14%) were transplanted to 6-in-diameter pots and were allowed to produce seeds. The sequence of selection to higher glyphosate rates was continued until the fourth generation. Dose-mortality response was conducted following the fourth generation. F1 plants were sprayed with glyphosate at 0.125 kg ha-1 and had 18% survivors. The F2 generation was sprayed with 0.21 kg ha-1 glyphosate and produced 49% survivors, and the F3 generation treated with 0.42 kg ha-1 had 14% survivors. F4 plants and ones from the initial population from which selection began were planted were treated with a range of glyphosate rates (0.053, 0.105, 0.21, 0.42, 0.84, 1.68, 3.36, and 6.72 kg ha-1) at the 8-leaf stage. The response of the F4 plants and initial population to glyphosate is evaluated and results will be presented.

EVALUATION OF *AMARANTHUS RUDIS* ACCESSIONS FOR SUSCEPTIBLITY TO GLYPHOSATE.

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ABSTRACT

Control of common waterhemp (*Amaranthus rudis*) by glyphosate has been variable in the Coastal Bend of Texas. Specifically, five plants surviving multiple in-season glyphosate applications at labeled rates were identified, and F_1 seed was harvested at maturity. The objective of this study was to screen the progeny to determine the level of glyphosate susceptibility within each population. For the initial screening, F_1 seeds were germinated in flats containing potting media and sprayed when the plants were less than 6 in. with 0.5, 1, 2, and 4X rates of glyphosate (1X = 22 oz/A). Spray solutions were applied using a standard greenhouse sprayer equipped to deliver 10 GPA with TurboTee® 110015 spray tips at 28 PSI. The percentage of survivors was determined 12 DAT. At the 1X rate, control ranged from 30 to 82%. At the 4X rate, two populations exhibited 35-46% survival rates, and two populations exhibited survival rates exceeding 60%. A Chi-Square analysis of the data ($P = 0.05$) indicated that two lines had w^+w X w^+w^+ parentage, two lines had w^+w X w^+w parentage, and one had inconclusive parentage. The novel *w* allele is believed to impart the variable levels of glyphosate control. To obtain a more homozygous population, plants within each population surviving the 2X and 4X rates were allowed to cross-pollinate. F_2 seed was harvested at maturity and planted in 5 in. pots for further screening. Complete germination failure indicated that dormancy issues may exist. The dormancy issues must be overcome prior with to use in dose response curve analyses. Additional screening of the F_1 seed was initiated by germinating seed in 5 in. pots containing universal potting media. Confirmed glyphosate-resistant and glyphosate-susceptible biotypes were included as positive and negative controls. Plants were thinned to one per pot with three replications, and a randomized block design was used. When the plants were less than 6 in., 9 rates (0, 0.5, 1, 2, 4, 6, 8, 10, and 12X) of glyphosate were applied using a standard greenhouse sprayer equipped to deliver 10 GPA with TurboTee® 110015 spray tips at 28 PSI. Visual control and height were evaluated 14 DAT.

EFFECT OF GLYPHOSATE RATES ON COMMON WATERHEMP (*AMARANTHUS RUDIS*) ECOTYPES. M.Y. Mohammed*,[1] N.R. Falkenberg,[2] J.M. Chandler[3]; [1]Borlaug Institute for International Agriculture - Texas A&M University System, College Station, TX, [2]Department of Soil and Crops Sciences - Texas A&M University, College Station, TX, [3]Department of Soil and Crops Sciences - Texas A&M University System, College Station, TX

ABSTRACT

Growth chamber studies were conducted to evaluate the response of common waterhemp (*Amaranthus rudis*) ecotypes to glyphosate during the spring of 2008 with the studies duplicated. Three common waterhemp ecotype seeds were planted in 15 cm diameter pots and arranged in a complete randomized design. Growth chamber temperatures were 35 and 22 C with 16 and 8 h day and night photoperiods. Six plants were maintained per pot and sprayed with glyphosate (RoundUp-WeatherMax™ 540 g ae l^{-1}) 18 - 23 days after germination when the average plant height reached 12 cm. Glyphosate was applied at 2X, 4X, 6X and 8X of the recommended dose of 840 g ae ha^{-1} plus the control that was sprayed with water. A non-ionic surfactant was used at 0.25% (v/v) with all treatments. All applications were made at 187 l/ha in a spray chamber equipped with a XR11002 flat fan nozzle. A visual rating scale of 0 through 100 was used to determine the weed injury with 0 = no injury and 100 = 100% injury. Common waterhemp tolerance was related to glyphosate application rates and the response curve for the three ecotypes across the glyphosate rates were similar. The visual injury peaked at 12 days after application and the degree of recovery by 21 days was related to the rate of glyphosate applied. The visual injury resulting from glyphosate at 2X was less than 80% for all ecotypes. Glyphosate at 4X resulted in injury less than 90% for all ecotypes while glyphosate rate of 6X and 8X provided injury of 95 and 98%. Ecotype 19 recovery was 10 - 15% better than ecotypes 6 and 15 with the 2X and 4X rates of glyphosate by 21 days after application. Appearance of new leaves and stem tissue was observed at the leaf axial by 18 days after treatment with glyphosate at 6X. Common waterhemp tolerance to glyphosate was regulated by application rates and variability among ecotypes.

INFLUENCE OF TIMING OF WEED REMOVAL ON SOYBEAN GROWTH AND DEVELOPMENT. S.A. Hansen*, S.A. Clay, D.E. Clay, G. Reicks; South Dakota State University, Brookings, SD

ABSTRACT

The morphological effects of velvetleaf on soybean growth, development, and yield in a controlled field setting were monitored and evaluated for one growing season. Velvetleaf remained for the entire season or was removed at V3 (5 WAP), R1 (7 WAP) or R2 (10 WAP) stages of soybean. Soybean plants were measured for height, density, biomass, leaf area and growth stage at each velvetleaf removal date. Velvetleaf height, density, biomass and leaf area were measured at each removal date. Soybean plant densities were similar at each sampling date among treatments. Velvetleaf plant density varied among replications at each sampling date. Densities ranged from 80 to about 550 plants/m^2. Total velvetleaf biomass, however, was less variable. Total dry weight of velvetleaf plants removed at V3 stage of soybean was similar regardless of plant density, and averaged 14 g/m^2. Soybean biomass but not leaf area was affected by the presence of velvetleaf as early as the V3 stage. At R1, total velvetleaf biomass was sensitive to velvetleaf density, with greater densities having greater biomass. A linear regression fit these data with a slope of 1.1 ($p=0.03$) and an adjusted $r^2 = 0.99$. The total biomass of velvetleaf plants removed at R2 or allowed to compete throughout the season was similar between these dates and velvetleaf biomass averaged about 100 g/m^2, regardless of density. Soybean leaf area and biomass were reduced by velvetleaf presence at R1 or R2 stage compared to the weed-free control plants. Soybean yield in the weed-free treatment averaged 2440 kg/ha. Soybean yield loss when velvetleaf was removed at V3 ranged from 4 to 14% and at R1, ranged from about 5% at low velvetleaf density to 35% at high velvetleaf density. Soybean yield loss data combined for V3 and R1 showed a linear relationship (adj $r^2 = 0.89$; slope = 0.05 $p=0.01$) to the velvetleaf density measured at these times of removal. When velvetleaf was removed at R2 or allowed to compete throughout the season, yield loss averaged about 70% and was not directly related to velvetleaf density nor biomass.

WEED COUNT TIMING CORRELATED TO SEED BANK GROW OUTS. E.E. Frasure*,[1] M.L. Bernards,[1] G.M. Sbatella,[2] L.A. Howlett,[2] R.G. Wilson[2]; [1]University of Nebraska, Lincoln, NE, [2]University of Nebraska, Scottsbluff, NE

ABSTRACT

Weed seed banks can be used as a predictor or measure of the weeds that will later grow in the field. However, many studies have been conducted to determine the correlation of weeds in the field to the seed bank with varying results. The objective of this study was to determine the relationship between seed bank grow-outs and weeds counted in 28 Nebraska fields. Fields representative of Nebraska from 2006 to 2007 were assessed. All fields were mapped using GPS with 40 sample sites established in each. Each field ranged from 8.1 ha to 24.3 ha in size. Fields were surveyed 4 times during the growing season for weeds: pre-plant, after emergence, after herbicide, and pre-harvest at each sample location. All weeds in a 0.5 m^2 quadrat were identified and counted. Soil samples were collected using a bulb planter (6.4 cm diameter x 15 cm deep) at the pre-plant timing from each of the 40 sample sites. The samples were grown in a green house to allow seed germination for identification and counting. Between field counts and greenhouse grow-outs, 95 different species were identified. Many species were counted in the field but were not found in the greenhouse. The amaranthus complex (redroot pigweed, common waterhemp, and palmer amaranth), velvetleaf, common lambsquarters, and green foxtail species were selected to compare field counts to soil seed bank counts. These species were selected because they were found in enough fields to provide some correlation. To conduct the analysis, all of the weeds counted at the 4 different timings were summed together and then plotted against the greenhouse grow-out counts. The most consistent correlation was for the amaranth complex. The R^2 value for 2006 was 0.49 and for 2007 was 0.62. The correlation for common lambsquarters varied widely between years. In 2006 the R^2 was 0.07 but in 2007 it was 0.86. The correlation values for green foxtail were similar between years, 0.17 in 2006 and 0.29 in 2007. Velvetleaf had very low correlation values both years, 0.03 in 2006 and 0.06 in 2007. In general the relationship between seeds in the soil and those counted in the field was poor.

EMERGENCE PATTERNS OF PALMER AMARANTH, APPLE OF PERU, EASTERN BLACKNIGHTSHADE, AND CUTLEAF GROUNDCHERRY IN ROW CROPS. A. Stark*,[1] S. Hoyle,[1] R. Richardson,[1] A. York,[1] M. Burton,[2] D. Jordan[1]; [1]NC State Unversity, Raleigh, NC, [2]Missouri State University, Springfield, MO

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*), Apple of Peru (*Nicandra physaloides*), and Eastern blacknightshade (*Solanum ptycanthum*) are prevealent in some crop production areas of North Carolina. Practitioners indicate that control of Apple of Peru is difficult, and rapid increases in distribution have resulted in increased concern among soybean and cotton growers. Glyphosate resistance in Palmer amaranth is well documented in North Carolina and Georgia and has become a major concern for cotton and soybean growers. Understanding germination patterns and other biology-related characteristics of these weeds could improve management of these weeds. The objective of this field experiment was to determine the effect of various crop canopies on the emergence of Apple of Peru, Eastern blacknightshade, the native solanaceous weed cutleaf groundcherry (*Physallis angulata*), and glyphosate susceptible and resistant Palmer amaranth. The study was conducted in North Carolina during 2007 and 2008 near Goldsboro and Kinston. Row crops used in the study included corn (*Zea mays*) (36 inch rows), cotton (*Gossypium hirsutum*) (36 inch rows), and wide and narrow row soybean (*Glycine max*) (28 or 14 inches and 36 or 18 inches at Goldsboro and Kinston, respectively). Sub-plots in each experiment consisted of four rows of each crop with weed seed planting sites spaced one m apart arranged between the second and third crop rows. Each of the five species/biotypes of weeds were planted twice in each sub-plot; first, one month prior to planting the crop, and second, on the day that the crop was planted. In the center of a 30 by 30 cm enclosure, 100 seeds from one species were planted in the uppermost inch of soil (200 seeds were planted for Palmer amaranth biotypes). Seedlings in each plot were counted and removed each week for the remainder of the growing season. The second planting date of weeds had a total germination roughly twice that of the early planting date. When the weed species/biotypes were compared, it was apparent that cutleaf groundcherry and glyphosate susceptible Palmer amaranth had the highest cumulative average emergence over all years and locations, more than 50% greater than all others. Of all weed species and biotypes, glyphosate resistant Palmer amaranth had the lowest germination at less than half that of the susceptible Palmer amaranth. Emergence of the majority of weeds in corn occurred in April and May, whereas emergence was skewed towards later months in cotton and both soybean row widths. Palmer amaranth emergence appears to be correlated with the planting date of the weeds and is not correlated with presence or lack of glyphosate resistance.

GRAZING BY WHITE-TAILED DEER ALTERS WEED SEEDBANK COMPOSITION IN OLD-FIELDS.
A. DiTommaso*, S.H. Morris, A.A. Agrawal; Cornell University, Ithaca, NY

ABSTRACT

Soil seedbank composition is important to the recovery of natural and semi-natural areas from disturbance and as a safeguard against environmental catastrophe. White-tailed deer (*Odocoileus virginianus*) populations have increased dramatically in New York State during the past century, and appear to influence plant community structure in affected areas. Deer are generalist browsers and grazers that thrive in suburban/natural habitats, and could potentially facilitate the transport of propagules of more palatable species. Additionally, deer feeding habits may alter plant community structure and thus impact seedbank composition. To study the long-term effects of deer browsing on old-field seedbank composition, six 15 x 15 m fenced exclosures were established in 2005 in recently fallowed agricultural fields near Ithaca, NY, USA. An equally-sized plot that was accessible to deer was also established adjacent to each exclosure. In mid-November of each of three years (2005-2007), four 3.5 L subsamples of soil were collected from each of the 12 plots and transferred to a heated greenhouse. Each sample was mixed (2:1) with a greenhouse potting soil, and spread to a depth 2.5 cm in a plastic flat. Emerged seedlings were identified, counted, and removed during a 7-wk period, after which flats were moved to a refrigerator (4°C) for a 4-wk cold stratification period. The flats were then returned to the greenhouse for a second 7-wk germination cycle. During the three sampling seasons, soil samples collected from deer exclosure plots had 21% more seedlings than soil samples from plots accessible to deer. Native species comprised 42% of seedlings from exclosure plots and 36% of seedlings from deer-accessible plots. In exclosure plots, 67% of seedlings were of perennial species, while perennials comprised 54% of seedlings from deer-accessible plots. Five of the six most abundant species in the exclosure plots during the 3-years of sampling were perennials and included curly dock (*Rumex crispus*) and white campion (*Silene alba*). In deer-accessible plots, the two dominant perennials included white campion and broadleaf plantain (*Plantago major*). Seedbank composition appeared to diverge between the two treatments with time. For example, in 2005, 2 of the top 3 most abundant species [yellow woodsorrel (*Oxalis stricta*) and common lambsquarters (*Chenopodium album*)] were found in both the exclosure and deer-accessible plots but, by 2007, none of the three most abundant species were similar. These early findings suggest that deer activity is already influencing seedbank composition in these old field systems and most likely through alterations in the structure of the aboveground plant community.

A RAINFED ROTATION OF GLYPHOSATE RESISTANT CORN AND SOYBEAN AND SHIFTS IN WEED SPECIES. R.N. Klein*, G.E. Hanson; University of Nebraska, North Platte, NE

ABSTRACT

Research continued in 2008 on a study begun in 1997 at North Platte, NE. Yearly treatments including two glyphosate-only treatments and a preemergence herbicide treatment; and a yearly alternating glyphosate/glyphosate + preemergence herbicide treatment are compared in glyphosate resistant continuous corn and corn-soybean rotations in a rainfed no-till system. It is hypothesized that multiple annual applications of glyphosate will result in gradual weed shifts to naturally resistant species and increase the chances of evolved resistance. Preplant weed populations, including Russian thistle (*Salsola iberica*), redroot pigweed (*Amaranthus retroflexus*), marestail (*Conyza canadensis*), and field sandbur (*Cenchrus longispinus*) were higher than normal due to early germination. Favorable precipitation for both crop growth and weed growth resulted in excellent weed control from all herbicide treatments. The crop canopy discouraged new weed germination, resulting in low weed populations at harvest time. Weed species which typically escaped the late POST treatments by late germination, such as carpetweed (*Mollugo verticillata*) and tumble pigweed (*Amaranthus albus*), were well controlled this year. At this point in the study, it appears no weeds have developed resistance to glyphosate. Marestail and common lambsquarters (*Chenopodium album*) have been seen in other field work to be difficult to control with glyphosate, but have not become a problem in this study.

WEED POPULATION DYNAMICS IN PACIFIC NORTHWEST MINIMUM DISTURBANCE SYSTEMS.

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ABSTRACT

Any cropping or weed control system that exerts a continuous, strong selection pressure will cause a buildup of the weed species most-adapted to that selection pressure. Little information exists on the effects of conservation tillage practices, including crop rotation, on weed populations in the high rainfall (>46 cm) zone of eastern Washington. A multi-year cropping systems study with a winter wheat (WW) - spring wheat (SW) - alternative crop rotation (winter or spring plantings each of barley, canola, or pea) was initiated in 2000 on the Cook Agronomy Farm near Pullman, WA, to evaluate, in part, the effect of conservation tillage practices on weed species populations' composition and distribution across the landscape. Each of the 6 rotations was represented by a large, farme-scale plot. At that time, the soil seedbank was sampled at 246 1 m^2 quadrats. In the spring of 2007, the same quadrats were resampled to evaluate the change in weed species populations composition and distribution in response to management practices, biotic and abiotic factors. Methods of exhaustive germination were similar at each sampling time. Homogenized soil samples were placed in 32 cm square plastic trays and watered regularly. Weed germination was recorded by species on one week intervals for 6 months. Each month, at the end of three weeks, the soil was allowed to dry for one week, and each sample was re-homogenized and re-randomized on the greenhouse benches. Nonmetric multidimensional scaling (NMS) ordinations using PC-ORD software (version 5.0) were conducted to examine compositional differences in the weed seedbank community among rotations over the two sampling intervals. Weed counts were averaged across the 6 farm-scale plot areas to yield a total of 24 data points (6 rotational crops, 2 sampling years, 2 adjacent fields). The abundance of each weed species changed depending on the 6 alternative rotation options during the study interval and the field being evaluated. Wild oat (*Avena fatua* L.) and common lambsquarters (*Chenopodium album* L.) abundance decreased while Italian ryegrass [*Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot] and mayweed chamomile (*Anthemis cotula* L.) increased when the rotation was WW - SW - spring alternative crop rotation. Weed species composition in winter canola or barley alternative crop systems changed from wild oat and common lambsquarters to prickly lettuce *(Lactuca serriola* L.), while weed species composition in winter pea changed depending on field position, becoming dominated by Italian ryegrass or prickly lettuce. The observed changes in weed species composition agree with the changes that have occurred in management practices on the site, particularly the repeated use of herbicides for wild oat control.

CLIMATE EFFECTS ON WEED POPULATION DYNAMICS. A LONG-TERM STUDY. J.L. Gonzalez-Andujar*,[1] M. Lima,[2] L. Navarrete[3]; [1]Instituto de Agricultura Sostenible (CSIC) & Laboratorio Internacional de Cambio Global, LINCG (CSIC-PUC), Cordoba, Spain, [2]Pontificia Universidad Catolica de Chile & Laboratorio Internacional de Cambio Global, LINCG (CSIC-PUC), Santiago, Chile, [3]Instituto Madrileño de Investigación Agraria y Alimentaria (IMIDRA), Alcala de Henares, Spain

ABSTRACT

Periodically oscillating populations have been of persistent interest in theoretical and applied ecology. From a dynamical system perspective periodic oscillations can be the result of endogenous or exogenous factors. Exogenous factors affect the population rate of change but they are unaffected by the current or past values of the population. By contrast, endogenous factors affect and are affected by the current or past values of population density. Oscillations have been observed in weed populations. Population dynamics of weeds are the result of the combined effects of feedback structure (ecological interactions within and between plant populations), limiting factors (nutrient and water limitation), climatic influences (rainfall, temperature) and stochastic forces. To understand how these factors may determine weed oscillations, we model both system-intrinsic processes and exogenous influences as a general model based in the *R*-function ($R_t = \log (N_t) - \log (N_{t-1})$.The *R*-function represents the realized per capita population growth rates that represent the processes of individual survival and reproduction. Here, we used a long-term data of *Papaver rhoeas* L. (poppy) in non-tillage and minimum tillage systems for determining the importance of endogenous processes, local weather and large-scale climatic factors. We focus on diagnostic and modeling tools from population dynamics theory to analyze these long-term data and to determine the role of the North Atlantic Oscillation (NAO) and local weather as exogenous factors influencing weed dynamics. *P. rhoeas* is one of the most common dicot weeds in winter cereals in the Mediterranean region and it is difficult to control because of some of its biological features, particularly, high fecundity, long persistence of the seed bank, and an extended period of germination. *Papaver rhoeas* is also a very competitive weed that can substantially reduce grain yields by 12% or more. The numerical fluctuation of *P. rhoeas* was characterized by irregular oscillations and a clear negative trend. Our analyses showed that the first-order logistic model without exogenous effects explains 60 and 49 % of the observed variation in *R* values in the non-tillage and minimum tillage system respectively. On the other hand, the model fitted using the non-tillage data and including the NAO, rainfall and temperature (winter and summer) as co-variables was able to show acceptable predictions in the minimum tillage data set. The same model fitted to minimum tillage data showed the best predictions in the non-tillage data. Our model, including local and global climatic factors was able to predict the population dynamics of *P. rhoeas* under two different tillage systems. This work, highlight the possible importance of the effect of large-scale climatic factors such as NAO on local population dynamics, similar effect have been showed in animal populations.

DIURNAL RHYTHM OF CATECHIN EXUDATION BY AN INVASIVE PLANT -SPOTTED KNAPWEED (*CENTAUREA MACULOSA*). D. Triebwasser,[1] N. Tharayil*,[1] R.M. Callaway[2]; [1]Clemson University, Clemson, SC, [2]University of Montana, Missoula, MT

ABSTRACT

Invasive plants rely upon unique traits and interactions to gain competitive advantage over native species. Allelopathy, the production of secondary metabolites at phytotoxic concentrations, has been proposed as mechanism of invasion of few exotic species. Catechin is a phytotoxic natural flavanoid implicated in the allelopathic interactions of *Centaurea maculosa.* Catechin also prevents conspecific seedling establishment, thus preventing intra-specific competition. However, catechin due to its structural instability, undergoes rapid redox and polymerization reactions, and is readily degraded by the microbes outside plant tissues. Investigating the mechanism of stability of catechin, we hypothesized that a pulsed release of catechin, by temporally overwhelming the degradation capacity, could result in its accumulation in the growth medium. We tested the hypothesis by quantifying the diurnal rhythm of catechin release of *C. maculosa* in a hydroponic system. Three week old plants were transplanted in batches of 12 to opaque polypropylene containers and maintained under full sunlight in the greenhouse. The catechin concentration was quantified at various time intervals in accordance with the difference in duration of light exposure. Analytical method for catechin quantification was optimized as follows: the growth solutions were filtered-sterilized and was further concentrated and purified on a polymeric solid phase extraction column. The compound was further quantified with an HPLC using a fluorescence detector, with an excitation-emission wavelength 205-315. This excitation-emission wavelength was found to be ten times more sensitive than the previously reported excitation-emission of 280-315, and the limit of detection was 0.1 ng. Catechin was detected 5-6 hours after exposure to sunlight and there was no accumulation of catechin overnight, indicating a possible diurnal rhythm in the exudation of the compound by *C. maculosa*. Catechin was found to further undergo degradation reaction resulting in a transient abundance of pyrocatechol in our system. Our results indicate the pulsed release could result in transient accumulation of catechin in growth medium.

DEHYDRATION-STRESS AFFECTS VEGETATIVE REPRODUCTION AND TRANSCRIPTOME PROFILES IN UNDERGROUND ADVENTITIOUS BUDS OF LEAFY SPURGE (*EUPHORBIA ESULA*).

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ABSTRACT

Leafy spurge is an invasive perennial weed that infests mainly range, recreational and right-of-way lands in the great plains of the US and Canada. Although spread occurs by both seeds and roots, the perennial nature of leafy spurge is attributed to vegetative reproduction from an abundance of underground adventitious buds commonly referred to as crown and root buds. The ability of herbaceous perennial weeds, like leafy spurge, to regenerate new shoot growth by vegetative reproduction from crown and root buds after severe abiotic stress is critical for survival. Since leafy spurge plants are often challenged by dehydration-stress during their perennial life cycle, the objective of this study was to determine how mild and severe dehydration-stress affects vegetative reproduction from crown and root buds, and to link relationships associated with molecular pathways affected by dehydration-stress. Microarray analysis was used to follow transcriptome profiles to identify critical defense and signaling pathways that may be linked to survival of crown and root buds during dehydration-stress. In a preliminary study, vegetative reproduction was determined at ten different time points during dehydration-stress, and the critical points (day-0, -3, -7, -14, -16, -21) were chosen for further study. cDNAs were generated from both crown bud and root bud samples collected separately during the dehydration study, and were hybridized to 23K element Euphorbiaceae-specific microarrays. The dosage of dehydration affected vegetative production from these buds. Transciptome analyses revealed that 280 and 254 genes (q value = 0.005) were differently expressed during dehydration stress in the crown buds and root buds, respectively. Differentially-expressed genes included functional ontologies, as defined by MIPS, that regulate metabolic functions, responses to stress (including osmotic and salt, oxidative, and heat shock), transport functions, DNA and RNA processing, binding (primarily protein, nucleic acid, DNA, and calcium), protein synthesis and processing, the cell cycle, cellular sensing and response to external stimulus, and cell and plant development.

EFFECTS OF TEMPERATURE, PHOTOPERIOD, AND VERNALIZATION ON ENDODORMANCY AND FLOWERING OF LEAFY SPURGE. M.E. Foley*, J.V. Anderson, D.P. Horvath; USDA-ARS, Fargo, ND

ABSTRACT

The herbaceous perennial weed leafy spurge (*Euphorbia esula*) reproduces by vegetative and sexual means; characteristics that are key to its persistence and survival. In this study, we examined environmental effects on dormancy and flowering under controlled conditions to further validate field observations and set the stage for the future identification of molecular mechanisms involved in dormancy and flowering regulation by transcriptome analysis. Shoot cuttings were exposed to different combinations of decreasing temperatures, decreasing photoperiods, and vernalization in growth chambers. Subsequently, shoots were removed and regrowth and flowering from new shoots were monitored in a warm temperature greenhouse under long-day conditions. Vernalization alone has no effect on regrowth and flowering. The plant required decreasing temperature followed by vernalization for rapid regrowth and flowering. Decreasing photoperiod at a constant temperature with or without vernalization had no significant effect on regrowth and flowering. In conjunction with previous field research, the results suggest that a gradually decreasing temperature is required as one of the components for flowering competence and vernalization is determinate for reproductive development under long-day conditions.

EARLY GROWTH AND DEVELOPMENT RESPONSE OF CORN TO CANOLA COMPETITION AND SHADE STRESS. J.C. Moriles*,[1] S.A. Clay,[1] D.E. Clay,[1] D. Horvath,[2] S. Hansen[1]; [1]South Dakota State University, Brookings, SD, [2]USDA- ARS, Fargo, ND

ABSTRACT

Corn-weed competition studies indicate that resource limitation slows normal corn growth and development and often results in lower yields. However there is minimal information on the physiological basis of crop competition, especially at the early growth stages when resources would be expected to be plentiful based on plant size. The research objectives of this study were to determine if gene expression and physiological responses of corn at the V2 and V4 growth stages differed when grown under optimal vs stress conditions. Stress treatments were 1) low N; 2) 40% shade applied at crop emergence and removed fromV2 toV8, and 3) canola planted in rows close to corn (to mimic weed stress) at corn planting and removed from VE to V8. At V2 and V4, corn height, leaf area, plant biomass, and chlorophyll content were measured and leaf tissue sampled for microarray analysis. Preliminary results show that corn plants grown under 40% shade had the least leaf area, biomass, chlorophyll content, and were shorter than corn grown alone or with canola at both sampling times. When shade was removed at V2, plants analyzed at V4 had less leaf area, biomass, and were shorter than nonstressed plants. Corn plants grown with canola removed from VE to V6 were similar in height and chlorophyll content as corn grown alone. At harvest, corn yield losses compared to the optimal treatment were only measured in two treatments, where canola was allowed to remain until the V8 stage or when grown under low N conditions. Based on very preliminary microarray data from V2, corn gene expression differed among the optimal, shade, and canola treatments. When corn was stressed with canola, multiple genes that regulate early light inducible proteins (ELIP) were induced whereas when corn was light stressed, several genes that regulate Photosystem II proteins were induced. These data appear to indicate that the physiological responses of corn to weed or light stress differ.

DOSE RESPONSE STUDY OF ACETYL-COENZYME A CARBOXYLASE-INHIBITING HERBICIDES IN SORGHUM SPECIES. K.S. Kershner*,[1] K. Al-Khatib,[1] M.R. Tuinstra[2]; [1]Kansas State Univ, Manhattan, KS, [2]Purdue University, West Lafayeete, IN

ABSTRACT

Studies were conducted to determine the level of resistance to acetyl-coenzyme A carboxylase-inhibiting herbicides in the wild sorghum and in a heterozygous genetic background of wild x grain sorghum. The wild biotype, elite sorghum parent Tx623, and their F1 progeny were grown under optimal conditions in a greenhouse. At 12 cm height, the seedlings were treated with selected rates of fluazifop, quizalofop, sethoxydim, or clethodim. Two weeks after treatment the plants were visually scored for injury and above-ground biomass harvested, dried, and weighted. Levels of resistance to the four herbicides were observed in the wild biotype with a 3 to 150 fold difference. The I_{50} for the wild biotype were 1956, 341, 227, and 16 g ha^{-1}; for the F1 progeny they were 857, 88, 170, and 14 g ha^{-1}; and for Tx623 the I_{50} were 17, 2.1, 59, and 4.4 g ha^{-1} for fluazifop, quizalofop, sethoxydim, and clethodim, respectively. Weight measurement GR_{50} values revealed similar results. In addition, segregation experiments showed that resistance is controlled by a single gene. This wild resistance is a very promising source to develop sorghum seed parents with resistance to field rates of aryloxyphenoxypropionate herbicides, fluazifop and quizalofop, yet still allowing susceptibility to cyclohexanedione herbicides, sethoxydim and clethodim.

GENETIC VARIATION IN PURPLE NUTSEDGE (*CYPERUS ROTUNDUS*). W.T. Molin*, J. Ray, B. Scheffler, R. Kronfol, C. Bryson; USDA-ARS, Stoneville, MS

ABSTRACT

Purple nutsedge (*Cyperus rotundus* L.) is an important agricultural weed worldwide which reproduces primarily by asexual means through the production of rhizomes and tubers. However, geographically distinct populations of purple nutsedge have been identified which exhibit quantifiable, morphological variations that include: shoot, bract, and culm length; inflorescence shape; number of leaves per shoot; leaf color and shape; and tuber size, texture, and shape. Therefore, one would predict that genetic diversity in purple nutsedge would manifest itself as several stable, easily differentiable lineages. The objective was to determine genetic diversity within a morphologically and geographically heterogenous cross-section of purple nutsedge biotypes using traditional genomic analytical techniques. DNA from 50 biotypes of purple nutsedge from 21 countries and 14 states in the United States, and one of yellow nutsedge from Mississippi, were subjected to Random Amplified Polymorphic DNA PCR analysis using 14 random primers and 20 soybean SSR markers. Phenograms based on molecular marker patterns and morphological characteristics were very similar, providing collaborating evidence for regional divergence among biotypes into three or four broad groups worldwide. These phenograms demonstrate regional evolution of purple nutsedge biotypes, but also suggest that some biotypes have distinct marker profiles indicative of new introductions. The differences observed may have important implications for weed control, because a more detailed understanding of the genetic lineages of different biotypes of purple nutsedge may allow enhanced predictive mitigation of purple nutsedge in agricultural and non-agricultural settings.

DORMANCY AND GERMINATION OF AFGHAN MELON (*CITRULLUS LANATUS*) IN WESTERN AUSTRALIA. P.J. Michael*,[1] K.J. Steadman[2]; [1]Curtin University of Technology, Perth, Australia, [2]University of Queensland, Brisbane, Australia

ABSTRACT

Citrullus lanatus (Thunb.) Matsum. & Nakai subsp. *lanatus*, a wild relative of the domesticated watermelon, is now widespread in all tropical, subtropical and warm temperate (hot summers) regions of the world including Australia, where it is one of the most prevalent summer weeds across the south-western grain-belt. However there has been very little work conducted on its ecology and biology, an essential step in developing crucial integrated weed management programs. The aim of our study was to investigate seed dormancy and germinability of *C. lanatus* under different temperature, light and ripening regimes. Mature seeds were able to imbibe water regardless of whether the seed coat was scarified or not, indicating the species does not possess physical dormancy. Intact seeds germinated at constant temperatures between 25-35°C, with optimal germination occurring at 30°C. Removal of the surrounding seed structures (exotesta and endotesta) enabled some germination (<20%) at more extreme temperatures (15-40°C). Germination was not effected by light conditions when tested at an alternating 35/25°C, although seeds tended to have slighter higher germination in constant darkness. The large majority of seeds stored on the soil surface germinated when incubated at 35/25°C regardless of ripening treatment (intact fruit or mesh bags), although a significant decrease was observed during the summer period suggesting a period of secondary dormancy. Accelerated ageing studies indicate that intact *C. lanatus* seeds are likely to have a field persistence of greater than 5 years.

BIOLOGY AND ECOLOGY OF BROWN FLATSEDGE (*CYPERUS FUSCUS*). C.T. Bryson*,[1] R. Carter[2]; [1]USDA-ARS, Stoneville, MS, [2]Valdosta State University, Valdosta, GA

ABSTRACT

Brown flatsedge (*Cyperus fuscus* L.) is a native to Europe, Asia, Indian subcontinent, and the Mediterranean Region of Northern Africa. It was first discovered in North America in 1877 and apparently was introduced around wharfs from contaminated ballast. Since that time, brown flatsedge has been discovered in Canada and U.S.A. In the U.S.A., it is found in Arkansas, California, Connecticut, Kansas, Maryland, Mississippi, Missouri, Nebraska, Nevada, New Jersey, Pennsylvania, South Dakota, and Virginia. Dispersal of brown flatsedge has been attributed to waterfowl and human activities, including use of construction equipment. Because brownscale sedge was reported as a weed in semitropical areas of the Old World where it is a significant weed in rice and it was recently detected in the rice production areas of the Delta Region, research was initiated at Stoneville, Mississippi, to study the basic biology and ecology of brown flatsedge. Field observations were made at three sites, Chicot County, Arkansas, and Pearl River and Washington counties, Mississippi, from early spring until frost during 2003 to 2007. Field observations at the three sites in Arkansas and Mississippi, determined that brown flatsedge was highly dependent on persistent moist soils or shallow standing water for establishment, growth, and seed production. Over a five-year period and under natural field conditions, brown flatsedge plants germinated from late March and early April until frost. Inflorescences were observed as early as May, and seed production continued until frost. Greenhouse studies were conducted in 2007 and 2008 at Stoneville, Mississippi, to determine growth parameters and reproductive potential of brown flatsedge. Brown flatsedge seed were collected form Washington County, Mississippi, during the fall of 2006 and planted during the summer of 2007. In the greenhouse, plants were grown in 10 cm-diam pots in standing water for 10 weeks. Brown flatsedge plant height, diameter, and number of leaves per plant, and days to first flower were recorded. All plants were harvested and dry weights were recorded for roots, leaves, culms, bracts, and inflorescences. In greenhouse experiments, ten-week old brown flatsedge plants were 30.2 cm tall and 63.9 cm in diameter with dry weights of 1.4, 2.0, 1.0, 0.5, 1.9 and 6.8 g for roots, leaves, culms, bracts, inflorescences and whole plant, respectively. The first brown flatsedge culm appeared five weeks after emergence (WAE) and all plants produced seed by nine WAE. Although brown flatsedge seems to be in the lag phase, it could pose a threat to rice production in Arkansas, California, Louisiana, Mississippi, Missouri, Tennessee, and Texas. Additional research is needed to determine the ecological range potential and to develop control methods for brown flatsedge.

DISTRIBUTION OF A*MBROSIA TRIFIDA* PLANT SIZE AND OTHER CHARACTERISTICS IN DIFFERENT HERBICIDE MANAGMENT PROGRAMS. D. Refsell*; University of Illinois, Urbana, IL

ABSTRACT

Giant ragweed (*Ambrosia trifida*) is a problematic weed due its ability to heavily compete with the crop, rapidly cumulate biomass, exhibit a long emergence pattern, persist in the soil seed bank, and the weed's resistance to glyphosate and ALS inhibiting herbicides. When giant ragweed is removed from a plant community, species diversity increases while the biomass of the community decreases, suggesting that giant ragweed is a 'keystone' species and regulates plant community assembly in disturbed areas. Little research has been conducted in the field crop setting in regards to the role of preemergence herbicides and the development of plant community structure such as density and size inequality. Early effects of preemergence herbicide usage on community structure could be reflected in the level of postemergence weed control that may be attained. The objective of this study was to determine if preemergence herbicides indeed affect giant ragweed community structure in corn and soybean cropping systems. Studies were conducted at two locations in Illinois during the 2007 and 2008 growing seasons which had a history of giant ragweed. Weed management was specific to eliminate all other species so that giant ragweed was the only weed present. The five treatments included postemergence herbicide alone, preemergence herbicide applied at a full rate, preemergence herbicide applied at a reduced rate, both preemergence treatments followed by a postemergence application in addition to an untreated plot. A 0.5 m-2 area was harvested from each plot just prior to postemergence application and again at harvest. Data collected from each plant included: dry weight, total leaf area, leaf area in 20 cm increments, leaf number, stem diameter, nodes, branches, and height. Giant ragweed density was not affected by the usage of a preemergence herbicide prior to postemergence application or at the time of harvest for all but one site year. Density of giant ragweed at harvest in DeKalb, IL, 2008, was only 3 plants m-2 in the full rate preemergence followed by post treatment, whereas density in the other treatments ranged from 10-40 plants m-2. Height, leaf area, and dry weight were all significantly affected by preemergence herbicide usage at Dixon Springs in 2007, and at both Dixon Springs and DeKalb in 2008, where the usage of a full rate preemergence herbicide was most effective in decreasing plant size. Giant ragweed height varied greatly at harvest depending on location and treatment, however, the full rate preemergence treatment at all site years had the lowest average height (40 to 160 cm) which was three to four times less than the treatments which did not receive a postemergence application. Leaf area and dry weight of giant ragweed were only significantly affected at DeKalb in 2007 and 2008 where the treatments which received a postemergence application had reduced biomass and leaf area than those which received a preemergence treatment alone or no treatment at all. As this research indicates, giant ragweed is affected by the usage of preemergence herbicides. Further investigation into size inequality and determining which individual and plant community characteristics are most affected by the usage of preemergence herbicides may aid in fine-tuning postemergence herbicide applications.

EFFECT OF FLOODING ON SURVIVAL AND GROWTH OF TEXASWEED (*CAPERONIA PALUSTRIS*).

R.K. Godara*, B.J. Williams, S.L. Angel; Louisiana State University AgCenter, Baton Rouge, LA

ABSTRACT

An experiment was conducted in 2008 at Northeast Research Station near St. Joseph, La. to study the effect of flooding on Texasweed (*Caperonia palustris*) survival and growth. The experiment was conducted under field conditions using 3 L capacity plastic pots. Pots were filled with Sharkey clay taken from a rice field and 15 Texasweed seeds were planted per pot. Plants were thinned to 3 plants per pot 3 days after emergence and to 1 plant per pot 10 days after emergence. The experiment was a two-factor factorial experiment with 5 flood depths and 2 Texasweed growth stages conducted in a completely randomized split-plot design with 3 replications. Flooding conditions were created by placing potted plants in 1.3 m x 0.7 m x 0.7 m PVC troughs. Flood depths of 0, 4, 6, 8, and 12 inches were achieved by siphoning off the excess depth of water in the troughs using the drainage pipes of appropriate height. The two Texasweed growth stages were obtained by deferred planting. Destructive samples were taken at 1, 2 and 4 weeks after flooding. One plant from each experimental unit was removed to record plant height, leaf count, and plant dry weight. Plant dry weight was partitioned into leaf and stem dry weights, and number of fruits per plant were also recorded at last sampling. Growth data obtained for various flooding depths were tested for differences using MIXED procedure of SAS. Texasweed plants were able to survive and produce fruits in all flood depths; however, growth and fruit production was significantly reduced due to flooding. Flood depths of 6 and 12 inches caused 58% and 76% reduction in total dry matter accumulation per plant in case of 2-3 leaf stage and 6% and 41% in case of 4-5 leaf stage of Texasweed, respectively. Increasing flood depths resulted in increased plant height and greater allocation of biomass to stem as compared to leaves. Texasweed plants under all flood depths were able to form canopy above water level as a result of this stem elongation. Texasweed plants produced adventitious roots and a thick spongy tissue (phellem) in the submerged roots and stem. Production of phellem has been reported in other plant species and has been found to play an important role in gas exchange under flooded conditions.

STRUCTURAL AND COMPOSITIONAL DIFFERENCES BETWEEN THE EXPLOSIVE BITERCRESS AND NON-EXPLOSIVE *ARABIDOPSIS* SILIQUES. K.C. Vaughn*, A.J. Bowling; USDA-ARS, Stoneville, MS

ABSTRACT

Bittercress *(Cardamine hirsuta*) and Mouse ear cress (*Arabidopsis thaliana*) both produce siliques that are morphologically similar to each other: a long cylindrical silique composed of two fused carpels. Despite this external similarity, the bittercress capsules have the ability to explosively discharge their seeds, whereas the siliques of *Arabidopsis* only crack open along the suture lines to disperse their seeds. This ability to explosively disperse their seeds is a competitive advantage to bittercress in propagule dispersal. To determine why these differences occur, we examined the developing seed capsules using microscopic techniques and immunocytochemical probes. Both species organize their siliques similarly. Locules that are filled with seed are surrounded by two carpels, connected by a replum that separates the seed cavity into locules. At the interface of the replum and the carpel, a zone of detachment occurs. In the carpels of the bittercess the inner wall of the carpel is highly thickened and enriched in xylans whereas the walls of the *Arabidopsis* silique are not. In addition, cells of another layer in the bittercress ovule wall are highly enriched in a mixture of various mucilaginous pectins not noted in the *Arabidopsis* silique. Both siliques seem to detach at the replum/ carpel interface, by the degradation of highly de-esterified pectins in the middle lamellae. However, the tension created by the drying of the mucilaginous cells adjacent to the rigid cells in the bittercress silique creates a pressure that explodes the silique and expels the seeds, a force that the *Arabidopsis* silique is unable to generate.

SWEET CORN HYBRID TOLERANCE TO EXPERIMENTAL HERBICIDES. C. Boerboom*,[1] R. Becker,[2] E. Peachey,[3] M. VanGessel[4]; [1]University of Wisconsin, Madison, WI, [2]University of Minnesota, St. Paul, MN, [3]Oregon State University, Corvallis, OR, [4]University of Delaware, Georgetown, DE

ABSTRACT

Herbicide use in sweet corn is limited because of potential herbicide injury. This study was conducted in 2008 in Delaware, Minnesota, Oregon, and Wisconsin to assess the tolerance of 39 sweet corn hybrids to three experimental herbicides. The purpose was to determine 1) if sweet corn hybrids have tolerance to saflufenacil and saflufenacil + dimethenamid-p; 2) if isoxadifen-safened nicosulfuron increases tolerance compared to nicosulfuron; and 3) if sweet corn hybrids tolerate reduced rates of dicamba+ diflufenzopyr + isoxadifen. Hybrids were selected that were classified as sensitive (20), intermediate (9), and tolerant (10) to nicosulfuron to provide a range of potential tolerance responses. Herbicides were applied at twice the potential labeled rates to determine injury potential in a worst case scenario. Rates were saflufenacil at 150 g ai/ha (250 g/ha at Minnesota); nicosulfuron at 57 g ai/ha alone and with 14 g ae/ha isoxadifen; and dicamba + diflufenzopyr + isoxadifen at 140 g ae//ha + 5 g ae/ha + 14 g/ha. Saflufenacil treatments were applied preemergence and other treatments were applied to V3-stage sweet corn. Nicosulfuron treatments included 1% v/v crop oil concentrate + 2.2 kg/ha ammonium sulfate and the dicamba-based treatment included 0.5% v/v nonionic surfactant + 2.5% w/w ammonium sulfate. Herbicides were applied to blocks of sweet corn. Within each block, sweet corn hybrids were planted in single 6-m long rows. A block of nontreated sweet corn hybrids was planted between the postemergence treatments and between the preemergence treatments so injury could be rated. Hybrid order was re-randomized at each location and each location had one replication. Significant differences in sweet corn injury from saflufenacil were observed among locations. Average stunting at the V2 stage was 4% in Wisconsin and 53% in Minnesota. Previous ratings of hybrid tolerance were not associated with saflufenacil injury as tolerant, intermediate, and sensitive hybrids averaged 20, 21, and 25% stunting. Rainfall was related to the severity of injury at the Minnesota location. Isoxadifen reduced nicosulfuron's stunting of sweet corn by about 50% at 7 days after treatment. Averaged within tolerance groups, the stunting from nicosulfuron was reduced with the addition of isoxadifen in sensitive hybrids from 15 to 8%; in intermediate hybrids from 9 to 5%; and in tolerant hybrids from 7 to 4%, respectively. Chlorosis was also reduced at locations where rated. Growth regulator injury was observed with the dicamba + diflufenzopyr + isoxadifen treatment and averaged 10, 11, and 17% for the tolerance, intermediate, and sensitive hybrids across locations. The injury observed with saflufenacil warrants further study to better understand the risks prior to use in sweet corn. Isoxadifen-safened nicosulfuron reduced the degree of stunting and chlorosis on all tested hybrids, except for a known hyper-sensitive hybrid, and should increase opportunities to use this herbicide in sweet corn. Even at the reduced rate of dicamba + diflufenzopyr + isoxadifen tested, the degree of injury justifies caution in developing this herbicide for sweet corn.

WEED CONTROL AND SWEET POTATO TOLERANCE WITH V-10142. D. Miller*,[1] T. Smith,[2] M. Mathews[1]; [1]LSU AgCenter, St. Joseph, LA, [2]LSU AgCenter, Chase, LA

ABSTRACT

A field study was conducted at the Sweet Potato Research Station near Chase, LA to evaluate sweet potato tolerance and weed control with V-10142. Study design was a randomized complete block with four replications. Treatments evaluated included V-10142 applied pre-transplant at 0.2, 0.3, or 0.4 lb ai/A, V-10142 at 0.2 lb ai/A plus Valor SX at 3 oz product/A pre-transplant, V-10142 at 0.3 lb ai/A pre-transplant followed by V-10142 at 0.3 lb ai/A 28 d post-transplant, Valor SX at 3 oz product/A pre-transplant followed by V-10142 at 0.3 lb ai/A 28 d post-transplant, Valor SX at 2 oz product/A followed by Command at 3 pt product/A post-transplant, and V-10142 at 0.2, 0.3, or 0.4 lb ai/A applied 14 d post-transplant. Post-transplant applications of V-10142 included Dyne-Amic at 1% v/v. Parameter measurements included visual assessment of weed control and crop tolerance 14 and 28 d after treatment (DAT) and yield. At 14 DAT of the pre-transplant application, V-10142 at all rates controlled barnyardgrass, goosegrass, cutleaf groundcherry, entireleaf morningglory, carpetweed, yellow nutsedge, and purple nutsedge 88 to 95, 91 to 99, 99 to 100, 96 to 100, 100, 93 to 96, and 93 to 96%, respectively. Sweet potato injury was no greater than 4%. Control and crop response was equal to the Valor/Command treatment which controlled these respective weeds 93, 96, 100, 100, 100, 88, and 88% and resulted in 4% visual response. At 14 DAT of the 14 d post-transplant application, V-10142 controlled cutleaf groundcherry, barnyardgrass, entireleaf morningglory, carpetweed, nutsedge, and goosegrass 93, 64 to 75, 100, 86 to 99, 94 to 95, and 79 to 89%, respectively. Injury with the three post-transplant applications of V-10142 ranged from 40 to 44%, however, in the form of plant stunting and yellowing. At 28 DAT of the pre-transplant V-10142 application, control of the respective weeds assessed at the 14 DAT rating was 81 to 90, 84 to 100, 91 to 100, 99 to 100, 100, 90 to 98, and 90 to 98% with only slight differences noted among rates evaluated. Crop injury was not observed at this rating interval. Control in most cases was equal to that for the Valor/Command treatment. At 28 DAT of the 14 d post-transplant application of V-10142, control of the respective weeds evaluated at the 14DAT rating was 71 to 84, 76 to 84, 100, 70 to 71, 95, and 43 to 60%. Crop injury ranged from 10 to 20%. Injury from the 18 d post-transplant V-10142 application at this rating interval, which corresponded to 14 DAT, was 48 to 55%. Total yield for V-10142 pre-transplant treatments ranged from 161 to 165 bu/A, which was lower than the 320 bu/A observed with the Valor/Command treatment. V-10142 in combination with Valor pre-transplant and Valor pre-transplant followed by V-10142 28 d post-transplant resulted in a total yield of 247 and 230 bu/A, respectively, which was equal to the Valor/Command treatment. V-10142 applied 14 d post-transplant resulted in a total sweet potato yield ranging from 65 to 96 bu/A.

HERBICIDE AND COVER CROP RESIDUE INTEGRATION AFFECTS ON WEED CONTROL, QUALITY, AND YIELD IN CONSERVATION TILLAGE TOMATO. M. Saini*,[1] A.J. Price,[2] E.v. Santen,[1] J.S. Bergtold,[3] T.S. Kornecki,[2] K.S. Balkcom[2]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL, [3]Kansas state University, Manhattan, KS

ABSTRACT

The increased adoption of conservation tillage in vegetable production requires more information on the role of cover crops in weed control, tomato quality and yield. Three conservation-tillage systems utilizing crimson clover (*Trifolium incarnatum* L.), brassica (*Brassica rapa* L. *subsp. rapa*) and cereal rye (*Secale cereale* L.) as winter cover crops were compared to a conventional black polythene mulch system, with and without herbicide, for weed control and tomato yield. The experiment was established in the fall of 2004 and 2005 at the North Alabama Horticulture Experiment Station, Cullman, AL and in the fall of 2005 at Tuskegee University's George Washington Carver Agriculture Experiment Station, Tuskegee, AL. The soils were a Hartsell fine sandy loam (Fine-loamy, siliceous, sub-active, thermic Typic Hapludults) at Cullman and a Marvyn fine sandy loam (Fine-loamy, kaolinitic, thermic Typic Kanhapludults) at Tuskegee. The experimental design was a randomized complete block with four replications and a factorial treatment arrangement. Plot size at both locations was 2.5 by 6 m containing a single row of tomatoes with 0.46 m spacing between plants. Herbicide treatments included a preemergence (PRE) application of S- metolachlor (1.87 kg a.i./ha) either alone or followed by an early postemergence (POST) metribuzin (0.56 kg a.i. /ha) application followed by a late POST application of clethodim (0.28 kg a.i./ha). All cover crops were flattened with a mechanical roller/crimper prior to chemical desiccation with herbicides. Without herbicide, weed control provided by cover crop residues ranged from 0 to 91% 4 WAT, depending on crop and weed species. Clover controlled yellow nutsedge (*Cyperus esculentus* L.) and smallflower morningglory (*Jacquemontia tamnifolia* (L.) Griseb.) 48 and 50%, respectively, while providing only 1 to 2% control of smooth pigweed (*Amaranthus hybridus* L.), tall morningglory (*Ipomoea purpurea* (L.) Roth), wild radish (*Raphanus raphanistrum*) and leafy spurge (*Euphorbia esula* L.). Brassica residue provided ≤ 34% control of all the weeds. Rye provided 81 to 91% control of Virginia buttonweed (*Diodia virginiana* L.) and smallflower morningglory respectively, whereas large crabgrass control (*Digitaria sanguinalis*) was only 11%. Neither cover crop nor the polythene mulch system provided adequate large crabgrass or wild radish control without herbicide. Tomato stand establishment was not affected by any cover crop residue treatment compared to plastic mulch. Averaged across cover crops, tomato yield was least in treatments receiving no herbicides and was maximized with inclusion of the POST application. Pooled over herbicide treatments yield was less following either crimson clover or brassica cover crops compared to rye or the polythene mulch system.

EFFICACY OF SAFLUFENACIL ON DIFFERENT TYPES OF WEEDS IN CITRUS. M. Singh*, S. Singh, S.D. Sharma; University of Florida, Citrus Research and Education Center, Lake Alfred, FL

ABSTRACT

Field study was conducted at Polk City, FL to evaluate the efficacy of saflufenacil in combination with other PRE and POST herbicides against grass and broadleaf weeds in citrus during Fall 2008. Texas panicum (*Panicum texanum*) and Florida pusley (*Richardia scabra*) were major weeds in the experimental plots. Other weeds such as dayflower (*Commelina diffusa*), hairy indigo (*Indigofra hirsute*) and black nightshade (*Solanum nigrum*) were also present. Treatments were applied when the height of grass weed was 4-6 inches and rosette of broadleaf weeds was less than 4 inches in diameter. Visual percent control of weeds recorded at 7, 15, 30, 60 and 90 days after herbicide treatments (DAT) revealed that maximum control of grass and broadleaf weeds was obtained with grower's practice (norflurazon at 2.4 lb ai/A + diuron at 2.4 lb ai/A + glyphosate at 1.0 lb ai/A) at 7 DAT. Application of tank mix of saflufenacil at 0.045 lb ai/A + glyphosate at 1.0 lb ai/A + pendimethalin (prowl H_2O) at 3.8 lb ai/A with adjuvants provided maximum (>90%) percent control of grass and broadleaf weeds at later stages (30, 60, and 90 DAT). Application of saflufenacil along with crop oil concentrate and ammonium sulfate provided similar control of broadleaf weeds compared to the treatments of glyphosate with ammonium sulphate at all the stages. Grass control was higher at 60 and 90 DAT with glyphosate compared to saflufenacil. Tank mix of glyphosate with saflufenacil significantly increased the control of grass and broadleaf weeds compared to saflufenacil alone at 15, 60 and 90 DAT. Addition of pendimethalin at 1.9 lb ai/A to tank mix of saflufenacil + glyphosate provided similar control of weeds compared to grower's practice at all the stages. Tank mixing of pendimethalin at 1.9 lb ai/A with saflufenacil + glyphosate gave 22% higher control of weeds compared to the tank mix without pendimethalin at 90 DAT. On an average weed control decreased by 19% with the tank mix of saflufenacil + glyphosate at 90 DAT over to 30 DAT rating, however, almost similar control of weeds was observed at 30, 60 and 90 DAT when this mixture was applied with pendimethalin at 1.9 lb ai/A.

TOLERANCE OF VEGETABLE FOLLOW CROPS TO PRONAMIDE USE IN LETTUCE. P.J. Dittmar*, D.W. Monks, K.M. Jennings; North Carolina State University, Raleigh, NC

ABSTRACT

Field studies were conducted in North Carolina in 2007 and 2008 to evaluate tolerance of vegetable follow crops planted at different timings to pronamide at 0.7, 1.4, and 2.8 kg a.i./ha. Herbicide treatments were applied to an Orangeburg loamy sand with a pH 6.0 and humic matter of 0.56%. Bell pepper 'Heritage', cucumber 'Fiesty', snapbean 'Ambra', and sweetpotato 'Beauregard' were planted 30, 60, and 90 DAT (days after pronomide application). No crop injury was observed in bell pepper, cucumber, or sweetpotato. In 2007 at 2 WAE (weeks after emergence), 5 and 10% snapbean crop stunting by 1.4 and 2.8 kg a.i/ha pronamide was observed in the 30 DAT planting. At 4 WAE, no crop stunting was observed in snapbean 30 DAT planting. In 2008, no snapbean crop injury occurred 30 DAT planting. Crop yield was not different by planting date or rate. For bell pepper, marketable yield ranged from 135 to 141 percent of check. For cucumber, total yield was 87to125 % of check and number one fruit yield ranged 82to150% of check. For snapbean, total yield was 91 to 106% of check. In sweetpotato, total yield was 112 to 116% of check and number one yield was 92to103% of check. Vegetables included in these studies that follow crops such as lettuce where pronamide is used can be planted as soon as 30 DAT with minimal crop injury and effect to yield.

TOLERANCE OF RHUBARB TO QUINCLORAC HERBICIDE. E. Peachey*, R. McReynolds; Oregon State Unviersity, Corvallis, OR

ABSTRACT

Field bindweed (*Convolvulus arvensis*), hedge bindweed (*Calystegia sepium*), and Canada thistle are difficult weeds to control in perennial crops such as rhubarb. Quinclorac is an herbicide that controls or suppresses these weeds depending on rate and time of application. The goal of this project was to determine rhubarb crop response to quinclorac when applied at times compatible with rhubarb culture. Experiments were located at 3 sites. The rhubarb plot at the North Willamette Research and Extension Center (NWREC) near Aurora was kept nearly weed free so that crop response to quinclorac could be measured. Hedge bindweed had completely over-run the field at the Dayton site, and Canada thistle covered nearly half of the field at the site near Needy. Quinclorac was applied to rhubarb at 0.42 and 0.84 kg ai/ha in the fall just before and after the first frost, early in the spring as soon as the target weeds had emerged, and again after the first harvest. Rhubarb was very tolerant to quinclorac applied at 0.42 kg ai/ha at all sites. There was a slight indication that quinclorac may have reduced total rhubarb yield at 0.84 kg ai/ha. Repeated measures analysis indicated no interaction between treatment and harvest date. Quinclorac provided selective control of bindweed and suppressed Canada thistle. Sequential applications may be needed to control more difficult weeds such as Canada thistle.

SCREENING PRE AND POSTEMERGENCE HERBICIDES FOR USE IN CILANTRO (*CORIANDRUM SATIVUM*). L. Brandenberger*, L. Carrier, R. Havener, R. Adams; Oklahoma State University, Stillwater, OK

ABSTRACT

The study was completed at the Vegetable research station at Bixby during the fall 2008 season. Seven different compounds were included in the study (S-metolachlor, flufenacet, pendimethalin H_2O, sulfentrazone, linuron, bensulide, and sethoxydim) at different rates for a total of 15 treatments plus a weeded check. The study was initiated on 8/21/08 by planting the experimental area to the Santo cilantro variety at an overall planting rate of 25 seeds per row foot. Plots included 4 rows of cilantro on 12 inch row centers 20 feet long. Treatments were replicated 4 times in a randomized block design. All treatments except for sethoxydim and linuron postemergence were applied after planting on 8/21/08 as preemergence treatments with the exception of bensulide which was pre-plant incorporated (PPI). Postemergence treatments were applied on 9/25/08 and included sethoxydim and linuron. Plots were rated for crop emergence, injury, and control of Palmer amaranth on 9/25/08 and for crop injury and Palmer amaranth control on 10/02/08. Ratings were completed as a percentage where 0 = 0% control, damage, or emergence and 100% = complete death or absence of cilantro or a given weed species or no loss of emergence. Plots were harvested with a mechanical plot harvester on 10/20/08. Emergence ranged from a low of 59 to a high of 91% with a high level of variability between plots. This was more than likely due to soil temperature which was still relatively high (low to high 80's^{o}F). Crop injury was observed as reduced growth in some treatment plots. Injury was highest on 9/25/08 for flufenacet, sulfentrazone, S-metolachlor at 0.975 lbs ai/acre, and bensulide at 6 lbs ai/acre pre treatments that had 21, 20, 16, and 14% injury, respectively. Highest crop injury on 10/02/08 was recorded for sulfentrazone, linuron 0.2 lbs ai/acre pre, and bensulide at 12 lbs ai/acre. Post treatments of linuron for all rates had injury ratings in the single digits. Palmer amaranth (*Amaranthus palmeri) control was 90% or higher on 9/25/08 for* pre treatments including S-metolachlor, flufenacet, pendimethalin H_2O 0.75 lbs ai/acre, sulfentrazone, and linuron 0.3 lbs ai/acre pre. On 10/02/08 Palmer amaranth control was highest for S-metolachlor, flufenacet, pendimethalin H_2O, sulfentrazone, linuron 0.3 lbs ai/acre pre, and linuron 0.3 lbs ai/acre post, these treatments recorded 76 to 96% control. A majority of treatments did not vary significantly in yield, more than likely due to variability in stands. Both pendimethalin H_2O treatments had the highest yields recorded in the study followed by linuron 0.3 lbs ai/acre pre.

DMDS AND THE 3-WAY: WHICH IS THE BETTER OPTION FOR GA VEGETABLE GROWERS? L.M. Sosnoskie*, A.S. Culpepper; University of Georgia, Tifton, GA

ABSTRACT

Methyl Bromide (MB) alternatives were used on nearly 50% of Georgia's fumigated plasticulture acreage in 2008. To date, most growers have adopted a 3-WAY system using Telone II, chloropicrin, and metam sodium. Dimethyl disulfide is nearing registration and may be available in 2009. An experiment was conducted in TyTy, Georgia comparing the 3-WAY program (applied under standard low density polyethylene (LDPE) mulch) to three formulations of DMDS plus chloropicrin (100:0, 90:10, 79:21), each applied at four rates (281, 374, 468, and 561 L/Ha) under Blockade (high barrier) mulch. Two additional treatments (LDPE mulch without fumigation and DMDS plus chloropicrin (79:21) at 561 L/Ha under LDPE mulch) were also included in the study. Fumigants were applied on February 17, 2008 (Tifton sandy loam soils were at 100% field capacity with soil temperatures ranging from 55 to 60 degrees F at a depth of 0.2 m) and 'Heritage' bell pepper was transplanted one month later. DMDS plus chloropicrin was injected 0.2 m below the bed top with three knives. For the 3-WAY Telone II was shank injected 0.35 m deep with three knives, chloropicrin was injected 0.2 m deep with three knives and Vapam was injected 0.1 m below the bed top with eight knives. Plot size was one mulched bed 0.8 m wide by 12.2 m in length. Two rows of peppers were planted in each bed; peppers were spaced along the bed on 0.3 m centers. Weed control and crop injury were rated throughout the growing season. The entire plot for each experiment was harvested for four consecutive weeks at the end of the season. The 3-WAY provided 98% control of large crabgrass at 7 weeks after planting (WAP). Only DMDS 79:21 at 468 and 561 L/Ha provided greater than 85% large crabgrass control. DMDS 79:21 applied at 561 L/Ha under LDPE (33% control)was less effective at controlling crabgrasses than DMDS 79:21 (92% control) applied at the same rate under Blockade. In contrast to large crabgrass, all programs provided excellent control of purple nutsedge. Pepper heights were not impacted by treatments, although yield differences were noted. The 3-WAY produced the greatest numbers of pepper fruit per plot when combined over all four harvest dates. Lower pepper production in the DMDS systems was likely a response large crabgrass competition and reduction in harvesting efficiency. For the DMDS systems to be adopted, herbicides must be used to control annual grasses and small-seeded broadleaf weed species. If DMDS is similar in cost to the 3-WAYprogram, DMDS systems will likely be adopted by Georgia growers because of its ease of application and because it consistently controls nutsedge, especially during fall fumigations.

FIRST YEAR EVALUATION OF A METHYL BROMIDE ALTERNATIVES SUSTAINABILITY TRIAL CONDUCTED IN CENTRAL FLORIDA. A.W. MacRae*, R.O. Kelly; University of Florida, Wimauma, FL

ABSTRACT

In the fall of 2008 a trial was initiated to look at the sustainability of four methyl bromide alternatives in a Florida double crop system. The initial treatments included Methyl Bromide 67:33 at 175 lbs/A, Midas 50:50 at 160 lbs/A, Paladin Pic at 60 gal/A, Telone II at 12 gal/A plus Chloropicrin at 150 lbs/A, Telone II at 12 gal/A plus Chloropicrin at 150 lbs/A plus KPam at 60 gal/A, and a non-treated control. All treatments were placed at 8 inches below the top of the bed except Telone II which was placed 14 inches below the bed top and KPam which was injected into the beds using double drip tape. Each treatment had a split plot of herbicide or no herbicide. The herbicide was applied beneath the plastic mulch and consisted of V10142 at 0.3 lbs ai/A and Devrinol 2 EC at 1 gal/A. The no herbicide subplots were planted with bell pepper and tomato while the herbicide plot was planted with tomato only. At the time of preparation of the abstract yield data, plant heights, and weed count data were not available.

CROP RESPONSE TO SIMULATED CARRYOVER OF MESOTRIONE RESIDUES. R. Riddle*,[1] J. O'Sullivan,[1] C.J. Swanton[2]; [1]University of Guelph, Simcoe, ON, Canada, [2]University of Guelph, Guelph, ON, Canada

ABSTRACT

Mesotrione is a HPPD-inhibiting herbicide registered for pre and postemergence broadleaf weed control in corn. Even at low concentrations mesotrione residues can injure sensitive crops grown in rotation. Bioassays are often used to determine the presence of phytotoxic levels of herbicide residues in the soil. Conventional field bioassays require at least two seasons of field research. The applicability of using simulated carryover studies to determine the carryover potential of mesotrione residues to sensitive crops in the rotation was evaluated. Simulated carryover studies require only one year of field research. The objective of these studies was to compare the bioactivity of mesotrione residues, carried over from applications to corn in the previous year, to the bioactivity of mesotrione applied in the current year at 0.1X of previous-year application rates. Field experiments were conducted from 2005 to 2007 at the Simcoe Research Station, Simcoe, Ontario. Mesotrione was applied preemergence to corn, after planting in the spring of 2005 and 2006, at 0, 70, 140 (1X), 280, 420 and 560g ha^{-1}. In the following spring of each year, mesotrione was applied to untreated field plots at 0.1X previous-year rates, i.e., 0, 7, 14 (10% of 1X rate), 28, 42 and 56 g ha^{-1}. These plots were randomized with plots that were sprayed with full rates the previous year, in a split plot arrangement, replicated four times. The entire experiment area was lightly tilled and sugar beets, cucumbers, green beans, peas and soybeans were planted. Visual injury ratings (0 to 100% scale), whole plant biomass and marketable yield data were collected. While mesotrione persistence varied between years and sensitivity to mesotrione varied between crops, generally, simulated carryover studies were as effective as conventional carryover studies in determining mesotrione persistence and rotational crop sensitivity. At mesotrione rates of 140 g ai ha^{-1} to corn in 2005, sugar beet dried biomass was reduced by 88% and 73%, while green bean dried biomass was reduced by 44% and 50%, in conventional and simulated residue carryover studies, respectively, in 2006. In these trials, sugar beets were the most sensitive crop followed by green beans, peas, cucumbers and soybeans. This research will reduce the time-period required to conduct in field bioassays from two years to one and will still help identify the potential for injury to rotation crops, following mesotrione application to corn.

RESIDUAL EFFECTS OF HERBICIDES IN SUMMER CROPS TO COOL-SEASON VEGETABLES. E.L. Alcober*,[1] N. Burgos,[1] V. Shivrain,[1] D. Motes,[2] M. Sales,[1] T. Tseng[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Alma, AR

ABSTRACT

Cool season crops such as spinach could potentially fit in a summer-fall-spring crop rotation system. However, herbicides applied to summer crops could injure the succeeding crops due to its residual toxicity. Thus, it is necessary to know the tolerance of cool-season crops to the soil-active herbicides applied in the summer. A 2-year experiment was conducted in 2007 and 2008 at the University of Arkansas Vegetable Substation, Kibler to evaluate the residual effect of various herbicides on cool-season vegetable crops. Herbicides evaluated were imazethapyr (Pursuit: 0.062 lb/A), imazamox (Raptor: 0.031 lb/A), halosulfuron (Sandea: 0.047 lb/A), sulfentrazone (Spartan: 0.188 lb/A and 0.375 lb/A), clomazone (Command: 0.375 lb/A), fomesafen (Reflex: 0.188 lb/A and 0.375 lb/A), flumioxazin (Valor: 0.066 lb/A and 0.188 lb/A) and rimsulfuron (Matrix: 0.031 lb/A and 0.062 lb/A) in three replications. Herbicides were applied at three timings, May 15, June 15, and July 15. Two plantings dates were set. In 2007, the fall crops were planted in September 27 and October 30. In 2008, the crops were planted on September 19 and October 13. The second planting is scheduled for harvesting in the first week of December. In 2007, Pursuit and Reflex at the higher rate caused 50% stand loss on collard relative to the nontreated check. Clomazone and flumioxazin did not cause significant injury to collard regardless of the planting interval. Imazethapyr was the only herbicide that caused yield reduction in collard planted 74 - 135 d after herbicide application (DAA). On the other hand, the stand of kale was not reduced, except at the high rate of fomesafen. Herbicides with the least residual effects on kale included imazamox, halosulfuron, clomazone, and flumioxazin. When planted 100 - 135 DAA, all herbicide treatments, except imazethapyr, did not reduce the yield of kale relative to the nontreated check. The second application (June 15) of imazethapyr, imazamox, halosulfuron, sulfentrazone (both rates), fomesafen (0.188 lb/A), flumioxazin (0.066 lb/A), and rimsulfuron did not reduce the mustard stand. Imazamox and halosulfuron did not cause injury to mustard planted at least 100 DAA. Moreover, flumioxazin caused negligible injury to mustard planted in September and minimal injury in October planting. Imazethapyr, imazamox, and the high rate of fomesafen reduced mustard yield significantly. In turnips, imazamox, halosulfuron, clomazone, and flumioxazin caused minimal injury at any of the planting intervals. Averaged over application time, most herbicide treatments produced similar turnip yields as the nontreated check, which were at least 1000 g/m of row. Imazethapyr, the high rate of sulfentrazone, and both rates of fomesafen reduced turnip yields. For spinach, imazethapyr, sulfentrazone (both rates), and the higher rate of fomesafen showed the highest residual effect averaged over herbicide application time and crop planting. The low rate of flumioxazin did not cause any injury while the high rate caused minimal injury to spinach planted in September. Averaged over herbicides, planting spinach at least 100 DAA did not cause yield loss. Crop response in 2008 is similar to that of 2007. Based on yield, cool-season crops can tolerate residual effect of herbicide applied at least 75 d before planting. Imazethapyr showed serious residual effect on all crops planted 135 DAA. Imazamox, its analogue, showed less residual activity than imazethapyr. Sulfentrazone showed significant residual activity on spinach at the low rate as well as on kale and turnip at the high rate. The results showed several promising herbicides that are safe on fall-planted cool-season crops.

GLYPHOSATE AND DICAMBA DRIFT ON COMMERCIAL PROCESSING TOMATOES. M.M. Kruger*,[1] G.R. Kruger,[1] W.G. Johnson,[1] D. Doohan,[2] T.A. Koch,[2] S.C. Weller[1]; [1]Purdue University, West Lafayette, IN, [2]The Ohio State University, Wooster, OH

ABSTRACT

Indiana and Ohio grow 5,828 ha of processing tomatoes annually valued at $33,818,000. The advent of herbicide-resistant crops has increased the potential for herbicide drift onto tomatoes from neighboring corn and soybean fields. Future release of dicamba-resistance stacked with glyphosate resistance in soybean will increase the use of dicamba and create additional concern regarding drift effects from both herbicides on tomato growth, development and yield. These studies addressed the effects of drift from glyphosate and dicamba onto processing tomatoes. Glyphosate and dicamba drift dose response studies were conducted in 2007 and 2008 in Lafayette, IN with the dicamba study replicated in Wooster, OH in 2008. Two tomato cultivars (611 and 331) and two application timings (early vegetative state, 2 weeks after transplanting and at flower initiation, 5 weeks after transplanting) were tested. Simulated drift rates of glyphosate and dicamba were 1/3rd, 1/10th, 1/30th, 1/100th, 1/300th, 1/1000th, and 0 based on an X rate of 0.64 kg ae/ha for glyphosate and 0.56 kg ae/ha for dicamba, respectively. Treatments were applied with a backpack sprayer delivering 140 l/ha at 117 kPa. Spray solutions contained 2.8 kg/ha of AMS and 0.25%v/v NIS was used with the dicamba. Crop injury, yield (red and green fruit), and flower loss were evaluated. Data were analyzed using non-linear log-logistic modeling in R and all data were combined across years, cultivars, and locations. Studies showed an increase in yield loss as the rate of drift increased at both timings, however, yield loss was generally greater at lower rates, especially for glyphosate, if drift occurred at flower initiation (5 weeks). A 10% yield loss occurred at 1/120th X for glyphosate and 1/224th X kg ae/ha for dicamba at timing two compared to 1/22nd X for glyphosate and 1/243rd X for dicamba at timing one.

ASSOCIATION OF POST AND PRE EMERGENCE HERBICIDES AS ALTERNATIVE CONTROL OF GLYPHOSATE RESISTANT *CONYZA* SPP IN CITRUS. M. Nicolai*,[1] P.J. Christoffoleti,[1] V.C. Cardinali,[1] M.S. Melo,[1] S.J. Carvalho,[1] M. VanGessel[2]; [1]University of Sao Paulo, Piracicaba, Brazil, [2]University of Delaware, Georgetown, DE

ABSTRACT

The difficulties of managing the weeds *Conyza bonariensis* and *Conyza canadensis* in the citrus cropping system in Brazil are well known by growers due to the high infestations of these weeds in the crop, and glyphosate resistance of some populations. Therefore, researches on chemical control options for these weeds in order to reduce the high infestation pressure, as well as alternatively control resistant biotypes to glyphosate are imperatives. The objective of this research was to identify post + residual effect treatments that are selective to a three years aged citrus orchard, variety "Pera", as well as treatments that are effective on the control of both species of *Conyza* resistant to glyphosate. The treatments were sprayed using a CO_2 pressurized sprayer, in May 15, 2008, under normal climatic conditions for the application, with the following treatments (g a.i. or a.e./ha): ammonium sulfate 400, ammonium sulfate + metribuzin 400 + 960, ammonium sulfate + diuron 400 +1000, glyphosate 1440, glyphosate + metribuzin 1440 + 960, glyphosate + diuron 1440 + 1000 and check plot. It was observed that all the treatments were effective, but glyphosate alone, due to the resistant population infestation in the experimental area. When diuron or metribuzin were present in the mixture, it was observed a good residual effect, up to 60 days after the treatments application. The combinations that ammonium glufosinate took part were considered the best options for the management of the weeds.

GENE MUTATIONS WHICH CONFER ALS RESISTANCE IN INDIANA HORSEWEED (*CONYZA CANADENSIS*) POPULATIONS. G.R. Kruger*,[1] V.M. Davis,[1] S.C. Weller,[1] P.J. Tranel,[2] W.G. Johnson[1]; [1]Purdue University, West Lafayette, IN, [2]University of Illinois, Urbana, IL

ABSTRACT

Horseweed populations with resistance to acetolactate synthase (ALS) inhibitors are common in Indiana. ALS-resistance is often due to target site mutations, and multiple mutations to the ALS enzyme have been documented. In the ALS-resistant horseweed populations in Indiana, there are at least three different mutations: pro197ser, pro197ala, and asp397gly. The objective of this experiment was to quantify the level of resistance conferred by horseweed populations with one of each of the three known mutations. Horseweed seed from a susceptible population and each of three ALS-resistant populations was germinated in the greenhouse. Seedlings were transplanted, and when rosettes were approximately 4 cm in diameter, they were sprayed with imazethapyr, flucarbazone, bispyribac, chlorimuron, or cloransulam using one of ten rates. The rates used were 0, 0.0032, 0.01, 0.032, 0.1, 0.32, 1, 3.2, 10 or 32 X where a 1X rate of imazethapyr was 105 g ai/ha, flucarbazone was 29 g ai/ha, bispyribac was 111 g ai/ha, chlorimuron was 9 g ai/ha, and cloransulam was 18 g ai/ha. At 28 DAT, plants were harvested to determine dry weight accumulation. Data were subjected to dose response analysis using the drc package in R. All three populations observed were resistant to all five ALS inhibitor herbicides tested. R:S ratios were calculated by comparing the GR_{90} for ALS-resistant populations with the GR_{90} for the susceptible population. The level of resistance observed in the horseweed populations varied by herbicide. Imazethapyr, an imidazolinone, caused the greatest dry weight reduction on the pro197ala population. The pro197ala population did not appear to be cross-resistant to imazethapyr with a R:S ratio of 0.35. The pro197ser population had the least reduction in dry weight in response to imazethapyr applications and had a R:S ratio of 11.1. Flucarbazone, a sulfonylamino-carbonyl-triazolinone, caused the greater reduction in dry weight to the pro197ser population than the asp397gly population with the two populations having R:S ratios of 8.4 and 94, respectively. We were unable to calculate a R:S ratio for the pro197ala population due to the lack of activity at even the 32X rate. Bispyribac, a pyrimidinyld(thio)benzoate, caused the greatest dry weight reduction to the pro197ser population and the least dry weight reduction to the asp397gly population. The R:S ratios for the horseweed populations in response to bispyribac ranged from 56.8 to 596.5. Chlorimuron, a sulfonylurea, caused the greatest reduction in dry weight to the pro197ser population and the least reduction in dry weight to the pro197ala population, similar to bispyribac. The R:S ratios for the horseweed populations in response to chlorimuron ranged from 27 to 41. Cloransulam, a triazolopyrimidine, caused the greatest reduction in dry weight to the asp376gly population and the least reduction in dry weight to the pro197ser population. The R:S ratios for the horseweed populations in response to bispyribac ranged from 2.3 to 10.5. In conclusion, cross-resistance was observed in all three horseweed populations to all five herbicides from the five different ALS families. However, the three ALS-resistant horseweed populations did respond differently to the five ALS herbicides tested.

A W574L MUTATION IN THE ALS ENZYME FROM BIDENS SUBALTERNANS FROM BRAZIL AND CONSEQUENCES TO THE FITNESS OF ALS-RESISTANT AND SUSCEPTIBLE BIOTYPES. F.P. Lamego,[1] R.A. Vidal*,[1] N. Burgos,[2] V. Shivrain,[2] M. Sales[2]; [1]UFRGS, Porto Alegre, Brazil, [2]Arkansas University, Fayetteville, AR

ABSTRACT

The first publication of herbicide resistance in Brazil was about a dozen years ago. Nowadays, there are 24 cases of herbicide-resistant weeds with thousands of infested fields, but, no report on the resistance mechanism in broadleaf weeds. The majority of resistance occur in soybean with ALS inhibitors. Bidens subalternans is a polyploid species and one of the most troublesome weeds in soybean fields in Brazil. The objective of this work was to characterize the resistance at of B. subalternans to ALS inhibitors. Experiments at the whole plant level and enzyme bioassays of an ALS-R biotype from Goiás, Brazil, have shown high levels of resistance. To investigate the molecular basis of resistance in B. subalternans, the conserved regions of ALS gene in susceptible and resistant biotypes were sequenced and compared. B. subalternans harbors, at least, three alleles for ALS gene. Analysis of the nucleotide and amino acid sequences demonstrated that a single-point mutation from G to T in one ALS allele conferred the change from the amino acid tryptophan to leucine at position 574 in the resistant biotype. Two other substitutions were observed, Phe116Leu and Phe149Ser, in the ALS3 gene of the R biotype, but were not associated previously with resistance to ALS herbicides. This research elucidated for the first time the molecular basis of resistance to herbicides in an important polyploid weed species from Brazil.

***psbA* MUTATION (PHE 255 TO ILE) IN *CAPSELLA BURSA-PASTORIS* CONFERS RESISTANCE TO TRIAZINONE HERBICIDES.** A. Perez-Jones*, S. Intanon, C. Mallory-Smith; Oregon State University, Corvallis, OR

ABSTRACT

A population of *Capsella bursa-pastoris* (L.) Medik. suspected to be resistant to the triazinone herbicide hexazinone, a photosystem II inhibitor, was collected from a lucerne field in 2007 in Oregon, USA. A whole-plant dose-response assay confirmed that the putative-resistant population was highly resistant to hexazinone. The resistant population was 26-fold more resistant to hexazinone when compared to the susceptible population. In addition, the hexazinone-resistant population was cross-resistant to the triazinone herbicide metribuzin but susceptible to other PS II inhibitors, including atrazine, diuron, and terbacil. DNA sequence analysis of the chloroplast *psbA* gene encoding the D1 protein of PS II, the target site of PS II inhibitors, identified a point mutation from Phe to Ile at position 255 in the hexazinone-resistant population. A different mutation (Phe_{255} to Try) at this position was previously reported in *Chlamydomonas reinhardtii* and *Synechococcus* after site-directed mutagenesis and was associated with resistance to PS II inhibitors. However, to our knowledge this is the first report of a mutation of the *psbA* gene at Phe_{255} in a field-selected herbicide-resistant plant.

GLYPHOSATE-RESISTANT PALMER AMARANTH FROM MISSISSIPPI. V. Nandula*,[1] R. Bond,[1] D. Poston,[2] C. Koger,[1] K. Reddy,[3] J. Bond[1]; [1]Mississippi State University, Stoneville, MS, [2]Pioneer Hi-Bred International, Inc, Stoneville, MS, [3]USDA-ARS, Stoneville, MS

ABSTRACT

In the summer and fall of 2007, Palmer amaranth seeds were collected from 35 populations that were suspected to be resistant to glyphosate in the northwestern part of Mississippi (Mississippi Delta region). A number of these populations survived a glyphosate treatment of 0.42 kg ae ha^{-1} in preliminary glyphosate-resistance screening studies. In follow-up experiments, plants at 10-cm height (3- to 6-leaf stage) were treated with glyphosate at 0.84 kg ha^{-1} and percent control and mortality measured 2 wk after treatment (WAT). Twelve of the 35 populations were resistant to glyphosate with control ranging from 10 to 50% and mortality from 1 to 45%. The 12 resistant populations, considered as the F1 generation, were then grown in isolation from each other for development of the F2 generation. For this purpose, at least one male and one female plant from a given population were grown together. In the process, 22 unique biotypes across the 12 populations were developed as the F2 generation. Glyphosate dose response experiments were conducted on the F2 biotypes by treating plants at 8- to 10-cm height (3- to 6-leaf stage) with glyphosate at 0. 0.42, 0.84, 1.68, 3.36, and 6.72 kg ha^{-1} and percent control and aboveground shoot fresh weight recorded 3 WAT. GR_{50} values (glyphosate dose required to cause a 50% reduction in shoot fresh weight) for the F2 biotypes ranged from 0.23 to 1.52 kg ha^{-1}. A susceptible check did not survive a low glyphosate dose of 0.11 kg ha^{-1}. Further studies are underway to determine the GR_{50} for the susceptible biotype. The F2 biotypes were also screened for response to selected herbicides (*S*-metolachlor, fomesafen, pendimethalin, and pyrithiobac) applied preemergence. Some of the biotypes survived only pyrithiobac treatment. Postemergence application of non-glyphosate herbicides such as paraquat, glufosinate, and fomesafen provided complete control, whereas, acetolactate synthase (ALS) inhibitors such as trifloxysulfuron, pyrithiobac, chlorimuron, and cloransulam provided less than adequate control. We conclude that glyphosate-resistant Palmer amaranth populations exist in Mississippi that are also resistant to ALS-inhibiting herbicides.

INVESTIGATING RESISTANCE MECHANISM IN GLYPHOSATE-RESISTANT *AMARANTHUS*. G.G. Light*,[1] R.J. Wright,[2] A.S. Culpepper[3]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas AgriLife Research, Lubbock, TX, [3]University of Georgia, Tifton, GA

ABSTRACT

Currently, there are nine different weed species in the U.S. with confirmed resistance to glyphosate, including both Palmer amaranth (*Amaranthus palmeri*) and common waterhemp (*A. rudis*). Both of these *Amaranthus* species are particularly troublesome in row crop agriculture due to their aggressive growth habit. The dioecious nature of these weeds results in distant pollen dispersal and the potential for interspecific hybridization. Previous studies have shown no differences in absorption or translocation between sensitive and resistant biotypes of *A. palmeri*, but differential accumulation of shikimate between susceptible and resistant biotypes implicates the EPSP synthase target site as a potential mechanism. Additionally, research in *A. rudis* has shown that shikimate accumulation in susceptible biotypes is 5-fold higher than in resistant biotypes, imputing differential inhibition of EPSP synthase. This research focuses on the possible molecular and biochemical mechanisms for glyphosate resistance in *Amaranthus*. To date, more than 1000 bp of the EPSP synthase gene has been sequenced to identify differences which may exist between susceptible and resistant biotypes. However, use of 5'-RACE to obtain the full coding sequence has been unsuccessful. Current efforts to elucidate the 5'-end of the gene are focused on the insertion of *Amaranthus* cDNA into *aroA*- lines of *E. coli* followed by selection on plates containing glyphosate. Surviving colonies will then be sequenced using primers upstream of the insertion site. Other possible mechanisms are also being explored, including: the presence of isozymes; over-expression of EPSP synthase in resistant biotypes; differences in the transit peptide of a precursor molecule; and the existence of enzyme promiscuity.

ANTAGONISM BETWEEN GLYPHOSATE AND GLUFOSINATE. R.K. Bethke*, C. Sprague, D. Penner; Michigan State University, East Lansing, MI

ABSTRACT

The stacking of genes to provide resistance to several herbicides previously injurious to a crop provides new opportunities for control of herbicide resistant weeds. Specifically the opportunity may exist to control glyphosate resistant weeds with glufosinate. The combination of glyphosate and glufosinate in a tank mix has the potential to cause unexpected interactions. The objectives of this study were to evaluate the combination of glyphosate and glufosinate on three annual weeds prevalent in Michigan cropping systems; giant foxtail, common lambsquarters, velvetleaf and the perennial weed, Canada thistle. In the greenhouse antagonism was observed with a low rate of one herbicide and a high rate of the other herbicide in Canada thistle, common lambsquarters, and velvetleaf. Synergism was observed in giant foxtail from low application rates of the combination of these two herbicides.

GLUCOSINOLATE VARIATION AMONG WILD RADISH (*RAPHANUS RAPHANISTRUM*) ACCESSIONS. M.S. Malik*,[1] J.K. Norsworthy,[2] M.B. Riley,[1] P. Jha[2]; [1]Clemson University, Clemson, SC, [2]University of Arkansas, Fayetteville, AR

ABSTRACT

Wild radish (*Raphanus raphanistrum L.*), a member of the Brassicaceae family, produces several glucosinolates (GSLs). These glucosinolates play an important role in weed, insect, and pathogen suppression when converted to isothiocyanates by myrosinase following tissue maceration. Experiments were conducted to determine GSL composition and concentration of wild radish at flowering among accessions of wild radish from eight states in the eastern United States. Seeds of wild radish were collected from Alabama, Florida, Georgia, Maine, Mississippi, New York, North Carolina, and South Carolina. The seeds were planted in pots, placed in a growth chamber, and harvested at the 50% flowering stage. GSLs were evaluated from plant parts including roots, leaves, flowers, primary branches, and secondary branches using High Performance Liquid Chromatography to determine which accessions may contain the higher GSL content. A total of 17 GSLs were identified among all accessions. Glucoraphenin, gluconapin, glucoerucin, glucobrassicin, and gluconasturtin were found in all accessions of wild radish. The accessions from Florida and Mississippi had the greatest total GSL concentration on a biomass basis, ranging from 4228 to 5254 µmol. However, no distinct differences were found in GSL concentration among accessions.

BIOCHEMICAL RESPONSE OF CATTAILS (*TYPHA* SPP.) TO HIGH WATER CONDITIONS IN STORMWATER TREATMENT AREAS. H. Chen,[1] K. Vollmer*,[2] M. Zamorano,[1] G. MacDonald,[2] J. Erickson[2]; [1]South Florida Water Management District, West Palm Beach, FL, [2]Univ. of Florida, Gainesville, FL

ABSTRACT

Typha domingensis (cattail) is a native wetland species that can be found throughout Florida and the United States. The ability of *T. domingensis* to uptake phosphorus make it an ideal vegetation for large-scale constructed wetlands, called the Everglades Stormwater Treatment Areas (STAs), to reduce phosphorus from nutrient-rich water before it enters the Everglades ecosystem. During the wet season, cattails in STAs often encounter extensive flooding stress. The objective of this study was to evaluate biochemical stress patterns in cattails as affected by high water conditions. Samples were collected from large aboveground tanks consisting of three flooding treatments: 1.25 feet, 3 feet, and 4.5 feet of water above the soil surface. There were three replications per treatment. Plants were subjected at these water depths for four weeks. After each flooding/recovery regime total nonstructural carbohydrate content (TNC) was measured in rhizome, leaf, and shoot-base tissue. Chlorophyll content was also measured in leaf tissue. There was no significant depth by time interaction on rhizome and shoot-base TNC content, but there was a significant depth by time interaction on leaf TNC content and leaf chlorophyll content. At the 1.25 feet deep treatment rhizome, shoot-base, and leaf TNC content decreased during the flooding stage and also during the recovery period, but there was no significant change in chlorophyll content. At the 3 feet depth treatment rhizome and leaf TNC as well as chlorophyll content increased during flooding and decreased during recovery, while shoot-base TNC content decreased during flooding but increased during the recovery period. At the 4.5 feet deep treatment, rhizome and shoot-base TNC content decreased among all treatments. Leaf TNC content increased during flooding, but decreased during the recovery period. Chlorophyll content decreased during flooding and increased during recovery of all treatments. Our results indicate that leaf and rhizome TNC content is being stored during flooding but is quickly re-mobilized during the recovery period. The drop in TNC content during the recovery period is indicative of carbohydrates being utilized by the plants for recovery/regrowth following a period of severe stress.

EFFECT OF WATER COMPETITION BETWEEN *ZEA MAYS* AND *SORGHUM HALEPENSE* ON LEAF GAS EXCHANGE AND COMPETITIVE ABILITY. H.A. Acciaresi*,[1] M.S. Zuluaga,[2] H. Chidichimo[1]; [1]Facultad Cs. Agr. y Ftales (UNLP)- CIC, La Plata, Argentina, [2]Facultad Cs. Agr. y Ftales (UNLP), La Plata, Argentina

ABSTRACT

The objective of this study was to determine the dynamics of leaf gas exchange in corn and Johnsongrass under water competition in order to know the water consumption strategy and to establish the effect in the competitive ability of both species. The soil water potential, leaf water potential, relative water content, (RWC) the photosynthetic rate (A), the stomatal conductance (Gs) and the transpiration rate (E) were measured during crop and weed vegetative growing stages. The derivative variables were the water use efficiency, the relative yield total production and the index of aggressivity for plant biomass and transpiration rate. It was observed that Johnsongrass made a continuous water absorption throughout the competition period, reaching a lower foliar water potential respect to corn. Johnsongrass maintained the RWC throughout the period of evaluation over 90%. In corn, the RWC diminished to values of 70% to the 10 days of initiate the period of competition. Also, Johnsongrass maintained an active gas exchange (A, Gs and E), with a greater transpiration rate aggressivity. The hybrids of corn showed a smaller competitive ability than Johnsongrass for the different levels of competition. These results demonstrate that the observed conservative water strategy of corn turned out to be detrimental for the crop, given the continuous absorption and water use that made Johnsongrass. These characteristics could be one of the causes that confer an important aggressivity to Johnsongrass in extensive production systems

AUTOPHOSPHORYLATION AFFECTS PROTEIN COMPLEX FORMATION AND ACTIVITY OF CDK-ACTIVATING KINASE (EE;CDKF;1) IN LEAFY SPURGE (*EUPHORBIA ESULA*). W.S. Chao*,[1] Y. Jia,[2] J.V. Anderson,[1]; [1]USDA-ARS, Fargo, ND, [2]Texas A & M University, Kingsville, TX

ABSTRACT

Leafy spurge is a deep rooted perennial weed that propagates both by seeds and underground adventitious buds located on the crown and roots (crown and root buds). As buds develop during the normal growing season, they are maintained in a quiescent state through correlative inhibition. To enhance our understanding of growth and development during seed germination and vegetative propagation, a cell cycle gene encoding CDK-activating kinase (Ee;CDKF;1) was cloned from leafy spurge. The Ee;CDKF;1 protein is involved in a phosphorylation cascade linked to early stages of cell cycle progression. Two threonine residues (Thr291 and Thr296) are mutually responsible for autophosphorylation and for phosphorylating its substrate protein, cyclin-dependent kinase (CDK). Also, Thr291 remains phosphorylated *in-vivo* at all times. Yeast two-hybrid screening performed using Ee;CDKF;1 as a bait indicated that one of the interacting proteins was Ee;CDKF;1. Protein-protein interaction of Ee;CDKF;1 was further confirmed by yeast two-hybrid interaction and *in-vitro* pull-down assays. The full-length Ee;CDKF;1 was shown to interact with N-terminal, middle, and C-terminal regions of Ee;CDKF;1. Gel exclusion chromatography and/or native PAGE showed that Ee;CDKF;1 and GST-Ee;CDKF;1 were capable of forming both homo-dimer and -trimer complexes in its native state. In addition, both forms were autophosphorylated and able to phosphorylate CDK. Moreover, mutant forms of Ee;CDKF;1 (106G/A, 166K/A), which lost autophosphorylation capability completely, were unable to form homo protein complexes in their native state. The result thus demonstrated that autophosphorylation of Ee;CDKF;1 is crucial for both kinase activity and complex formation.

THE PHYSIOLOGICAL BEHAVIOR OF AMINOCYLOPYRACHLOR IN SELECTED INVASIVE WEED SPECIES. J. Bell*,[1] I.C. Burke,[1] T.S. Prather[2]; [1]Washington State University, Pullman, WA, [2]University of Idaho, Moscow, ID

ABSTRACT

Aminocyclopyrachlor is a new herbicide being developed by DuPont Crop Protection for broadleaf weed control. To better understand observed field efficacy, uptake and translocation of aminocyclopyrachlor acid (DPX-MAT28) and its methyl ester derivative DPX-KJM44 were evaluated on rush skeletonweed (*Chondrilla juncea*), prickly lettuce (*Lactuca serriola*), and yellow starthistle (*Centaurea solstitialis*)- three troublesome weeds in noncrop, range, and conservation reserve program lands in Washington. Rush skeletonweed plants were grown from rhizome fragments while prickly lettuce and yellow starthistle were grown from seed. At the 4 to 5 leaf stage, a 1 cm^2 portion of the adaxial side of the newest fully expanded leaf was marked and covered to prevent the spray solution from contacting the leaf. The plants were then treated with a non-radiolabeled mixture containing 210 g ai/ha of either DPX-MAT28 or DPX-KJM44 and a nonionic surfactant at 0.25% v/v using a carrier volume of 300 l/ha. Immediately after application, 5 1-µL droplets containing in total 3.33 kBq of radioactivity (either DPX-MAT28 or DPX-KJM44) on the marked leaf area. Plants were harvested at 2, 4, 8, 24, or 72 h after treatment (HAT), divided into seven parts (above treated leaf, below treated leaf, crown, root, above treated portion, treated, below treated portion), dried, weighed, and then oxidized using a biological oxidizer to recover ^{14}C. Absorption and translocation differed between formulation and weed species. In prickly lettuce, absorption of DPX-KJM44 increased with time, with a maximum of 10% of applied radioactivity absorbed at 72 HAT. Absorption of DPX-MAT28 was similar at all harvest intervals and never exceeded 5%. Translocation of both formulations in prickly lettuce was similar, with 33% of absorbed material translocated out of the treated leaf at 72 HAT, and similar amounts of both formulations accumulated in the crown (3%) and root (2%). In yellow starthistle, absorption of DPX-MAT28 and DPX-KJM44 was higher compared to prickly lettuce, with 15% and 31% of applied material absorbed at 72 HAT, respectively. Total translocated material was different between formulations, with 70% of absorbed DPX-MAT28 and 59% of absorbed DPX-KJM44 moved out of treated leaf by 72 HAT. Accumulation of both formulations in crown and root tissue was significantly higher in yellow starthistle than prickly lettuce. Approximately 14% absorbed material moved to the crown and 9% to root 72 HAT. In contrast, absorption of both formulations by rush skeletonweed was greater, with 54% and 68% of applied DPX-MAT28 and DPX-KJM44 absorbed at 72 HAT. Proportional movement out of the treated leaf to the crown and roots was different in rush skeletonweed than prickly lettuce or yellow starthistle. The amount of ^{14}C was recovered from the crown of rush skeleton weed at 72 HAT was 1% of the absorbed, and at 72 HAT 6% of the absorbed had translocated to the roots (including the rhizome), regardless of formulation.

PREDICTING N AND P FERTILIZER EFFECTS ON WEED SPECIES COMPETITIVENESS WITH WHEAT. R.E. Blackshaw*, R.N. Brandt; Agriculture & Agri-Food Canada, Lethbridge, AB, Canada

ABSTRACT

Previous research has indicated that weed species can be inherently quite different in their level of responsiveness to higher soil N and P levels. However, questions remain about how this information could best be utilized to improve weed management. Could this information be used to predict crop-weed competitive outcomes as affected by fertilizer programs? Replacement series experiments were conducted under controlled environment conditions to examine the effect of three N (60, 120, and 240 mg N kg^{-1} soil) and three P (5, 15, and 45 mg P kg^{-1} soil) rates on the competitive ability of various weed species grown with wheat. Grass and broadleaf weed species were chosen to represent species that varied in their growth responsiveness to N and P. The competitive ability of the low N responsive species, Persian darnel (*Lolium persicum*) and Russian thistle (*Salsola iberica*), was not influenced by N rate; supporting our hypothesis that N rate would have little effect on the competitiveness of species responding minimally to N. Conversely, the competitiveness of the high N responsive species redroot pigweed (*Amaranthus retroflexus*) progressively improved as N rate increased. The competitive abilities of the low P responsive species, Persian darnel and kochia (*Kochia scoparia*), decreased as P rate increased; again supporting our hypothesis that the competitiveness of species responding minimally to P would remain unchanged or decrease at higher P levels. As expected, the competitiveness of the high P responsive species round-leaved mallow (*Malva pusilla*) progressively improved as P dose increased. However, results with wild oat (*Avena fatua*) did not support our hypothesis as its competitiveness with wheat was unaffected by N or P rates used in this study even though it was previously categorized as being highly responsive to both of these nutrients. Thus, with five of six species, knowledge of weed growth responsiveness to N or P was useful information in predicting competitive outcomes with wheat at higher fertilizer rates. Results suggest that fertilizer management strategies that favor crops over weeds deserve the greatest attention when weed infestations consist of species known to be highly responsive to higher soil fertility levels. Information gained in this study will be used to advise farmers of the importance of strategic fertilizer management in terms of both weed management and crop yield.

VEGETATION CONTROL WITH LIME, SODIUM CARBONATE (ASH) AND IMAZAPYR ON SANDBARS ALONG MISSOURI RIVER. S. Knezevic*, A. Datta, J. Scott, C. Shapiro, M. Mainz; UNL, Concord, NE

ABSTRACT

Lack of bare sandbars due to vegetative overgrowth is the main reason for the reduction of nesting habitats for two endangered bird species, Piping Plovers (*Charadrius melodus*) and Interior Least Terns (*Sterna antillarum*). In an effort to create suitable nesting habitats (e.g. open bare sand areas), a series of vegetation management practices are being tested on existing sandbars along the Missouri River. Field studies were initiated on two exiting sandbars in 2007 and 2008 by Springfield, SD with the objective to test vegetation control as influenced by liming, ash, imazapyr, and their interactions. The sites were treated with 3 quarts of glyphosate to control existing vegetation prior to the experiment initiation. The experimental design was a split plot with 18 treatments replicated 4 times. The main plot was soil amendment (lime or sodium carbonate surface applied) each at 3 rates (0, 3, and 6 t/ha) and the sub-plot of imazapyr (0, 0.56, and 1.58 kg/ha). The dominant weed species of the sandbars were nutsedge, waterhemp, sweet clover, common ragweed, horsetail, and marestail. Best overall vegetation control was achieved with imazapyr applied alone at 1.68 t/ha, or following application of lime at 3 t/ha, which provided more than 70% control of most weed species one year after application. Lime or ash applied alone, or a combination of ash and imazapyr did not provide adequate vegetation control. sknezevic2@unl.edu

RESPONSE OF PIGWEED AND FOXTAIL SPECIES TO BROADCAST FLAMING. S. Knezevic*, S. Ulloa, A. Datta; UNL, Concord, NE

ABSTRACT

Propane flaming could be an effective tool for weed control in organic cropping systems. However, susceptibility of major weeds to broadcast flaming must be determined in order to optimize its proper use. Therefore, field experiments were conducted during summer of 2008 at the Haskell Agricultural Laboratory, Concord, NE utilizing six rates of propane and four weed species, including green foxtail (*Setaria viridis*), yellow foxtail (*Setaria glauca*), waterhemp (*Amaranthus rudis*), and redroot pigweed (*Amaranthus retroflexus*) with the objective to collect some base-line information on their tolerance to broadcast flaming. Propane flaming response was evaluated at three growth stages for each weed species. The propane rates applied were 0, 12, 31, 50, 68 and 87 kg ha^{-1} corresponding to 0, 2.5, 6.5, 10.5, 14.4 and 18.4 gal $acre^{-1}$. Flaming treatments were applied utilizing an ATV mounted flamer moving at a constant speed of 6.5 km h^{-1} (4 m h^{-1}). The response of the weed species to propane rates was based on visual injury rating and percent biomass loss recorded at 14 days after treatment (DAT) and described by log-logistic model. Overall response of the weed species to propane flaming varied among species, growth stages, and propane rates. In general, foxtail species were more tolerant than pigweed species. Waterhemp and redroot pigweed did not differ in their response to broadcast flaming and were easily controlled (90% control) with propane rate of about 60 kg ha^{-1} when flamed at early growth stages (3-5 leaf stage), however they needed higher propane rate of about 90 kg ha^{-1} at later growth stages (9 leaf stage to flowering). Foxtail species differed in their response to broadcast flaming. Green foxtail was more tolerant than yellow foxtail regardless of the growth stage. Propane rate of 110 kg ha^{-1} was needed to provide 90% control of green foxtail irrespective of the growth stage. In contrast, 90% control of yellow foxtail was achieved with propane rate of 80 kg ha^{-1} for any growth stage. It is important to point out that foxtail species started re-growing at about 14 DAT regardless of the growth stage flamed, whereas pigweed species did not re-grow, especially when flamed with rates above 60 kg ha^{-1}. sknezevic2@unl.edu

RESPONSE OF CORN TYPES TO BROADCAST FLAMING. S. Knezevic,[1] S. Ulloa*,[1] C. Bruening,[2] G. Gogos,[1] C. Costa,[1] A. Datta[1]; [1]UNL, Concord, NE, [2]UNL, Lincoln, NE

ABSTRACT

Propane flaming has the potential to be included into an integrated weed management systems of both conventional and organic productions. Previous experiments tested flaming mostly in vegetable crops. In order to incorporate flaming in major agronomic crop such as corn, it is important to collect baseline data on the tolerance of different corn types to broadcast flaming. Field studies were initiated on two location at the Haskell Agricultural Laboratory in 2008 utilizing six rates of propane and three corn types, including field corn (*Zea mays* L.*)*, pop corn (*Zea mays* L. *var everta*), and sweet corn (*Zea mays* L.*var rugosa*). Propane rates were 0, 12, 31, 50, 68, and 87 kg/ha, corresponding to 0, 2.5, 6.5, 10.5, 14.4, and 18.4 gal/acre. Flaming treatments were applied utilizing an ATV mounted flamer moving at a constant speed of 6.5 km/h (4 m/h). Corn species response to propane flaming were estimated on the basis of visual damage and dry matter loss, and described by log-logistic models for each corn type. Overall response to propane flaming varied among the corn types, growth stages, and propane rates. Preliminary data suggested that all corn types presented high levels of tolerance to broadcast flaming. Sweet corn was the most tolerant while pop corn was the least tolerant regardless of the growth stages. Additional studies are needed to test the relationship between the injury level by flaming, and corresponding crop yields and yield components (sknezevic2@unl.edu).

KNOWLEDGE, PERCEPTION AND ATTITUDES OF ORGANIC FARMERS ABOUT WEED CONTROL. D. Doohan*,[1] E. Canales,[1] J. Parker,[2] R. Wilson[2]; [1]The Ohio State University, Wooster, OH, [2]The Ohio State University, Columbus, OH

ABSTRACT

Previous research has shown that organic farmers rely on non-traditional sources of agricultural production knowledge. Networks of like-minded individuals willing to share knowledge were preferred over programming provided by land grant universities. Moreover a strong emphasis upon heuristic approaches has been identified. A predictable outcome of such preferences is belief in concepts not yet supported by scientific evidence. The objective of this research was to identify key concepts and attitudes held by organic farmers about weeds and weed control and determine how they differed from those held by conventional farmers. Methodology included development of an expert model that described key concepts about how weeds are introduced and spread in the agro-ecosystem, management strategies and techniques, and positive and negative impacts. Thirteen organic farmers from central and northern Ohio were selected for interviews using an open-ended survey instrument that was based on the expert model. Most interviews were conducted in person and lasted approximately 90 minutes. Interviews were transcribed and key concepts were coded and mapped on an influence diagram. This process provided for the development of a mental model describing the deeply held knowledge, perceptions and attitudes of this cohort. Similarities and contrasts with a mental model previously completed for conventional farmers were identified and characterized. The long term goal of this research is to identify and develop new education and research opportunities that are more appropriate to the needs of organic farming.

ORGANIC WEED CONTROL IN CERTIFIED ORGANIC WATERMELON PRODUCTION. C.L. Webber*,[1] A.R. Davis,[1] J.W. Shrefler[2]; [1]USDA, ARS, SCARL, Lane, OK, [2]OSU, Lane, OK

ABSTRACT

The increasing perception by consumers that organic food tastes better and is healthier continues to expand the demand for organically produced crops. Field research was conducted in southeast Oklahoma to determine the impact of organic production systems on weed control and watermelon (*Citrullus lanatus* var. *lanatus*) yields. Six watermelon varieties were transplanted at two locations (Lane, Ok and Center Point, OK). The six varieties included three seeded varieties ('Early Moonbeam', 'Sugar Baby', and 'Allsweet') and three seedless varieties ('Triple Crown', 'Triple Prize', and 'Triple Star'). The weed control system at Lane utilized black plastic mulch on the crop row; the area between rows was cultivated to control weeds. The no-till organic system at Center Point used a mowed rye and vetch cover crop, hand weeding, and vinegar (5% acetic acid) for weed control. When averaged across watermelon varieties, the organic production system at Lane produced significantly more fruit per plant (4.2 vs. 2.3 fruit/plant), greater marketable yields (16.0 vs. 8.4 kg/plants), and higher average marketable weight per fruit (6.1 vs. 4.0 kg) than at Center Point. Plants at Center Point produced a greater percentage of marketable fruit, 92%, compared to plants at Lane, 63%. Four of six varieties had significantly greater numbers of fruit per plant and higher marketable yields at Lane than at Center Point. Except for 'Early Moonbeam', all other varieties produced significantly heavier fruit at Lane than at Center Point. Plants at the Center Point location produced a greater percentage of marketable fruit for all varieties except 'Allsweet'. The plastic mulch and cultivation between crop rows was a successful method of weed control at the Lane location and provided a stronger weed barrier to prevent weed emergence than the cover crop mulch at Center Point. In conjunction with this research, fruit quality evaluations (lycopene and brix) determined that the fruit quality was as good or better when harvested from the weedier Center Point location. Fruit quality differences between locations may be a reflection of weed pressure, other production factors, or a combination of both. Further research will specifically investigate the impact of weed competition on watermelon fruit quality.

RATE-RESPONSE OF MUSTARD AND WEEDS TO CLOVE OIL AND VINEGAR ACROSS MULTIPLE STATES. D.C. Brainard*,[1] R.R. Bellinder,[2] W.S. Curran,[3] M. Ngouajio,[1] M.J. VanGessel,[4] M.J. Haar,[5] W.T. Lanini,[6] J.B. Masiunas[7]; [1]Michigan State University, East Lansing, MI, [2]Cornell University, Ithaca, NY, [3]The Pennsylvania State University, State College, PA, [4]University of Delaware, Newark, DE, [5]University of Minnesota, Lamberton, MN, [6]University of California Davis, Davis, CA, [7]University of Illinois, Urbana-Champaign, IL

ABSTRACT

Weed management is a major constraint to successful production of many organically grown crops. Currently, soil disturbance is the primary means by which weeds are managed organically, resulting in losses in soil quality as well as high energy and labor costs. Natural product herbicides offer a useful addition to the suite of weed management tools available to organic growers, but limited information is available to guide the optimal use of these products. The objectives of this research were to 1) evaluate the efficacy of four rates of Matran EC (eugenol) and vinegar (acetic acid) on weeds across multiple states, and 2) assess the potential role of temperature and relative humidity in explaining variations. From 2006-2008, a total of 19 field trials were conducted in 7 states using an identical protocol. Seeds of brown mustard 'Florida broadleaf' were sown and herbicides applied to both mustard and emerged weeds when mustard reached the 4 leaf stage (leaf stages of other species varied but usually exceeded 4). Herbicide treatments included Matran at 5, 10, 15, and 20% concentrations and 35 GPA and vinegar at 5, 10, 15, and 20% concentrations and 70 GPA. Results varied widely across trials. In general, concentrations of at least 15% were needed for good control of mustard at the 4 leaf stage. Both products were more effective at suppressing mustard than pigweed species or common lambsquarters. Poor control was observed for grasses, purslane, and velvetleaf. No significant effects of temperature on efficacy of either product were detected. In contrast, relative humidity was positively correlated with efficacy of both Matran and vinegar.

MUSTARD MEAL AS AN ORGANIC HERBICIDE. C.L. Webber*,[1] J.W. Shrefler,[2] R.A. Boydston[3]; [1]USDA, ARS, SCARL, Lane, OK, [2]OSU, Lane, OK, [3]USDA, ARS, Prosser, WA

ABSTRACT

Mustard meal (MM) is phytotoxic and a potential pre-emergent and preplant-incorporated organic herbicide for controlling germinating and emerging weed seedlings: unfortunately, MM may also adversely impact seedling survival of certain direct-seeded vegetable crops. Field research was conducted in southeast Oklahoma (Lane, OK) to determine the phytotoxic impact of MM on seedling establishment of cantaloupe (*Cucumis melo* L.). The factorial experiment included 2 MM incorporation levels (no incorporation and incorporation), 2 MM application rates (2.25 and 5 mt/ha), 2 application patterns (banded and solid), 2 controls (1 for each incorporation method) and four replications. The soil [Bernow fine sandy loam, 0-3% slope (fine-loamy, siliceous, thermic Glossic Paleudalf)] was prepared for planting by plowing, fertilizing, and forming raised beds. MM was applied to raised beds 3 m-long on 91 cm-centers. The banded application produced a 10 cm-wide MM-free area in the bed center where the crop would later be direct-seeded. The MM was then either left on the surface or incorporated into the top 2.5 - 5.0 cm and then direct-seeded with 'PMR-45' cantaloupe. Plant stands and weed control ratings were collected during the experimental period. Twenty-eight days after planting (DAP), the entire plot was harvested and the fresh and dry plant weights determined. Total weed control ranged from good (greater than 80%) to excellent (greater than 90%) for all MM weed control treatments. Unfortunately, all MM applications adversely affected seedling establishment independently of application rate, incorporation level, and application pattern. Injury and morality occurred prior to seedling emergence. MM was clearly phytotoxic to germinating and emerging weed species and cantaloupe. MM has potential as an organic pre-emergent and preplant-incorporated organic herbicide, but application rates and application methods must be further refined to control weeds while protecting direct-seeded crops such as cantaloupe.

ELUCIDATION OF FERTILITY AND MOWING HEIGHT PRACTICES ON WEED ENCROACHMENT IN TALL FESCUE. M. Cutulle*, J. Derr, B. Horvath; Virginia Tech, Virginia Beach, VA

ABSTRACT

Tall Fescue (*Festuca arundinacea*) is a commonly- utilized turfgrass in the temperate and transition zone areas of the United States. It establishes quickly, requires moderate amounts of nitrogen, and is resistant to most diseases. However, during hot humid summers, tall fescue is under stress and is susceptible to *Rhizotonia solani* infestations. This disease, referred to as brown patch, causes turf thinning, leading to encroachment from weeds such as bermudagrass (*Cynodon dactylon*). Cultural practices such as fertility and mowing height may impact bermudagrass encroachment and brown patch disease in tall fescue. Improved brown patch control may result in lower weed infestations. Two mowing heights (5 and 10 cm), and 3 levels of fertility (49, 171, and 220 kg of nitrogen annually per hectare) were evaluated in an established stand of 'RTF' tall fescue. Three plugs of common bermudagrass were planted in each plot in May of 2008. Data collected monthly included weed composition and density, bermudagrass diameter, brown patch severity, and turf quality. Mowing height had a significant effect on bermudagrass diameter in June, July, and August. A higher mowing height resulted in less bermudagrass encroachment. The mean bermudagrass diameter, averaged across fertility treatments, was almost 30 cm for the 5 cm mowing height compared to less then 20 cm bermudagrass diameter for the 10 cm mowing height treatment. Bermudagrass stolons were not able to root into the soil when tall fescue was maintained at 10 cm while they could at 5 cm mowing height. Fertility did not have an effect on bermudagrass diameter. In July and August, southern crabgrass (*Digitaria ciliaris*) density was much higher in the 5 cm mowing height plots. Tall fescue cover was significantly reduced in the 5 cm mowing treatment due to weed competition but was acceptable at the 10 cm height. Combining the higher mowing height with the highest fertility treatment resulted in 16 % brown patch cover, which was significantly greater than the other treatment combinations; however, the plots recovered when weather was cooler and dryer. Maintaining a 10 cm mowing height results in lower crabgrass density, less bermudagrass encroachment, and greater tall fescue cover compared to a 5 cm height. Cultural practices are an important component of a disease and weed management program.

GENOTYPIC AND CULTURAL WEED MANAGEMENT PRACTICES FOR ORGANIC PEANUT PRODUCTION. G.T. Place*, D.L. Jordan, T.G. Isleib; North Carolina State University, Raleigh, NC

ABSTRACT

Research was conducted in North Carolina in 2007 and 2008 to compare weed control in programs consisting of three levels of weed management (clethodim applied postemergence, cultivation and hand removal of weeds, clethodim and appropriate broadleaf herbicides applied postemergence), two levels of cultivar selection (NC 12C and VA 98R), and three levels of row pattern (single rows spaced 91 cm apart, standard twin rows spaced 20 cm apart on 91-cm centers, narrow twin row pattern including twin rows spaced 20 cm apart on 46-cm centers). Cultivar did affect eclipta (*Eclipta prostrata* L.) control in 2007 but had no effect on pod yield. Main effect of weed management program did affect the 3 dominant weeds: eclipta, upright spurge (*Euphorbia serrulata* Thuill.) and common lambsquarters (*Chenopodium album* L.) control in both years in 10 of 11 experiments. Main effect of row pattern was significant for weed control in 3 of 11 experiments. Interaction of weed management and row pattern was significant for weed control in 1 of 11 experiments. Organic and conventional weed management systems were similar in weed control in most cases. Twin and narrow twin row patterns resulted in similar weed control in all cases. Pod yield was not affected in two experiments when only broadleaf weeds were present. However, when Texas panicum was present, the interaction of row pattern and weed management on pod yield was significant. In a separate experiment, yield of the cultivars Phillips, VA 98R, NC 10C, NC-V 11, and NC 12C and the breeding lines N99027L, N02020J, and N01013T was compared when clethodim alone was applied or when diclosulam pre emergence was followed by clethodim post emergence. Cultivars with weed suppressive ability or weed tolerance could be one part of an organic weed management system. Weed biomass and peanut biomass for these genotypes was determined in plots with no herbicide at 10 weeks after planting. Significant differences in weed biomass did exist between some genotypes in 2007, suggesting genetic differences in weed suppressive ability. However, this effect was not seen in 2008. Percent of weed-free yield reduced by weeds was compared to detect cultivars with potential weed tolerance ability. Such a weed tolerance effect was not detected. Predominant weeds included annual morningglory (*Ipomoaea* spp.), lambsquarters (*Chenopodium album*) and Jimsonweed (*Datura stramonium*).

EVALUATION OF PREEMERGENCE HERBICIDES FOR CONTROL OF GLYPHOSATE-RESISTANT PALMER AMARANTH IN COTTON. J.R. Whitaker*, A.C. York; North Carolina State University, Raleigh, NC

ABSTRACT

Widespread planting of Roundup Ready crops and extensive use of and reliance on glyphosate has led to selection for glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*). By 2008, this pest had been documented in five southern states. Research has shown that preemergence (PRE) herbicides are essential for adequate control of this weed. The objective of our study was to determine the most effective PRE herbicides which could be applied for Palmer amaranth (AMAPA) control in cotton. These PRE applications were incorporated into season-long systems to examine glyphosate-resistant (GR) AMAPA control and their effect on cotton injury and yield. This experiment was conducted at one site in North Carolina during 2007 and 2008. This site had a loamy sand soil with low organic matter and was infested with a mixed population of glyphosate-susceptible and GR AMAPA. Cotton (PHY 485 WRF) was planted in May. Treatments consisted of no PRE, diuron (0.90 kg/ha), fluometuron (1.12 kg/ha), pendimethalin (1.12 kg/ha), fomesafen (0.28 and 0.35 kg/ha), and pyrithiobac (0.05 kg/ha) applied alone and in combinations of diuron with pendimethalin and pyrithiobac, along with fomesafen (0.28 kg/ha) combined with fluometuron, diuron, pendimethalin, and pyrithiobac applied PRE. All plots received glyphosate plus *S*-metolachlor (0.79 kg ae/ha plus 1.05 kg/ha) applied to 1- to 2-leaf cotton (POST 1) followed by glyphosate (1.24 kg ae/ha) applied to 4- to 6-leaf cotton (POST 2) and a lay-by application of trifloxysulfuron plus prometryn (0.004 plus 0.45 kg/ha) and MSMA (2.25 kg/ha). Weed control and cotton injury were visually rated throughout the season and yields were recorded. Palmer amaranth control estimated before POST 1 varied between years, likely due to differences in rainfall. Except for fluometuron and pendimethalin alone, all PRE herbicides in 2008 were at least 95% effective. Among the individual herbicides in 2007, fluometuron and pendimethalin were least effective, diuron and both rates of fomesafen were intermediate, and control from pyrithiobac was best at 93%. Combining pendimethalin did not increase fomesafen or diuron control. Pyrithiobac plus diuron control was better than diuron alone, and combinations of fomesafen plus fluometuron or diuron were more effective than each herbicide applied alone. Pyrithiobac plus diuron or fomesafen were the best options and were at least 97% effective. Late-season AMAPA control was less than 70% when no PRE was applied. All PRE applications increased control except for pendimethalin in 2007. Pyrithiobac and fomesafen were the most effective individual herbicides. The higher rate of fomesafen provided 15% more control in 2007 but no increase in 2008. Excellent control, 92 to 98%, was obtained with combinations of pyrithiobac plus fomesafen or diuron in 2007 and 2008 along with fomesafen plus diuron in 2008. Inclusion of PRE herbicides generally increased yield over the no PRE system. Systems which received no PRE yielded 660 and 1510 kg/ha during 2007 and 2008, respectively. In 2007, all PRE applications, except for diuron plus pendimethalin and fomesafen plus fluometuron, increased cotton yields from 57 to 95% compared to no PRE, and combinations of fomesafen plus diuron, fomesafen plus pyrithiobac, and diuron plus pyrithiobac increased yield by 59, 74, and 110%, respectively. All PRE herbicides except pendimethalin increased yield in 2008 by at least 46% compared to no PRE, and all combinations of PRE herbicides increased yield similarly from 62 to 80%. Minor cotton injury was observed from PRE herbicides at time of POST 1 application, but injury was less than 8% at POST 2. Our results suggest management systems for GR AMAPA must include PRE herbicides and reinforces the idea that POST-only residual systems will not be effective for control of this pest. Combinations of PRE herbicides are more likely to be effective than individual herbicides even if residual herbicides are applied POST and at lay-by. Among PRE herbicides, pyrithiobac and fomesafen alone were the most effective options, and pyrithiobac plus fomesafen or diuron and fomesafen plus diuron were the most effective PRE combinations observed for AMAPA control. It should be noted that ALS-resistant AMAPA is present throughout the Southeast. Therefore, if ALS resistance is suspected, applications of fomesafen plus diuron would likely be the most effective PRE option.

EVALUATION OF SELECTED HERBICIDES FOR DALLISGRASS CONTROL. J.B. Willis*, M.J. Goddard, J. Keating, S.D. Askew; Virginia Tech, Blacksburg, VA

ABSTRACT

Dallisgrass (*Paspalum dilatatum* Poir.) is a common and problematic weed of the south and occurs predominantly in the coastal plains, but does persist in the Piedmont and mountainous regions of Virginia. Current control recommendations for dallisgrass include sequential applications of MSMA alone or tank mixed with simazine, foramsulfuron or sulfosulfuron. These herbicides are registered for use in warm season turfgrasses. Any of these herbicides used alone or without sequential applications only suppress dallisgrass. EPA has introduced legislation that could lead to greater restriction on the use of or a refusal to reregister MSMA for turfgrass markets. Our objectives are to screen herbicides and herbicide combinations that could potentially be used for dallisgrass control in turfgrass. Dallisgrass was harvested with a sod cutter at Chatmoss Country Club in the Piedmont region near Danville, Virginia. Sod was washed and dallisgrass plants were selected that contained roots, rhizomes, and 3 to 5 tillers. These plants were immediately transplanted into 15 by 15 cm pots with mixed 50/50 silt-loam and sand soil media on March 7, 2007. Dallisgrass was allowed to acclimate and continue to mature in the greenhouse under weekly mowing at 5 cm for 1 year before trial initiation on March 13, 2008. Ninety total treatments were included in this trial, we will not list them all but will discuss them with relevance. A randomized complete block experimental design was used with 4 replications. Statistical analysis was preformed with Fisher's Protected LSD ($P = 0.05$). Herbicides or herbicide combinations of interest were applied in single applications or up to 3 sequential applications at 2 week intervals depending upon the suspected utility of specific products. Industry standard treatments mentioned above and nontreated comparison treatments were included. Our discussion will focus on treatments with greater than 60% control 2 to 4 weeks after final application (WA). Those herbicides in treatments that did not control dallisgrass more than 60% included metsulfuron, quinclorac, imazaquin, metribuzin, flazasulfuron, sulfentrazone, flucarbazone, amicarbazone, mesotrione, and others especially when these products were applied alone. The industry standard treatment of MSMA at 2400 kg/ha alone or in combination with metribuzin at 986 g ai/ha, applied in 3 sequential applications controlled 79 and 89% of dallisgrass 2 WA. Glyphosate (Roundup ProMax) at 280-1120 g ai/ha was the only herbicide that controlled dallisgrass significantly better than the industry standard treatments. Glyphosate treated dallisgrass plants were the only ones that did not recover and regrow to substantial levels by the studies end (8 WA). Glyphosate can not be used for selective control in cool-season turfgrass, but in bermudagrass turf, rates of 280 to 840 g ai/ha may be useful, or in situations where bermudagrass has entered dormancy. Treatments containing imazapic at 52 g ai/ha controlled dallisgrass equivalent to the industry standard and warrants further investigation in warm-season turf. Sequential applications of foramsulfuron in combination with MSMA and MSMA followed by two applications of foramsulfuron controlled dallisgrass 66 and 64%, respectively and much dallisgrass recovered by 8 WA. Sequential applications of tembotrione at 276 g ai/ha and topramezone at 55 g ai/ha alone controlled dallisgrass 61% and 49%, respectively. Thiencarbazone methyl at 32 g ai/ha alone or in combination with foramsulfuron applied in sequential applications controlled dallisgrass 64 and 74%, respectively. Other than glyphosate, much recovery and regrowth was observed from aforementioned treatments, however these treatments preformed best when compared to all others and do hold promise for use in a program approach to dallisgrass control in cool- and warm-season turfgrass. Further field research is needed to warrant recommendations of these treatments for selective dallisgrass control strategies.

THE ECONOMIC VALUE OF IMPLEMENTING AN ON FARM RESISTANCE WEED MANAGEMENT STRATEGY. J.W. Weirich*,[1] D.R. Shaw,[1] W.A. Givens,[1] J.A. Huff,[1] R.G. Wilson,[2] W.G. Johnson,[3] S.C. Weller,[3] M.D. Owen,[4] D.L. Jordan,[5] B.G. Young[6]; [1]Mississippi State University, Mississippi State, MS, [2]University of Nebraska, Scotts Bluff, NE, [3]Purdue, West Lafayette, IN, [4]Iowa State University, Ames, IA, [5]North Carolina State University, Raleigh,, NC, [6]Southern Illinois University, Carbondale, IL

ABSTRACT

When a producer is making decisions about weed control programs one of the top deciding factors is the economic benefit of the program. This study was conducted to assess long-term viability of glyphosate-resistant technology as a foundation for cropping systems. A four year study with researchers from six states, Illinois, Indiana, Iowa, Nebraska, North Carolina, and Mississippi was developed. The research team established 156 on-farm sites in 2006-2007. Production systems were divided into three groups for this assessment: continuous glyphosate-resistant (GR) crop, GR crop rotated with a different GR crop, and GR crop followed by a non-GR crop. The on-farm sites were divided into two treatments on halves of the field: the producer's normal glyphosate-based program and university recommendations based on weed resistance management principles. Across both treatments, costs were kept equal except for the application and herbicide cost. Preliminary results for growing season 2006-2007 will evaluate total returns and expenditures to determine net returns. Across all production systems except for GR corn followed by a non-GR crop herbicide cost for the universities resistance weed management system was significantly higher than the producer's normal glyphosate-based program. Among all systems there was no statistically significant yield difference between the universities and producers herbicide programs. Although not significant, yield for the universities program was slightly higher than that of the producers program. Even though the university-recommended weed resistance management program required more intensive inputs and management, they resulted in similar yields and net returns. Thus, resistance management strategy can preserve glyphosate as an effective tool, without reduction in farm profits.

INFLUENCE OF HERBICIDES APPLICATION TIMINGS ON WEED POPULATIONS INTENSITY IN WINTER CANOLA (*BRASSICA NAPUS* L). L. Paudel*, U. R. Bishnoi; Alabama A&M University, Normal, AL

ABSTRACT

Weeds and their population intensity in field crops are one of the major constraints in crop production causing loss in yield even upto 50 percent. Control of weeds in general and effects of herbicide application timings on weed intensity in particular on crops especially in winter canola has not been well documented. Therefore, research experiments were conducted during 2005 to 2007 crop growing seasons to evaluate the effects of herbicide application timings for weed control in winter canola cv Jetton. Results showed that pre-emergence timing of trifluralin at 1 kg ai ha^{-1}controlled 51% of primrose *(Oenothera laciniata)*, and 85% of hop clover *(Trifolium campestre)* in 2005. Pre-emergence timing of trifluralin at 1 kg ha^{-1} controlled 67% of primrose and 56% of hop clover in 2006 whereas it controlled 58% primrose and 73% of plantain *(Plantago major)* in 2007 as compared to weedy plots. Differences in control of population of these weeds was observed each year by use of pre-emergence application of trifluralin and it produced 184%, 203% and 82% higher canola yield in 2005, 2006 and 2007 respectively in comparison to weedy plots. Research results revealed that herbicide application timing significantly reduced weed population of different species caused differences in canola yield.

SAW PALMETTO CONTROL WITH TRICLOPYR AND METSULFURON SPOT TREATMENTS. B.J. Fast*,[1] J.A. Ferrell,[1] B.A. Sellers[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Ona, FL

ABSTRACT

A field experiment was conducted in 2007 to determine the efficacy of triclopyr and metsulfuron on saw palmetto, a perennial shrub commonly found in pastures, forests, and non-crop areas throughout Florida. Herbicide treatments were triclopyr (2 and 4% v/v), metsulfuron (1, 2, and 3 oz/100 gal), and triclopyr + metsulfuron (0.5% v/v + 0.5 oz/100 gal., 0.5% v/v + 1 oz/100 gal, 1% v/v + 0.5 oz/100 gal, and 1% v/v + 1 oz/100 gal). The ester formulation of triclopyr was applied using a product that contained 4 lb ae/gal, and metsulfuron was applied using a product that contained 60% ai w/w. All treatments included methylated seed oil (2% v/v). Herbicides were applied to individual plants using a 38720-PPB-X12 hollow cone nozzle with a CO_2-pressurized backpack sprayer, and plants were sprayed until leaves were visibly wet, but not to the point of runoff. Saw palmetto control was visually evaluated 6, 12, and 18 months after treatment (MAT), and 80% was established as the minimum acceptable level of saw palmetto control. With the exception of metsulfuron applied alone, all treatments provided acceptable control 6 MAT. Triclopyr (4% v/v) and all treatments that included triclopyr + metsulfuron provided acceptable control 12 MAT. Applications of triclopyr caused extensive levels of leaf necrosis; however, it was observed that many of these treatments contained a sub-lethal herbicide dose and sprouting from the terminal bud was observed by 18 MAT. Triclopyr (4% v/v) and triclopyr + metsulfuron (1% v/v + 1 oz/100 gal) provided acceptable control 18 MAT; however, control provided by triclopyr + metsulfuron (1% v/v + 1 oz/100 gal was highly variable. Based on these results, it was concluded that consistent, acceptable saw palmetto control can be achieved with spot treatments of triclopyr (4% v/v).

EFFECTS OF IMAZAPIC AND FLAZASULFURON ON DALLISGRASS IN BERMUDAGRASS TURF. S. Wells*, R.H. Walker, J.L. Belcher; Auburn University, Auburn University, AL

ABSTRACT

A field experiment was conducted in 2008 to investigate control of dallisgrass (*Paspalum dilatatum*) and turfgrass tolerance with flazasulfuron and imazapic in 'Tifway' hybrid bermudagrass (*Cynodon dactylon* x *C. transvaalensis*). Flazasulfuron was applied at 105 and 210 g/ha. Imazapic was applied at 0.58 L/ha. Herbicides were applied alone, in combination, or sequentially with one compound following another, separated in time by 7 days. All treatments contained a nonionic surfactant 0.25% v/v. Two applications were made; the first was initiated on 09 April and the second on 16 April. Visual ratings on a scale of 0-100%, with 100 being complete kill, were taken for bermudagrass injury and dallisgrass control. Four weeks after initial treatment (WAIT), bermudagrass injury with all imazapic-containing treatments was severe, 71% or greater, while dallisgrass control ranged from 78-90%. Flazasulfuron applied at 210 g/ha on 16 April resulted in bermudagrass injury of 38% 4 WAIT. However, bermudagrass injury with all other treatments containing flazasulfuron alone was within acceptable limits (<30%). However, dallisgrass control was poor, ranging from 20-48% control with all flazasulfuron-only treatments at this rating. All treatments containing imazapic resulted in dallisgrass control ranging from 78-83% 16 WAIT. The exception was imazapic applied alone at the second application date, which resulted in 63% control. Bermudagrass injury with these treatments was well within acceptable limits (<30%) 16 WAIT. No dallisgrass control or bermudagrass injury was noted by any treatment containing flazasulfuron alone 16 WAIT. The results indicate that imazapic must be used to obtain significant reductions in dallisgrass populations. However, due to the severe injury to bermudagrass, this compound should only be considered for turfgrass renovation situations or where a high level of injury can be tolerated. Flazasulfuron, while generally safer to bermudagrass, did not provide acceptable levels of control of dallisgrass.

LONG-TERM WEED MANAGEMENT RESULTS USING CONVENTIONAL AND FLEX-COTTON WEED CONTROL SYSTEMS. E.W. Rounds*,[1] C. Talley,[1] S.W. Murdock,[2] D.S. Murray[1]; [1]Oklahoma State University, Stillwater, OK, [2]Monsanto, St. Louis, MO

ABSTRACT

The release of Flex-cotton has permitted growers to use glyphosate for season-long weed control. However, questions arose concerning the necessity or value of including for PPI/PRE applied herbicides in Flex-cotton weed control systems. The objectives of this study are: 1) determine if PPI/PRE herbicides are beneficial, 2) compare Flex-cotton weed control systems to conventional weed control systems (non-glyphosate herbicides), 3) determine the number of OTT applications of glyphosate required for adequate weed control and 4) identify which treatments provided the maximum weed control and highest lint yield. A long-term field experiment with Flex-cotton was conducted during the 2005 to 2008 growing seasons at the Oklahoma Agricultural Experiment Station located near Chickasha, OK. The 2005 to 2008 treatments were a modification of treatments which have been applied to cotton since 1990 when the initial experimental site was established. The current treatments include 13 glyphosate treatments with and without PPI/PRE herbicides, two conventional herbicide treatment systems and one untreated check. All herbicides were applied at the recommended label rate. Weed counts were collected before defoliation for palmer amaranth (*Amaranthus palmeri* S. Wats.), johnsongrass (*Sorghum halepense* L.), and common cocklebur (*Xanthium strumarium* L.). This experiment showed a beneficial response to use of PPI/PRE herbicides. The populations of palmer amaranth and johnsongrass were reduced by the use of these herbicides. The combination of a PPI and PRE herbicide provided the best control of palmer amaranth. The Flex-cotton weed control system had lower populations of the weeds than the untreated check. Population of common cocklebur was lower with the Flex-cotton weed control system compared to the conventional weed control systems. Yield was higher in the Flex-cotton weed control system compared to the untreated and conventional weed control systems. This yield decrease was due to high weed populations that prevented the mechanical harvest of these plots. When the yield of the unharvestable plots was removed from the analysis, no treatment effect was observed. Maximum palmer amaranth control was obtained with two applications of herbicides. One application of post applied herbicide was required for johnsongrass control. The optimum treatment for weed control was achieved with two applications of glyphosate, regardless of the PPI/PRE herbicide.

WINTER COVER RESIDUE AMOUNT AFFECTS EARLY SEASON WEED BIOMASS IN A CONSERVATION TILLAGE CORN AND COTTON ROTATION. M. Saini*,[1] A.J. Price,[2] E.v. Santen,[1] F.J. Arriaga,[2] K.S. Balkcom,[2] R.L. Raper[2]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL

ABSTRACT

Use of the winter cover crops is an integral component of the conservation systems in corn (*Zea mays* L.) and cotton (*Gossypium hirsutum* L.). Field experiments were conducted from autumn of 2003 at the Alabama Agricultural Experiment Station's E.V. Smith Research Center at Shorter, Al and Tennessee Valley Research and Extension Centers at Belle Mina, AL through cash crop harvest in 2006. Experiment was also conducted at the University of Florida's West Florida Education and Research Center at Jay, FL from autumn of 2004 to cash crop harvest in 2006. The soil types were Compass loamy sand (coarse-loamy, siliceous, subactive, thermic Plinthic Paleudults) at E.V. Smith, Decatur silty loam (fine, kaolinitic, thermic, Rhodic Paleudult) at Tennessee Valley and Dothan sandy loam (Fine-loamy, siliceous, thermic Plinthic Kandiudults) at Jay Florida. The experiment for each location was a randomized complete block design (r = 3) with a split block restriction on randomization. The treatments were five cover crop seeding dates each autumn and four cover crop termination dates each spring. The seeding dates were based on the 30 year average date of the first 0 C temperature at each location. The five seeding dates were: on the first average 0 C temperature date, two and four weeks prior and two and four weeks after the average 0 C temperature date. Termination dates were four, three, two, and one week prior to the average date for the establishment of the cash crop, which is based the long-term average soil temperature. Rotation for winter cover crops included crimson clover (*Trifolium incarnatum* L.) preceding corn and cereal rye (*Secale cereale* L.) preceding cotton. Results showed biomass production by winter covers was impacted with even a week's delay in winter cover crop seeding and corresponding reduction in summer annual weed suppression. Different weather conditions encountered at the three locations resulted in large differences in cover crop biomass production. Maximum clover biomass production (5447 kg ha^{-1}) was observed at Shorter, AL in 2005 when crimson clover was seeded four weeks prior to the average first day of a 0 C temperature and terminated four weeks prior to planting the cash crop corn. The least clover biomass production (0.72 kg ha^{-1}) was observed at Belle-Mina, AL in 2004 when the clover was seeded at the last establishment date (4-wk post 0 C temperature) and terminated four weeks prior to corn planting. Cereal rye biomass was maximum (10953 kg ha^{-1}) in year 2004 at Belle-Mina when covers were planted on the first planting date and terminated only a week prior to the cash crop cotton planting. At shorter the maximum cereal rye biomass production was 8522 kg ha^{-1} in year 2006 when rye was planted two weeks before 0 C freeze and terminated a week prior to cash crop planting. Maximum observed cereal rye biomass at the southernmost location (Jay, FL) was 7468 kg ha^{-1} when cereal rye was planted four weeks prior to 0 C temperature and terminated two weeks before the seeding of cotton in 2006. The lowest observed weed biomass was 0.67 Kg ha^{-1} corresponding to clover biomass of 2453 kg ha^{-1} at Shorter 2006. Maximum weed biomass in corn was 407 kg ha^{-1} at Belle Mina 2006 corresponding to clover biomass of 405 kg ha^{-1}In cotton, there was observed general increase in weed biomass with earlier termination and late planting of the cereal rye cover crop. Maximum weed dry biomass observed was 1551 in treatment combination providing only 275 kg ha^{-1} cereal rye biomass at Shorter 2004. In general, winter cover crop biomass increased with the earlier planting and later termination and weed biomass decreased with increasing cover crop biomass. Observations indicate that high cover biomass can decrease early season weed interference and facilitate flexibility of POST application timing.

COMPLEMENTARY HERBICIDE PROGRAMS FOR PALMER AMARANTH (*AMARANTHUS PALMERI* S. WATS.) CONTROL IN GLYPHOSATE-TOLERANT COTTON AND SOYBEANS. M.W. Marshall*; Clemson University, Blackville, SC

ABSTRACT

Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats.) has emerged as one of the most severe threats to reduced tillage crop production in South Carolina. Field studies were conducted at Edisto Research and Education Center (EREC) and Pee Dee Research and Education Center (PDREC) in 2008 to evaluate different combinations preemergence and postemergence herbicides for glyphosate-resistant Palmer amaranth control in glyphosate-tolerant cotton and soybeans in South Carolina. Cotton preemergence treatments included pendimethalin at 1.12 kg/ha, alachlor at 1.12 kg/ha, fluometuron at 1.12 kg/ha, and fomesafen at 0.42 kg/ha. Cotton postemergence treatments included glyphosate at 0.84 kg ae/ha, s-metolachlor at 1.46 kg/ha, and pyrithiobac at 0.11 kg/ha. Soybean preemergence treatments included flumioxazin at 0.072 kg/ha, pendimethalin at 1.12 kg/ha, chlorimuron at 0.021 kg/ha, chloransulam at 0.029 kg/ha, sulfentrazone at 0.13 kg/ha, and metribuzin at 0.42 kg/ha. Soybean postemergence treatments included glyphosate at 0.84 kg ae/ha, lactofen at 0.17 kg/ha, fomesafen at 0.40 kg/ha, and aciflourfen at 0.84 kg/ha. Preemergence (PRE) treatments were applied shortly after planting. Postemergence (POST) treatments were applied at the 3-4 leaf stage (15 cm height in soybeans). An untreated check was included for comparison. The study was arranged as a randomized complete block design with 3 or 4 replications. Individual plot sizes were 3 by 12 m. Since rainfall is sporadic during cotton planting in South Carolina, supplemental overhead irrigation was provided at both locations. At PDREC, alachlor plus fomesafen or alachlor plus fluometuron in the glyphosate treated blocks provided nearly 100% Palmer amaranth control. However, alachlor plus fomesafen or fluometuron in the glufosinate-only blocks did not provide the same level of control (60%). fluometuron was inconsistent in controlling Palmer amaranth. Alachlor + fluometuron fb glyphosate + s-metolachlor POST had the highest cotton yield compared to all other treatments. At EREC, very little (less than 5.0%) soybean injury was noted with any of the treatments. Flumioxazin, alachlor, chloransulam, chlorimuron, and metribuzin provided good to excellent preemergence control of Palmer amaranth in soybeans. In addition, acifluorfen and lactofen controlled any Palmer amaranth escapes. Overall, the addition of fomesafen or flumioxazin to the preemergence herbicide program in cotton or soybeans dramatically improved Palmer amaranth control. In cotton, glufosinate is a fair to good herbicide alternative for control of small Palmer amaranth (less than 3" tall) where glyphoste-resistant biotypes exist. If irrigation or rainfall is timely, preemergence programs combined with glufosinate-tolerant programs in cotton or glyphosate plus aciflourfen or lactofen in soybean will continue to play an important role in managing glyphosate-resistant Palmer amaranth. Glufosinate-tolerance technology is scheduled to be released in 2009 which will provide another alternative in soybean production.

AGRONOMIC PERFORMANCE AND HERBICIDE EFFICACY IN STACKED GLUFOSINATE/GLYPHOSATE TOLERANT COTTON. P.A. Dotray*,[1] J.W. Keeling,[2] W.R. Perkins,[3] C.G. Henniger,[4] L.V. Gilbert[2]; [1]Texas Tech University, Texas AgriLife Research, and Texas AgriLife Extension Service, Lubbock, TX, [2]Texas AgriLife Research, Lubbock, TX, [3]Bayer CropScience, Idalou, TX, [4]Bayer CropScience, Lubbock, TX

ABSTRACT

Experiments were conducted in regulated trials in 2008 to determine field tolerance of GlyTol™ (glyphosate-tolerant) cotton following applications of several different formulations of glyphosate and in GlyTol™ plus LibertyLink® (glyphosate- and glufosinate-tolerant) cotton following applications of glyphosate and glufosinate ammonium (Ignite 280) either alone, as part of sequential applications, or in tank mixture. No adverse affects on plant establishment, plant height, maturity, vigor, and yield and quality were recorded. The objectives of this research were to determine Palmer amaranth (*Amaranthus palmeri*) and ivyleaf morningglory (*Ipomoea hederaceae*) control in non-crop areas following tank mix combinations of glyphosate and glufosinate ammonium when holding the rate of glyphosate at 0.75 lb ae/A (1X) and varying the amount of glufosinate ammonium added to the tank (1X or 0.52 ai/A, 0.75X, 0.5X, and 0.25X). Applications were made to Palmer amaranth on May 27 when weeds were 2 to 3 inches in height and to ivyleaf morningglory on June 18 when weeds were 2 to 6 inches in height. An additional study was conducted on Palmer amaranth using either herbicide alone at 1X or varying the ratio of the two herbicides (75:25, 50:50, 25:75) to equal 1X. All applications were made at 3 MPH using a tractor-mounted compressed-air sprayer calibrated to deliver 10 GPA using 10015 TT spray nozzles. Glyphosate (Roundup PowerMax) alone controlled Palmer amaranth 100% 10 days after application (DAA). Tank mix combinations of glyphosate (1X) plus glufosinate ammonium was less effective at controlling Palmer amaranth (up to 88%). Glyphosate plus glufosinate ammonium at 0.25X (the lowest rate of glufosinate ammonium used) provided the greatest level of control when using this tank mix combination. At 24 DAA, glyphosate alone controlled Palmer amaranth 77%, whereas no tank mix combination controlled this week greater than 15%. Glyphosate or glufosinate ammonium alone at 1X controlled ivyleaf morningglory 53 and 83%, respectively, 9 DAA. The combination of the 1X rate of each herbicide controlled this weed 88%, but control decreased as the rate of glufosinate ammonium decreased (52% Palmer amaranth control with the 0.25X rate of glufosinate ammonium plus glyphosate). At 14 DAA, glyphosate at 1X plus glufosinate at 1X, 0.75X, 0.5X, and 0.25X controlled this weed 79%, 70%, 63%, and 52%, respectively. When holding the herbicide rates as 1X, either alone or in tank mix combinations, the greatest Palmer amaranth control was observed with glyphosate alone. The less glyphosate in the tank mix the less Palmer amaranth control. GlyTol™ and GlyTol™ plus LibertyLink® cotton has shown exceptional tolerance to glyphosate and glyphosate + glufosinate, respectively. Additional noncrop studies suggested that a tank mix of glyphosate plus glufosinate appears to be antagonistic regarding Palmer amaranth control with glyphosate; however, this mix may improve the control of ivyleaf morningglory relative to either herbicide used alone. Additional research is needed because the opportunity to use GlyTol™ plus LibertyLink® cotton may occur as early as 2010.

LIBERTY LINK COTTON TOLERANCE TO COMBINATIONS OF GLUFOSINATE WITH INSECTICIDES AND MEPIQUAT CHLORIDE. D. Miller*,[1] D. Stephenson,[2] D. Scroggs,[2] M. Mathews[1]; [1]LSU AgCenter, St. Joseph, LA, [2]LSU AgCenter, Alexandria, LA

ABSTRACT

Field studies were conducted at the Northeast Research Station near St. Joseph, LA, the Dean Lee Research Station near Alexandria, LA, and the Macon Ridge Research Station near Winnsboro, LA to evaluate effects of insecticides on Liberty Link cotton tolerance when co-applied with Ignite in multiple applications. Study design was a randomized complete block with a factorial arrangement of Ignite/PGR co-application (Ignite at 29 oz/A alone or co-applied with Stance at 3 oz/A), insecticides (Acephate at 0.5 lb ai/A, Baythroid at 0.033 lb ai/A, Bidrin at 0.4 lb ai/A, Centric at 0.047 lb ai/A, Dimethoate at 0.25 lb ai/A, Diamond at 9 oz product/A, Carbine at 0.088 lb ai/A, Zephyr at 5 oz product/A, Oberon at 5 oz product/A, or Vydate at 0.4 lb ai/A), and application timing (match-head square or first bloom). Treatments were applied to each 6.67' x 30' plot with a CO_2 backpack or tractor mounted compressed air sprayer at 15GPA. Cotton variety FM 1735 LLB2 was planted in early May at each location. Blanket insecticide applications and Ignite hooded sprayer applications were made as needed to the entire test area to ensure lack of weed or insect interference with results. Maintenance applications were not made within 14 days of treatment applications. Parameter measurements included visual assessment of crop injury 7, 14, and 28 d after treatment (DAT), plant height 14 and 28 DAT, and cotton lint yield. At 7 DAT for the match-head square application in Alexandria, injury in the form of leaf speckling with Ignite co-applied with insecticides Carbine and Zephyr averaged across Ignite/PGR co-application was 8% and greater than all other co-applications. At 14 DAT, injury for these two co-applications was 5 and 3%, respectively, and greater than all other treatments. Injury for this early application assessment interval was no greater than 3% at the St. Joseph and Winnsboro locations. By 28 DAT, injury following the earlier application timing was no greater than 1% at all locations. At all locations, injury following the later application timing was no greater than 2%. At Alexandria, averaged across insecticides cotton height was significantly lower with the addition of Stance to Ignite compared to Ignite alone at 14 (81 vs 73 cm) and 28 (97 vs 93 cm) DAT of the match-head square application timing. This effect was similar at St. Joseph for cotton height 14 (74 vs 66 cm) and 28 (90 vs 81 cm) DAT and at Winnsboro 14 DAT (68 vs 56 cm). Addition of Stance to Ignite at the later application timing had no impact on cotton height at any location. Insecticide co-application also had no effect on height. At Alexandria, cotton lint yield, averaged across insecticide co-application, was lower with the addition of Stance to Ignite (595 vs 476 lb/A). At St. Joseph, lint yield was lower with Ignite alone compared to the addition of Stance (608 vs 670 lb/A) while yield was not impacted by Stance addition at Winnsboro. At Alexandria, insecticide co-application had no impact on lint yield. At St. Joseph, averaged across PGR treatment and application timing, lint yield for insecticides Acephate (592 lb/A), Baythroid (507 lb/A), Bidrin (615 lb/A) and Centric (585 lb/A) were all lower than the highest numeric yield for Diamond (972 lb/A). At Winnsboro, PGR application had no impact on yield, but insecticide Vydate (394 lb/A) resulted in a lower lint yield than the highest numeric yield for Bidrin (573 lb/A).

LIBERTY LINK COTTON TOLERANCE TO COMBINATIONS OF GLUFOSINATE AND INSECTICIDES. D. Miller*,[1] D. Stephenson,[2] D. Scroggs,[2] M. Mathews[1]; [1]LSU AgCenter, St. Joseph, LA, [2]LSU AgCenter, Alexandria, LA

ABSTRACT

Field studies were conducted at the Northeast Research Station near St. Joseph, LA, the Dean Lee Research Station near Alexandria, LA, and the Macon Ridge Research Station near Winnsboro, LA to evaluate effects of insecticides on Liberty Link cotton tolerance when co-applied with Ignite in multiple applications. Study design was a randomized complete block with a factorial arrangement of Ignite/insecticide co-application (Ignite at 22 oz/A alone or co-applied with insecticides Acephate at 0.5 lb ai/A, Baythroid at 0.033 lb ai/A, Bidrin at 0.4 lb ai/A, Centric at 0.047 lb ai/A, Dimethoate at 0.25 lb ai/A, Diamond at 9 oz product/A, Carbine at 0.088 lb ai/A, Zephyr at 5 oz product/A, Oberon at 5 oz product/A, or Vydate at 0.4 lb ai/A) and application timing (2 to 3 leaf, 2 to 3 leaf followed by 6 to 8 leaf, or 2 to 3 leaf followed by 6 to 8 leaf followed by 1 week after flowering). Treatments were applied to each 6.67' x 30' plot with a CO_2 backpack or tractor mounted compressed air sprayer at 15GPA. Cotton variety FM 1735 LLB2 was planted in early May at each location. Blanket insecticide applications and Ignite hooded sprayer applications were made as needed to the entire test area to ensure lack of weed or insect interference with results. Maintenance applications were not made within 14 days of treatment applications. Parameter measurements included visual assessment of crop injury 7 and 14 d after treatment (DAT), plant height prior to harvest, seed cotton yield. At 7 DAT for the 2 to 3 leaf application in Alexandria, injury in the form of leaf speckling with Ignite co-applied with insecticides Zephyr and Oberon was 8 and 4% respectively, and greater than all other co-applications. At 14 DAT, injury for these two co-applications was 14 and 4%, respectively, and greater than all other treatments. Injury for this early application was no greater than 2% at the St. Joseph and Winnsboro locations. At all locations, injury following the later application timings was no greater than 4%. Cotton height prior to harvest ranged from 108 to 118 cm, 108 to 177 cm, and 112 to 117 cm at the Alexandria, St. Joseph, and Winnsboro locations, respectively, and was equal for all Ignite-insecticide co-applications when averaged across application timings. At the Alexandria location, averaged across application timings, seed cotton yield was lower for the 2 to 3 leaf application (1656 lb/A) and 2 to 3 leaf followed by 6 to 8 leaf application (1669 lb/A) when compared to the 2 to 3 leaf followed by 6 to 8 leaf followed by 1 week after flowering application (1808 lb/A). Insecticide co-applications had no impact on lint yield. At the St. Joseph and Winnsboro locations, cotton lint yield was not impacted by insecticide co-application or application timing.

TOLERANCE OF GLYPHOSATE/GLUFOSINATE RESISTANT COTTON TO TOPICAL APPLICATIONS OF GLYPHOSATE AND GLUFOSINATE. D.M. Dodds*,[1] J.T. Irby,[1] D.B. Reynolds,[1] L.T. Barber,[2] C.L. Main,[3] K.L. Smith,[4] A.M. Stewart,[5] S. Baker[6]; [1]Mississippi State University, Mississippi State, MS, [2]University of Arkansas Extension Service, Little Rock, AR, [3]University of Tennessee, Knoxville, TN, [4]University of Arkansas Monticello, Fayetteville, AR, [5]LSU Agricultural Center, Louisiana State University, LA, [6]Bayer Crop Science, Memphis, TN

ABSTRACT

Weed control systems in cotton have become heavily reliant on herbicide resistant technologies. With the rapid adoption of herbicide resistant cotton, research continues to focus on the development of new and improved herbicide resistant technologies. These new technologies include GlyTol™ and GlyTol+LibertyLink® cotton which are being developed by Bayer CropScience. Experiments were conducted at 6 locations in 4 states during the 2008 growing season in order to observe overall crop tolerance as well as yield performance after multiple herbicide application timings. A randomized complete block design was used with each treatment being replicated 4 times. There were 2 entries, with the first being a GlyTol variety and the second being a GlyTol+LibertyLink variety. There were 2 treatments for the GlyTol variety and 6 treatments for the GlyTol+LibertyLink variety. Each herbicide treatment was applied at 4 application timings. These timings included applications at the 2 and 6-8 leaf stages, at lay-by, and when bolls were approximately 50% open. The treatment structure for the GlyTol variety included an application of 1 pound of the active ingredient glyphosate per acre (lb ai/A) as well as an untreated check. Treatments for the GlyTol+LibertyLink variety included an untreated check, 1.12 kg ai/ha glyphosate, and 0.56 kg ai/ha glufosinate applied alone, tank-mixed, and sequential applications of each active ingredient. Visual ratings for crop tolerance were recorded 7, 14, 21, and 28 days after application (DAA) for each application timing. In addition to the visual ratings, plant heights were recorded 10-14 days after each application in order to monitor for changes in plant height due to herbicide application. After the application at lay-by, a non-destructive boll sample was collected in order to monitor boll development for misshapen or abnormal bolls. The results of these data indicate that minimal visual injury was observed and no differences in yield were noted for any of the treated plots when compared to the untreated within either variety. Slight reductions in plant height did occur after the application at the 6-8 leaf stage when glufosinate was applied to the GlyTol+LibertyLink variety. However, no reductions in plant height were noted after any of the other application timings. No differences in the number of misshapen or abnormal bolls were observed. These data indicate excellent crop tolerance for both the GlyTol and the GlyTol+LibertyLink varieties. Further research will be conducted in order to observe crop tolerance and yield performance after multiple applications of glyphosate and/or glufosinate.

EFFECTS OF HERBICIDES, STRIP-TILLAGE, AND CROP STATURE ON KOCHIA INTERFERENCE IN SUNFLOWER. B.L. Olson*, P.W. Stahlman, P.W. Geier; Kansas State University, Manhattan, KS

ABSTRACT

Short stature sunflowers and strip-till production have been introduced into sunflower production in recent years. Both of these "new" introductions have the potential to improve sunflower competitiveness with broadleaf weeds. In order to evaluate the effect of these new introductions, a multi-year study was initiated to evaluate whether short stature sunflowers and strip-tillage improve or decrease the competitiveness of sunflowers to varying levels of kochia (*Kochia scoparia* (L.) Schrad.) control as compared to conventional sunflowers or those grown in no-till. Weather conditions and non-uniform population levels of kochia across sites hindered the collection of consistent data. There was no tillage by crop stature by kochia control interaction at any site. Strip-till did not increase sunflower competitiveness. Short stature and conventional height sunflower yield potential was similar when competing with a tall aggressively growing weed such as kochia.

INFLUENCE OF GLYPHOSATE ON RHIZOCTONIA CROWN AND ROOT ROT IN GLYPHOSATE RESISTANT SUGAR BEET. K.A. Barnett*, L.E. Hanson, C.L. Sprague; Michigan State University, East Lansing, MI

ABSTRACT

Previous work with an experimental glyphosate-resistant sugarbeet variety indicated host resistance to Rhizoctonia crown and root rot could be compromised when plants were exposed to glyphosate. In order to improve disease management recommendations, greenhouse and field research was initiated to examine the interactions between disease management and weed control strategies in newly commercialized glyphosate-resistant sugarbeet varieties. In greenhouse trials there was a significant interaction (P=0.04) between sugarbeet variety (Rhizoctonia-susceptible, Rhizoctonia-resistant, and intermediate) and herbicide treatment (no herbicide, glyphosate, or the standard herbicide program of phenmedipham & desmedipham + trisulfuron-methyl + clopyralid). There was also a significant interaction (P=0.02) among sugarbeet varieties, herbicide treatments, and the presence or the absence of the pathogen, *Rhizoctonia solani* AG-2-2. Herbicide treatment did not affect the disease severity on the Rhizoctonia-susceptible variety; however in the Rhizoctonia-resistant variety disease severity was higher in plants treated with either herbicide treatment. In the variety that had intermediate resistance to Rhizoctonia disease severity was not affected by an application of glyphosate. In the field, four different glyphosate-resistant sugar beet varieties were examined ACH 827RR, Hilleshog 9027, Hilleshog 9028, and Hilleshog 9029. Each variety was treated with three different weed management programs which consisted of: 1) no herbicide (hand-weeded control), 2) a standard-split herbicide program (two applications of desmedipham & phenmedipham + triflusulfuron + clopyralid + non-ionic surfactant), and 3) three applications of glyphosate. Plots inoculated and not inoculated with *Rhizoctonia solania* AG-2-2 IIIB were compared for each variety by weed management combination. Additional treatments in inoculated plots included azoxystrobin (a fungicide) applications either in-furrow or postemergence to 6-leaf sugarbeets. The differences between the addition of the pathogen (inoculation), fungicide treatment, and variety were all significant. Herbicides and interactions with herbicide programs were not significant. Results from the first year of greenhouse and field research were contradictory. Results from the greenhouse indicate that disease management using some host resistance may be incompatible with some weed management systems. However in the field, weed management strategies did not have a significant impact on Rhizoctonia severity. Variety choice (disease-resistant varieties) and fungicide applications were the most important factors in reducing Rhizoctonia root rot disease severity.

RESPONSE OF DRY BEAN TO PREPLANT-INCORPORATED AND PREEMERGENCE APPLICATIONS OF PYROXASULFONE. N. Soltani*, C. Shropshire, P.H. Sikkema; University of Guelph, Ridgetown, ON, Canada

ABSTRACT

Three field trials were conducted over a two-year period at Exeter (2007, 2008) and Ridgetown (2007), Ontario to evaluate the tolerance of two market classes and two cultivars of each market class (cranberry, 'Etna' and 'Hooter'; kidney, 'Red Kanner' and 'Red Hawk') of dry bean to preplant incorporated (PPI) and preemergence (PRE) applications of pyroxasulfone at 209 and 418 g ai/ha. All treatments including the non-treated control were maintained weed free during the growing season. There was greater injury when pyroxasulfone was applied PPI than PRE, and injury was greater with the high rate at 1, 2, and 4 weeks after emergence (WAE). Pyroxasulfone at 209 and 418 g ai/ha caused as much as 32 and 61% visible injury when applied PPI and 15 and 30% visible injury when applied PRE in dry bean, respectively. Pyroxasulfone at 209 and 418 g ai/ha decreased shoot dry weight as much as 60 and 80% when applied PPI and 30 and 50% when applied PRE in dry bean, respectively. Plant height was not affected by pyroxasulfone application timing but was cultivar dependent. Height was reduced 14, 13, 22 and 13% at 209 g ai/ha and 24, 31, 42 and 27% at 418 g ai/ha for 'Etna', 'Hooter', 'Red Kanner' and 'Red Hawk' cultivars, respectively. Dry bean yield was reduced as much as 29% at 209 g ai/ha and 45% at 418 g ai/ha. Based on these results, there is not an adequate margin of crop safety for pyroxasulfone applied PPI or PRE at the rates evaluated in 'Etna', 'Hooter', 'Red Kanner' and 'Red Hawk' dry beans in Ontario.

ROW SPACING INFLUENCES YIELD AND WEED MANAGEMENT IN GLYPHOSATE-RESISTANT SUGAR BEET. J.Q. Armstrong*, C.L. Sprague; Michigan State University, East Lansing, MI

ABSTRACT

Field trials were conducted at three locations in 2007 and 2008 to evaluate the effect of row width on yield, quality, and weed management in glyphosate-resistant sugarbeet. Three row widths, 38-, 51-, and 76-cm, were investigated in four environments and 38- and 76-cm row widths were investigated in two environments. Four populations, 54,000; 78,000; 101,000; and 124,000 plants ha-1, were planted for each row width. Overall, crop canopy development was greater in 38- and 51-cm rows. Sugarbeet root yields were highest in 51-cm rows compared with 38- and 76-cm rows at locations comparing the three row widths. Sugar beet root yield was similar for 38- and 76-cm rows at locations that compared the two row widths. Root yields were not influenced by sugarbeet population. However, sugarbeet quality, expressed as recoverable white sugar per Mg of root, was influenced by population. When averaged across all row widths, sugarbeet quality increased as plant population increased. Among untreated plots, weed biomass was similar for all row widths and plant populations. This was likely due to the slow growth habit of sugarbeet. However, for plots that were treated with a single glyphosate application when weeds averaged 10-cm in height, subsequent weed biomass accumulation was reduced by 51% and 44% in 38- and 51-cm rows, respectively, compared with 76-cm rows at locations where all three row widths were compared. Weed biomass was similar among all row widths and populations at the locations where only 38- and 51-cm rows were compared. Narrowing sugarbeet row widths to 51-cm may be a valuable tool for producers to increase yields and supplement weed control in glyphosate-resistant sugarbeet.

TOLERANCE OF SOYBEAN TO PRE-PLANT APPLICATIONS OF HALOSULFURON. T.W. Dillon*, N.D. Pearrow, R.C. Scott; University of Arkansas, Lonoke, AR

ABSTRACT

Nutsedge is a problematic weed in Arkansas soybean production with the majority of the acreage grown being glyphosate-tolerant. However, glyphosate proves to be very ineffective at controlling nutsedge. One of the most effective herbicides to control nutsedge is halosulfuron (Permit) which is not labeled for application on soybean due to injury. A pre-plant label for permit in soybean would enhance nutsedge control in glyphosate-tolerant soybean production systems. Two studies were initiated to determine the safety of planting non-STS soybean following the pre-plant application of halosulfuron. Herbicide treatments at the Lonoke (pH 4.3) location consisted of halosulfuron applied at 1, 2, 3, 4, and 10 oz/A; at 14 and 7 days prior to planting and pre-emergent. This study included a STS-soybean running check and an untreated check. Herbicide treatments for the Cross county (pH 8.3) location consisted of halosulfuron applied at 1, 2, 3, 4, and 10 oz/A; at 28, 20, and 12 days prior to planting. Both sites were all irrigated or received rain within 3 days of planting. No injury was assessed on STS soybean at the Lonoke location. At the Lonoke location injury to non-STS soybean increased as rate increased by timing of application. The closer the application was made to planting the greater the injury sustained. Canopy heights followed the same trends as injury with the greatest reductions in height from the higher rates and applications closer to planting. Yield at the Lonoke location was not affected by any rate at any timing, except 10 oz/A applied Pre. Injury at the Cross county location responded similarly to that of Lonoke. Injury at Cross county was greater than that at Lonoke across all timings. The greatest injury was at the 10 oz/A rate applied both at 20 and 12 Days prior to planting 83 days after treatment. Soybean injury from pre-plant applications of halosulfuron is potentially higher on high pH soils**.** No yield reduction or sever injury was documented from the 1 oz rate applied at any timing. There is an acceptable crop response from 1oz/A of halosulfuron when applied at least 12 to 14 days prior to planting.

WINTER CROPS AND BURN DOWN HERBICIDE MANAGEMENT IN NO-TILL TRANSGENIC SOYBEANS IN BRAZIL. D.L. Gazziero*,[1] C.E. Prete[2]; [1]EMBRAPA SOJA, Londrina- Paraná, Brazil, [2]UEL, Londrina- Paraná, Brazil

ABSTRACT

Weed pressure in soybean crop is influenced by the weed management control strategies adopted during winter. Inadequately cultivated areas in the winter have their seed banks increased by weeds that have the ability to germinate and grow during all the year in the tropical condtions. An experiment was carried out in the winter season, to evaluate weed control in no- till submitted to winter corn using herbicide (CWH), corn without herbicide (CWOH), oat and four different weed management before glyphosate resistant soybean planting. It was observed that sequential application of glyphosate in weeds which germinate before sowing soybean crop is an important alternative to weed control; weed control in soybean is improved by the use of CWH; corn with atrazine or oat crop associated with the sequential application of glyphosate reduces the amount of burn down herbicide (desiccant) and retards post-emergence use; herbicide in winter corn restores the seed bank in the winter, affecting soybean management in the summer.

WEED CONTROL IN GLYPHOSATE-TOLERANT CORN WITH GLYPHOSATE TANKMIXES. P.H. Sikkema*, C. Shropshire, N. Soltani; University of Guelph, Ridgetown, ON, Canada

ABSTRACT

Eight field trials were conducted over a three-year period at Exeter (1 site in 2005 and 2006) and Ridgetown (3 sites in 2005, 2 sites in 2006 and 1 site in 2007), Ontario to evaluate different postemergence glyphosate tankmixes for weed management in glyphosate-tolerant corn. Treatments included a weedy check, a single application of glyphosate, a sequential application of glyphosate and tankmixes of glyphosate plus either atrazine, dicamba/atrazine, mesotrione, s-metolachlor plus atrazine, s-metolachlor/atrazine, dicamba/diflufenzopyr, dimethenamid plus atrazine, dicamba, pendimethalin plus atrazine and rimsulfuron. There was minimal (< 2%) visible injury with all postemergence glyphosate tankmixes evaluated. A single application of glyphosate, the sequential application of glyphosate and tankmixes of glyphosate plus either atrazine, dicamba/atrazine, mesotrione, s-metolachlor plus atrazine, s-metolachlor/atrazine, dicamba/diflufenzopyr, dimethenamid plus atrazine, dicamba, pendimethalin plus atrazine and rimsulfuron provided 92-100% control of AMARE, 87-100% control of AMBEL, 81-100% control of CHEAL, and 43-100% control of SETVI at 1-3 weeks and 11-13 weeks after the second application. All herbicide treatments had higher yield than the weedy check. There were no differences in corn yield among the herbicide treatments evaluated.

WANTED:DEAD - RYEGRASS AND BROME IN PENNSYLVANIA WHEAT FIELDS. D.D. Lingenfelter*, W.S. Curran; Penn State University, University Park, PA

ABSTRACT

From 2005 to 2008, fall- and spring-applied herbicides were evaluated to determine their impact on control of annual/Italian ryegrass (*Lolium multiflorum*) and downy brome (*Bromus tectorum*) in winter wheat fields in southeastern and western Pennsylvania. Treatments were applied in early November (weedy grasses - 2-3 leaves; 2-3 inches tall) and mid-April (weedy grasses - 2-3 tillers; 3-6 inches tall) with a hand-held boom sprayer that delivered 187 L ha-1. Mesosulfuron was applied at 15 g ai ha-1; pinoxaden at 54.4 g; diclofop at 840 g; sulfosulfuron at 35.2 g; chlorsulfuron plus flucarbazone premix at 45.2 g; and propoxycarbazone plus mesosulfuron premix at 23.5 g. All treatments contained the recommended adjuvants. Plots were replicated and randomized and measured 3 m wide by 9 m long. Ratings taken in late June/early July revealed that mesosulfuron, pinoxaden, and propoxycarbazone plus mesosulfuron premix always provided greater than 90% control of Italian ryegrass regardless of application timing. Diclofop provided 88 to 100% control and sulfosulfuron ranged from 50 to 98% control of ryegrass. Mesosulfuron (fall-applied) and sulfosulfuron (fall- or spring-applied) provided 80 to 100% control of downy brome. The chlorsulfuron plus flucarbazone and propoxycarbazone plus mesosulfuron premixes provided variable results ranging from 62 to 100% downy brome control depending on application timing and location. Pinoxaden and diclofop provided poor downy brome control (0-28%). Fall-applied herbicide generally provided more consistent control of the weedy grasses. Mesosulfuron, pinoxaden, diclofop, and propoxycarbazone plus mesosulfuron provide the most effective control of Italian ryegrass, whereas, sulfosulfuron provides the most consistent control of downy brome. Many of the herbicides in this study could provide some suppression/control of light to moderate infestations of either weedy grass, however heavy populations would likely be a problem. Crop rotation and the use of other weed control tactics including different herbicide programs and modes of action provides the most reliable means of controlling Italian ryegrass and downy brome.

PYROXSULAM FOR WEED CONTROL IN SOUTHERN WHEAT. N. D. Pearrow*, B. M. Davis, R. C. Scott; University of Arkansas, Cooperative Extension Service, Lonoke, AR

ABSTRACT

Pyroxsulam or Powerflex® is a new wheat herbicide from Dow AgroSciences. It is a sulfonylurea with activity on ryegrass and some specific broadleaf weeds. Studies were conducted in the fall and spring of 2007 and 2008, to evaluate pyroxsulam on ryegrass, Hoelon resistant-ryegrass, henbit, little barley, and buttercup. The objective of these studies was to evaluate the potential weed control spectrum of pyroxsulam in Arkansas. Herbicide treatments consisted of pyroxsulam at 2.5, 3.0, 3.5 oz/A, and pyroxsulam 3.5 oz/A + Pendimax at 2.67 pt/A. Both studies also included treatments of Osprey at 4.75 oz/A, Axial XL at 16.4 oz/A, Hoelon at 2.4 pt/A and an untreated check for comparisons. Application timings for treatments consisted of fall application on 4 leaf ryegrass and spring applications on 3 tiller ryegrass. Applications were made using a pressurized CO_2 backpack sprayer with a four-nozzle boom delivering a spray volume of 93 liters per hectare. Pyroxsulam provided 90% or better control of Hoelon resistant-ryegrass when applied in the fall at any rate. Pyroxsulam and Pendimax provided better control than pyroxsulam at 3.5oz/A alone. Similar to fall applied pyroxsulam, spring applications provided 90% control or better of Hoelon resistant-ryegrass. Yields were increased substantially compared to the check with all four pyroxsulam treatments when applied in the fall. Pyroxsulam provided control of horseweed 70%; however yields were not increased. At Furlow, pyroxsulam did provide excellent control of buttercup, henbit, ryegrass and adequate control of little barley compared to other treatments. Yields (Furlow) were only increased when pyroxsulam was applied at 3.5 oz/A compared to the check. Pyroxsulam can be a useful tool to help control Hoelon resistant ryegrass; however the key to success is timely application. Pyroxsulam does provided adequate control of other Arkansas weed species making it a viable wheat herbicide in the state.

EFFECT OF NITROGEN TOPDRESS APPLICATION METHOD ON WINTER WHEAT GROWTH AND YIELD. J. Edwards*; Oklahoma State University, Stillwater, OK

ABSTRACT

Wheat producers in the southern great plains typically tankmix herbicides with topdress nitrogen applications. To ensure herbicide efficacy, these applications are made using floodjet nozzles. Recently some producers have opted for stream-jet nozzles which reduce the amount of dessication associated with foliar nitrogen application but also eliminate the possibility of tankmixing herbicides with nitrogen. A two-year experiment was conducted at Lahoma, OK to determine the effect of topdress nitrogen delivery method and timing on hard red winter wheat physiology and yield. Experimental design was a factoral arrangement of topdress timing (mid February or Mid March), application method (granular urea, UAN through floodjet nozzles, or UAN through Chafer stream bars), and the presence or absence of a urease inhibitor. None of the treatments affected green leaf area or the rate of crop canopy closure. The mid-March topdress timing resulted in greater wheat yield both years of the experiment. This was likely due to better coordination with rainfall events and less volitalization losses both years. Application method had no impact on wheat grain yield the first year of the experiment; however, both UAN treatments out-yielded the granular urea treatments the second year of the experiment. These data indicate that as long as calibration and application uniformity are equivalent, broadcast nozzles can be used to apply topdress nitrogen with no yield penalty. Further research is needed to determine if similar responses occur in other classes of wheat and environments with higher average temperature during February and March.

WHEAT RESPONSE TO AEF130060 AND DIFFERENT TIMINGS OF NITROGEN FERTILIZER. J.R. Martin*, C.R. Tutt, D.L. Call; University of Kentucky, Princeton, KY

ABSTRACT

AE F130060 (proposed common name mesosulfuron methyl) is a foliar-applied herbicide used to manage weedy gasses after wheat emergence. It is an Acetolactate Synthase (ALS) inhibitor that can injure wheat; consequently, it is formulated with the safener, mefenpyr diethyl. There have been isolated cases in Kentucky where AE F130060 injured wheat, particularly when it was applied near the time of topdressing nitrogen fertilizer. The herbicide label for AE F130060 cautions against making applications within 14 days of topdressing ammonium nitrogen fertilizer due to the risk of crop injury. This research was conducted over a two-year period during the 2006-2007 and 2007-2008 growing seasons to evaluate wheat response when nitrogen fertilizer was topdressed at different times relative to spring application of AE F130060. Liquid nitrogen was applied with stream bars at 120 units/A. The commercial formulation of AE F130060 with the safener was applied in mid-March at a rate of 0.21 oz ai/A plus surfactant, plus 28% liquid nitrogen at 1 qt/A in water at spray volume of 20 GPA with 8003 flat fan tips. The timing for topdressing nitrogen in the first study occurred over a period of five weeks at weekly intervals designated as -14, -7, 0, + 7, and +14 days relative to timing of AE F130060. The timings for the second study also included -21 and + 21 days, consequently topdressing timings occurred over a period of seven weeks. Each nitrogen treatment that was associated with AE F130060, had the same nitrogen fertilizer treatment but without AE F130060. Wheat injury in the form of yellow or necrotic leaves and stunted plants tended to be greatest where AE F130060 and 28% liquid nitrogen were applied the same day. Wheat plants usually recovered from discoloration within 4 to 5 weeks after the herbicide was applied. Wheat plants were numerically shorter than the non-treated checks within one week after AE F130060 in both studies. The amount of stunting was usually greater when nitrogen fertilizer was topdressed the same day as spraying AE F130060 (i.e. 0-day timing of N fertilizer). AE F130060 tended to cause stunting for all timings through 6 weeks after application. Freezing temperatures during April 6 -10 caused substantial freeze damage to plants that were rapidly growing and not injured from the AE F130060. By the time wheat matured in 2007, the plants that were initially injured from AE F130060 tended to be taller than the plants that did not receive AE F130060. It is likely that the initial injury from the herbicide delayed the development of wheat; consequently these plants were able to tolerate the freezing temperatures that occurred during early April. In the second study the herbicide-treated plants were numerically shorter than the non-treated checks and were statistically significant when nitrogen was topdressed at -14 days, the same day, and +14 days. The unexpected higher yield in the first study where plants were injured the greatest from AE F130060, compared with plants that did not receive AE F130060, is attributed to the unusual freezing temperatures in early April in the first study. Plants that were injured from the March application of AEF 130060 were delayed in growth and less prone to the freezing temperatures in early April. AE F130060-treated plants were able to recover more quickly from the freeze injury and yielded better than plants that did not receive the herbicide. Herbicide injury in the second study limited wheat yield by 8.3 and 9.6 bu/A when liquid nitrogen was topdressed the same day as AE F130060 and seven days after AE F130060, respectively. In spite of herbicide injury, the best overall wheat yield in the second study occurred for nitrogen topdressed February 21 or 14 days before Osprey. In summary, AE F130060 caused wheat to be stunted and have yellow or necrotic leaves. The plants recovered from discoloration by 5 weeks after the herbicide was applied; however, stunting occurred up to maturity for some treatments in the second study. The only treatments where AE F130060 limited wheat yield was in the second study when nitrogen was topdressed the same day as AE F130060 and seven days after the herbicide.

***LOLIUM PERENE* MANAGEMENT IN WHEAT CROP WITH CLODINAFOP AND IODOSULFURON+MESOSULFURON IN BRAZIL.** R.A. Vidal*, A. Kalsing; UFRGS, Porto Alegre, Brazil

ABSTRACT

Ryegrass management in wheat crop in Brazil with clodinafop and iodosulfuron+mesosulfuron. The expenditure with wheat imports in Brazil exceeds 1.2 billion dollars annually. There is a limited area planted with the crop and the crop yield is very low, in part, due to weed competition. The objective of this work were: a) to evaluate the efficacy of two herbicides on the control of ryegrass (*Lolium* spp), and b) to estimate the impact of ryegrass competition on the crop yield. The herbicides tested on spring wheat variety 'Nova Era' were clodinafop-propargyl at 120 g/ha and the formulated mixture of mesosulfuron-methyl and iodosulfuron-methyl-sodium (+ the safener mefenpyr-diethyl) at 12 + 2.4 g/ha, respectively; when applied in ryegrass at two growth stages: beginning of tillers and beginning of stem elongation. Herbicides were applied using a $C0_2$-pressurized backpack sprayer with four 80.02VS nozzle calibrated to deliver 150 L/ha solution. Adequate (>90%) ryegrass control was observed when both herbicides were used at the beginning of the tillering stage. But, when applied at the beginning of the stem elongation ryegrass stage, only mesosulfuron-methyl + iodosulfuron-methyl-sodium maintained adequate weed control. Considering a ramet to be either the ryegrass mother-plant or a tiller, the wheat grain was reduced 60 g for each ramet per square meter competing with the crop up to the crop first tiller stage. When both herbicides were sprayed on ryegrass at the first growth stage, the crop grain yield was not reduced when compared to the weed-free plots. When sprayed at the second growth stage, the wheat grain yield did not differ from the untreated, independent of the level of the herbicide efficacy. This work has demonstrated early herbicide spray is crucial to avoid weed competition.

TOLERANCE OF WINTER WHEAT TO SAFLUFENACIL. N. Soltani*, C. Shropshire, P.H. Sikkema; University of Guelph, Ridgetown, ON, Canada

ABSTRACT

Saflufenacil is a new herbicide developed by BASF for residual broadleaf weed control in corn, soybean and other crops. Four field studies were conducted over a three year period at Ridgetown (2006-2008) and Exeter (2008), Ontario Canada to evaluate the tolerance of winter wheat to preplant (PP), preemergence (PRE) and postemergence [POST; with and without surfactant Merge (1% v/v)] applications of saflufenacil at 0, 25, 50, 100 and 200 g ai/ha. Visible injury ratings were taken at 1 wk after treatment (fall) and in early May and early June of the following year. At Ridgetown, there was no visible injury with all treatments evaluated. At Exeter, saflufenacil applied PP and PRE caused minimal visible injury (3% or less) at all ratings. Saflufenacil applied POST without Merge caused as much as 6, 5 and 2% visible injury and with Merge caused as much as 24, 14 and 3% visible injury in winter wheat in the fall, early May, and early June, respectively. Saflufenacil applied PP, PRE and POST (with and without Merge) had no adverse effect on plant height or yield of winter wheat at rates evaluated. Based on these results, saflufenacil applied PP and PRE can be safely used in winter wheat at rates evaluated; however, saflufenacil applied POST with Merge results in unacceptable injury in winter wheat at rates evaluated. These results are consistent with the proposed PP and PRE use pattern for saflufenacil.

EFFECT OF VOLUNTEER CANOLA ON BARLEY PRODUCTIVITY. J. Lajeunesse*, D. Pageau; Agriculture and Agri-Food Canada, Normandin, QC, Canada

ABSTRACT

Canola (*Brassica napus* L.) is generally included in a 4-year crop rotation system in Quebec (Canada). Plants emerging from remnant seeds in the subsequent years are a common problem in crop rotation systems and volunteers canola have been observed for up to 5 years after canola production. From 2004 to 2007, a trial was conducted to evaluated the effect of volunteer canola on barley (*Hordeum vulgare* L.) productivity. Canola cv. Hyola 401 was seeded at five seeding rates (0, 1.5, 3.0, 4.5, 6.0 and 7.5 kg ha^{-1}) while barley cv. Chapais was seeded perpendicularly to the canola row. Fertilization and herbicide were applied according to provincial recommendations. Prior to harvest, canola density was evaluated by counting the number of plants on two randomly 1.0 m length in each plot. Canola density ranged from 9.7 to 35.4 plants m^{-2} in 2004, 8.3 to 52.1 plants m^{-2} in 2005, 9.0 to 26.4 plants m^{-2} in 2006 , and 25.7 to 104.9 plants m^{-2} in 2007. At a seeding rate of 7.5 kg ha^{-1}, the grain yield was significantly reduced by 16.8%, 10.4%, and 13.9%, in 2004, 2005 and 2007 respectively, when compared to the control. In 2006, the grain yield of barley was not affected by volunteer canola and average grain yield was 7 087 kg ha^{-1}. The presence of volunteer canola had no significant effect on the 1000-kernel weight of barley in 2004, 2006 and 2007. In 2005, volunteer canola reduced significantly the 1000-kernel weight of barley. Test weight of barley decreased linearly with the increment of volunteer canola density in 2004, 2005, and 2007. In 2006, test weight of barley was not affected by volunteer canola population. These results demonstrate that a low volunteer canola density had little effect on barley production. Nevertheless, when volunteer canola population is high, it could reduce signicantly the grain yield of barley.

IMPACT OF VOLUNTEER OILSEED FLAX ON BARLEY PRODUCTION. D. Pageau*, J. Lajeunesse; Agriculture and Agri-Food Canada, Normandin, QC, Canada

ABSTRACT

Because of crop losses during flax (*Linum usitatissimum* L.) harvest, the presence of volunteer plants in the next production has become common. A two-year test evaluated the effect of volunteer flax on barley (*Hordeum vulgare* L.) productivity. Flax cv. AC Bethune was seeded at five seeding rates (0, 10, 20, 30, 40 and 50 kg ha^{-1}) while barley cv. Chapais was seeded perpendicularly to the flax row. Fertilization and herbicide were applied according to provincial recommendations. Prior to harvest, flax density was evaluated by counting the number of plants on two randomly 0.5 m length in each plot. During the first year (2006), flax density ranged from 39 to 286 plants m^{-2}. In 2007, the densities were much higher and ranged from 103 to 670 plant m^{-2}. In 2006, the grain yield of barley was not affected by volunteer flax for seeding rate of 10 to 40 kg ha^{-1}. At a seeding rate of 50 kg ha^{-1}, the grain yield was significantly reduced by 7 % compared to the control. Because volunteer flax populations were much higher in 2007, the effect of volunteer flax on grain yield of barley was more important. Thus, at a seeding rate of 10 kg ha^{-1}, the presence of flax reduced cereal grain yield by 10 %. However, grains yield were reduced by 17 % when the seeding rate of flax was 50 kg ha^{-1}. The presence of volunteer flax had no significant effect on the test weight and the 1000-kernel weight of barley in 2006. In 2007, volunteer flax significantly reduced both kernel weight and test weight of barley. Those results suggest that low volunteer flax density had little effect on barley productivity. However, when flax density is more important, the presence of volunteer flax can reduce the grain yield of the cereal.

INTERACTION BETWEEN PREEMERGENCE HERBICIDES AND POSTEMERGENCE APPLICATION TIMING IN GLYPHOSATE-RESISTANT CORN. M.M. Loux*,[1] A. Dobbels,[1] W. Johnson,[2] B. Young[3]; [1]The Ohio State University, Columbus, OH, [2]Purdue University, West Lafayette, IN, [3]Southern Illinois University, Carbondale, IL

ABSTRACT

A field study was conducted at a total of 7 sites in 2007 and 2008 to determine the effect of PRE herbicide and POST application timing on weed control and yield in glyphosate-resistant corn. PRE herbicide treatments, which were intended to represent low, medium, and high levels of residual herbicide, included: atrazine (1.1 kg ai/ha); atrazine (1.4 kg/ha) + s-metolachlor (1.1 kg ai/ha); atrazine (1.3 kg/ha) + s-metolachlor (1.5 kg/ha) + mesotrione (; and none. POST herbicide application timings included: 30-cm corn; 1 wk after 30-cm corn; and 2 wks after 30-cm corn. The POST herbicide treatment consisted of glyphosate (0.84 kg ae/ha) and ammonium sulfate (2% w/v). The experimental design was a two-way factorial in a randomized complete block, with four replications. Weed control was determined at each POST herbicide timing and just prior to corn harvest. Control of weeds at the time of POST glyphosate application ranged from 30 to 100%. Control generally increased with the rate and complexity of the PRE herbicide treatment, and decreased at the later POST application timings. Averaged over POST timings, the PRE treatments that consisted of two or more herbicides resulted in higher corn yield than atrazine or no PRE treatment, and yields were higher for atrazine compared with no PRE treatment. Averaged over PRE herbicides, yield was similar for the first two POST timings, but decreased at the last timing in comparison to the earliest timing. Late-season weed control ranged from 63 to 100%, although control of common ragweed, velvetleaf, common cocklebur, common lambsquarters, barnyardgrass, and Pennsylvania smartweed exceeded 90% for all treatments. Giant foxtail was more effectively controlled where the PRE treatment contained atrazine and s-metolachlor, in comparison to atrazine alone. There was a trend for most effective control of giant ragweed, redroot pigweed, and ivyleaf morningglory with the PRE combination of atrazine, s-metolachlor, and mesotrione. Control of most weeds was unaffected by POST application timing, although there was a trend for improved control of giant foxtail, common lambsquarters, and redroot pigweed at the later timings

IN-CROP AND FALL-APPLIED GLYPHOSATE REDUCED PURPLE NUTSEDGE DENSITY IN NO-TILL GLYPHOSATE-RESISTANT CORN AND SOYBEAN. K.N. Reddy*, C.T. Bryson; USDA-ARS Southern Weed Science Research Unit, Stoneville, MS

ABSTRACT

Purple nutsedge is a difficult to control weed because of prolific tuber production, ability of tuber to sprout several times, and the lack of herbicides to kill dormant tubers. In the southern US, corn and soybean are harvested beginning in August. The time between harvest in August and frost provides a favorable environment for purple nutsedge to re-establish and replenish tubers, resulting in future infestations. A 3-yr field study was conducted during 2005 to 2007 at Stoneville, MS to determine efficacy of in-crop and fall-applied glyphosate on purple nutsedge populations and crop yields in no-till glyphosate-resistant (GR) corn and GR soybean. Separate experiments were conducted in GR corn and GR soybean in areas maintained under no-tillage system after the fall of 2004. At the initiation of study, experimental area was densely infested with purple nutsedge (186 shoots/m^2). Each experiment was conducted in a split-plot arrangement of treatments in a randomized complete block design with fall application (with and without glyphosate at 1.68 kg ae/ha) as the main plot and in-crop application (with and without glyphosate at 0.84 kg ae/ha applied twice as early and late postemergence) as the subplot with three replications. In GR corn, glyphosate applied in the fall reduced purple nutsedge density by 40 to 67% compared to no glyphosate during three years. In GR corn, glyphosate applied in-crop reduced purple nutsedge density by 48% in 2005, 92% in 2006, and 100% in 2007 compared with no glyphosate. However, GR corn yields were not affected by either in-crop or fall-applied glyphosate. In GR soybean, glyphosate applied in the fall reduced purple nutsedge density by 64 to 83% compared to no glyphosate during three years. Glyphosate applied in-crop in GR soybean reduced purple nutsedge density by 81% in 2005, 100% in 2006, and 100% in 2007 compared with no glyphosate. GR soybean yields were similar in 2005, but yields were 34 and 18% higher in 2006 and 2007, respectively, following fall-applied glyphosate compared to no glyphosate. GR soybean yields were higher with glyphosate applied in-crop compared with no glyphosate in one of three years. These results indicate that purple nutsedge density could be reduced with glyphosate applied in-crop in GR corn and GR soybean. In addition, fall-applied glyphosate was effective in preventing re-establishment of purple nutsedge following harvest of crops and could be an effective purple nutsedge control strategy regardless of GR trait.

EVALUATION OF BALANCE FLEXX, CAPRENO, CORVUS, AND LAUDIS IN CORN. D.O. Stephenson*, D. M. Scroggs; LSU AgCenter, Alexandria, LA

ABSTRACT

Research was conducted evaluating the potential of Balance Flexx, Capreno, Corvus, and Laudis for season-long weed control in corn at the Dean Lee Research Center in Alexandria, LA. Balance Flexx (isoxaflutole plus cyprosulfamide) and Corvus (thiencarbazone-methyl plus isoxaflutole plus cyprosulfamide) were evaluated as PRE treatments in one experiment. In a separate experiment, Capreno (tembotrione plus thiencarbazone-methyl plus isoxadifen-ethyl) and Laudis (tembotrione plus isoxadifen-ethyl) were evaluated as POST treatments. In the preemergence trial, treatments included Corvus (115 g ha^{-1}) plus atrazine (1120 g ha^{-1}) PRE, Balance Flexx (87 g ha^{-1}) plus atrazine PRE, Balance Flexx (52 g ha^{-1}) plus atrazine PRE followed by (fb) glufosinate (470 g ha^{-1}) plus atrazine POST, Balance Flexx (52 g ha^{-1}) fb glyphosate (900 g ha^{-1}) plus atrazine POST, atrazine (1800 g g ha^{-1}) plus *S*-metolachlor (1400 g ha^{-1}) PRE, and atrazine plus *S*-metolachlor PRE fb glyphosate POST. In the POST experiment treatments were Laudis (92 g ha^{-1}), Capreno (91 g ha^{-1}), and mesotrione (105 g ha^{-1}) applied alone and co-applied with atrazine (1120 g ha^{-1}), Laudis plus glufosinate (470 g ha^{-1}), Capreno plus glufosinate, Laudis plus glyphosate (900 g ha^{-1}), Capreno plus glyphosate, and atrazine (1800 g ha^{-1}) plus *S*-metolachlor (1400 g ha^{-1}) plus glyphosate. All POST treatments included either ammonium sulfate (1400 g L^{-1}), 28% urea/ammonium nitrate solution (3.5 g L^{-1}), or crop oil concentrate (1% v/v) and all were applied to 23 cm corn. In the PRE experiment, glufosinate or glyphosate were needed to provide greater than 80% control of johnsongrass at corn harvest. All treatments except Balance Flexx plus atrazine PRE provided 80% control of barnyardgrass, but no treatment controlled browntop millet greater than 80%. All treatments controlled Palmer amaranth greater than 90%. Corvus plus atrazine PRE, and Balance Flexx plus atrazine fb glufosinate or glyphosate controlled entireleaf morningglory at least 85%. Corn yields did not differ among PRE treatments. In the POST experiment, glufosinate and glyphosate was needed to provide 87% or greater control of johnsongrass; however, Capreno plus atrazine provided 88% control at harvest. Barnyardgrass and browntop millet control was increased with the addition of glufosinate and glyphosate, but Capreno plus atrazine provided at least 80% control of each weed. All treatments provided at least 78% control of Palmer amaranth and entireleaf morningglory except Laudis POST which provided only 65% control of entireleaf morningglory. Corn yields did not differ among POST treatments. Data indicates that glufosinate or glyphosate is needed for season-long weed control when Corvus or Balance Flexx are applied PRE. Data also indicates that Capreno plus atrazine provides season-long weed control as compared to Laudis alone or co-applied with atrazine, glufosinate, or glyphosate. Research will continue to substantiate these findings.

RESIDUAL EFFECT OF PRIMARY TILLAGE ON WEED CONTROL AND COTTON YIELD. M.G. Patterson*,[1] C.D. Monks,[1] A. Price,[2] R.W. Goodman[1]; [1]Auburn University, Auburn University, AL, [2]USDA-ARS, Auburn University, AL

ABSTRACT

A field trial was initiated in the spring of 2006 to evaluate the effect of inversion tillage compared to disking and notill on weed control and seed cotton yield; and to determine the residual effect of this tillage in subsequent years. Delta and Pine Land 147 BG/RF seed was planted in a completely randomized experimental design with a 4 X 6 factorial arrangement of treatments, with tillage and herbicide systems as main factors. Tillage system treatments included 1) inversion with a moldboard plow followed by (fb) disking (with pendimethalin ppi) prior to planting; 2) two diskings (with pendimethalin ppi) prior to planting; 3) no-tillage (with pendimethalin pre) and 4) no-tillage. Herbicide system treatments included 1) fluometuron pre fb glyphosate post; 2) fluometuron pre; 3) prometryn pre fb glyphosate post; 4) prometryn pre; 5) glyphosate post; and 6) none (no pre or post herbicide). Following the initial tillage treatments in 2006, the entire trial area was planted no-till in 2007 and 2008 using pendimethalin as a pre herbicide. Rates for herbicides used were; pendimethalin 1.1 kg/ha, fluometuron and prometryn 1.68 kg/ha, and glyphosate (as Roundup Weathermax) 1.0 kg/ha. Data collection each year included crop injury and weed control ratings, pigweed populations at late season, and seed cotton yield. There was no significant (>10%) crop injury recorded for any herbicide system treatment, regardless of tillage system in 2006. The highest level of pigweed (*Amaranthus spinosus)* and annual grass (*Eleusine indica)* control (>90%) was recorded in the moldboard plowed treatments. In the double disked and no-till systems, glyphosate was needed in addition to soil-applied treatments to provide control late in the season. Seed cotton yield in the tillage systems (when averaged over herbicide systems) was in the following order: inversion fb disking with pendimethalin (3038 kg/ha) > double disking with pendimethalin = no-tillage with pendimethalin (2266 kg/ha) > no-tillage (1615 kg/ha). In 2007 this trend continued but to a lesser degree with yields as follows; inversion tillage with pendimethalin (2676 kg/ha) > double disking with pendimentalin = no-tillage with pendimethalin (2358 kg/ha) > no-tillage with pendimethalin 2nd year (1763 kg/ha). There were no differences between tillage systems in 2008 for weed control ratings and seed cotton yields (avg 2050 kg/ha).

EFFECT OF TILLAGE SYSTEMS, ROW SPACINGS, AND HERBICIDE TECHNOLOGIES ON PLANT GROWTH AND LINT YIELD OF COTTON. J.S. Aulakh*,[1] A.J. Price,[2] K.S. Balkcom,[2] F.J. Arriaga,[2] D.P. Delaney[1]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, NSDL, Auburn Univ, Auburn, AL

ABSTRACT

A cotton study was conducted during 2004-2006 growing seasons at the E.V. Smith Research Center, Field Crops Unit near Shorter, AL, to compare a conventional variety, a glyphosate tolerant variety, and a glufosinate tolerant variety grown in both a conventional tillage and high-residue rye conservation tillage system, with standard row (40-inch) and narrow row (15-inch) planting patterns. The experimental design contained a split-split plot treatment restriction in a randomized complete block design with four replicates. The main plots consisted of row spacing (15-inch vs 40-inch row spacing), the subplots were varieties represented by different herbicide resistant (HR) technologies (conventional variety - FM966®, glyphosate tolerant variety - FM960 RR®, and a glufosinate tolerant variety - FM966 LL®), and the sub-subplots were tillage system (conventional and conservation tillage). Results showed that in all years the conservation tillage system provided better weed control than conventional system when conventional seed was utilized. In general, the weed control efficiency of HR technologies was comparable and both the glyphosate-tolerant and the glufosinate-tolerant varieties were significantly better than conventional variety. The weed control in glyphosate and glufosinate tolerant varieties was not influenced by the tillage systems. When looking at conventional variety data, Palmer amaranth, coffee senna, smallflower morningglory and sicklepod control was higher in the conservation tillage system. At the 40 inch spacing, the glufosinate system gave better control of coffee senna and sicklepod than glyphosate system. However, in 15 inch spacing, the glyphosate system provided better control of coffee senna and sicklepod. Lint yields were influenced more by the growing seasons than row spacing, variety, or tillage system. The 15-inch spacing lint yields were equivalent to 40-inch spacing lint yields in all years. In 2005, conventional tillage cotton produced 12% greater yields compared to conventional tillage, while glyphosate-tolerant cotton produced 13% greater yields compared to glufosinate-tolerant cotton. In 2006, glyphosate-tolerant cotton was superior to both conventional and glufosinate-tolerant cotton by 29%. No lint yield differences were observed in 2004.

PERFORMANCE OF VARIOUS WINTER COVER CROPS AND THEIR AFFECTS ON WEED BIOMASS AND YIELD WHEN USED IN CONSERVATION-TILLAGE CORN-COTTON ROTATION. A. Folgart*,[1] M. Saini,[1] A.J. Price,[2] E. van Santen[1]; [1]Auburn University, Auburn, AL, [2]National Soil Dynamics Laboratory, Auburn, AL

ABSTRACT

Winter cover crops are an integral component of conservation-tillage systems in a corn (*Zea mays* L.) - cotton (*Gossypium hirsutum* L.) rotation. Some winter cover crops are used in corn and cotton for better nutrient cycling, increase in water availability for crop production, improving soil quality and weed suppression. An ongoing long term field experiment was initiated in fall 2001 at the Field Crops Unit, E. V. Smith Research and Extension Center of the Alabama Agricultural Experiment Station near Shorter, AL to evaluate the effects of various winter cover crops on weed biomass and crop yield in a conservation-tillage corn cotton rotation. Winter cover crops included black oat (*Avena strigosa* Schreb.), two crimson clover cultivars (*Trifolium incarnatum* L.); two cultivars of forage rape (*Brassica napus* L. var. *napus*), spring and winter; oil radish (*Raphanus sativus* var. *oleiformis Pers.*); three cultivars of turnip (*Brassica rapa* L. *subsp. rapa*), white lupin (*Lupinus albus* L.); and a mixture of black oat and lupin. Two-year conservation-tillage rotational sequences included conventionally tilled continuous corn and cotton winter fallow systems as controls. The 10 conservation tillage winter cover crop systems investigated were three continuous cotton systems that alternated a winter legume (lupin or clover), six cotton-corn systems, where lupin preceded cotton and radish, rape, or turnip preceded corn, and a cotton-corn system that had a lupin-black oat mixture as a winter cover crop every year. Cotton yield was highest in all years following the mixture of black oat and lupin (2407 kg ha^{-1}) as well as for the white lupin treatment (2450 kg ha^{-1}). Weed biomass reduction in cotton varied between years. The lowest weed biomass was observed in 2006. Averaged across years, the white lupin treatment reduced weed biomass in cotton better than the other winter cover crops (871 kg ha^{-1} weed biomass). In all years, corn yielded highest following turnip (80.2 bu $acre^{-1}$) and rapeseed (82.2 bu $acre^{-1}$) as winter covers. Weed biomass was reduced the most by radish (656 kg ha^{-1} weed biomass).

PALMER AMARANTH CONTROL AND COTTON RESPONSE TO EARLY PREPLANT AND PREEMERGENCE APPLICATIONS OF RESIDUAL HERBICIDES. L. Steckel*,[1] C. Main,[1] J. Holloway[2]; [1]University of Tennessee, Jackson, TN, [2]Syngenta Crop Protection, Jackson, TN

ABSTRACT

Glyphosate-resistant Palmer amaranth has been identified in 10 Tennessee counties. In order to be able to grow cotton in the future soil applied herbicides will be needed to manage this pest. As a result, research was initiated that examined control of Palmer amaranth with herbicides applied 28 days before planting (DBP), 14 DBP and pre emergence. The herbicides used in the study were Caparol, Prowl H2O and Reflex. These herbicides were applied alone and in combinations with each other. Cotton was unaffected by all the herbicides used in the study regardless of timing or herbicide tankmixtures. The best Palmer amaranth control was with the applications made 14 DBP and the pre applications.

PALMER AMARANTH CONTROL IN DIFFERENT COTTON TILLAGE SYSTEMS. L.V. Gilbert*,[1] A.J. Bloodworth,[2] P.A. Dotray,[3] J.W. Keeling,[1] B.W. Bean[4]; [1]Texas AgriLife Research, Lubbock, TX, [2]Texas Tech University, Lubbock, TX, [3]Texas Tech University, Texas AgriLife Research, and Texas AgriLife Extension Service, Lubbock, TX, [4]Texas AgriLife Extension Service and Texas AgriLife Research, Amarillo, TX

ABSTRACT

With continued increases in seed, herbicide, and energy costs, producers across the U.S. and in the Texas High Plains struggle to find effective ways to maintain yields while reducing their input costs. Conservation tillage is one alternate farming practice that may allow fewer trips across a field while offering better retention of soil moisture from both irrigation and rainfall. Strip-tillage and no-tillage are two forms of conservation tillage that are currently being utilized. While these systems rely heavily on the use of herbicides for weed control, more research is needed to develop effective and economical weed control programs. The overall objective of this trial was to examine weed control in conventional tillage, strip-tillage, and no-tillage for effective and economical weed management strategies in Roundup Ready Flex cotton. Field studies were conducted in 2008 at the Texas AgriLife Research Center near Halfway, TX on an Olton Clay Loam soil with a pH of 7.8 and less than 2% organic matter. Plots were established under an overhead sprinkler irrigation system following a grain crop in a grain/cotton/cotton rotation. Sixteen treatments were established in each tillage system using various combinations of soil residual herbicides. The soil residual herbicides were pendimethalin (Prowl H2O) at 1.0 lb ai/A preplant incorporated (PPI), prometryn (Caparol) at 1.2 lb ai/A preemergence (PRE), pyrithiobac (Staple LX) at 0.0525 lb ai/A postemergence-topical (POST), and diuron (Direx) at 1.0 lb ai/A at layby. Preplant incorporated applications were made to designated plots on May 2 with a tractor-mounted compressed-air broadcast sprayer calibrated to deliver 10 GPA, and incorporated within 24 hours. Conventional tillage beds were listed prior to PPI applications and treatments were incorporated once with a rolling cultivator. Strip-tillage treatments were incorporated once with a strip-tillage implement at an 8 to 10 inch depth in the seed zone and one inch of overhead irrigation in row middles. No-tillage treatments were incorporated with one inch of overhead irrigation. Stoneville 4554B2F was planted on May 19 and PRE treatments were applied in designated plots immediately after planting. Average cotton stand was 2.3 plants/ft in conventional tillage, 2.2 plants/ft in strip-tillage, and 2.0 plants/ft in no-tillage. There was no difference between stand in conventional tillage compared to strip-tillage; however, stand in no-tillage was reduced as compared to conventional tillage and strip-tillage. Glyphosate (Roundup WeatherMax) at 0.75 lb ae/A was applied POST alone or in tank mix combination with pyrithiobac on June 27. A layby application of glyphosate alone or in tank mix combination with diuron was applied on July 25. In conventional tillage plots, Palmer amaranth (*Amaranthus palmeri*) control was 96% or greater throughout the growing season across all treatments. In strip-tillage plots, control ranged from 94 to 100% throughout the growing season among treatments, and Palmer amaranth control ranged from 88 to 100% in no-till plots. Lint yield in conventional tillage was 993 lb/A, 1130 lb/A in strip-tillage, and 914 lb/A in no-tillage. Strip-tillage lint yield was greater than conventional tillage and no-tillage, and conventional tillage lint yield was greater than no-tillage. Gross returns based on lint yield were calculated by treatment in the strip-tillage system and ranged from $502.93 to $706.76. Weed control costs were analyzed by calculating herbicide input costs per treatment and net returns above weed control costs. Herbicide input costs per treatment in strip-tillage ranged from $32.94 to $83.10, and net returns above weed control costs in strip-tillage ranged from $425.83 to $652.48. Conservation tillage appears to be an excellent option for producers in the Texas High Plains. Although the benefit of a residual herbicide was not apparent in this study, the concern of weed resistance must be considered when developing long-term weed management strategies, regardless of tillage system.

EFFECT OF FOMESAFEN ON GLYPHOSATE PLUS S-METOLACHLOR APPLICATION TIMING IN COTTON. D.O. Stephenson*, D.M. Scroggs; LSU AgCenter, Alexandria, LA

ABSTRACT

Research investigating the effect of fomesafen PRE on glyphosate plus *S*-metolachlor application timing in cotton was conducted at the Dean Lee Research Center in Alexandria, LA. The experiment was a 4 x 4 factorial arranged as a randomized complete block with three replications. The first factor consisted of fomesafen applied PRE at 0, 280, and 420 g ha^{-1}. The second factor was the application of glyphosate (880 g ha^{-1}) plus *S*-metolachlor (1070 g ha^{-1}) to 4, 6, or 8 node cotton POST. A PRE only treatment was included. Data collected included cotton injury and weed control (0 = no injury/control, 100 = plant death) and data was subjected to analysis of variance and means separated with Fisher's Protected LSD at the 0.05 probability level. Cotton injury and weed control data collected 14 d after the 8 node POST application timing (DA8POST) and at harvest and seed cotton yield are presented. When averaged across all POST application timings, no differences between fomesafen PRE rates were observed for control of johnsongrass (93-96%), barnyardgrass (93-96%), browntop millet (94-98%), Palmer amaranth (95-99%), and entireleaf morningglory (87-90%) 14 DA8POST or at cotton harvest. Averaged across PRE treatments, johnsongrass control was increased by applying the POST treatment to 4 or 6 node cotton 14 DA8POST and at cotton harvest. Control of barnyardgrass and entireleaf morningglory was greater when glyphosate and *S*-metolachlor were applied prior to 8 node cotton 14 DA8POST, but no differences were observed at cotton harvest. Regardless of PRE treatment, all POST application timings controlled browntop millet and Palmer amaranth at least 90% at both rating dates. In the absence of a POST application, seed cotton yield increased following PRE application and increasing fomesafen rate with the nontreated, fomesafen at 280, and 420 g ha^{-1} treatments yielding 1340, 3430, and 7120 kg ha^{-1}. Neither fomesafen PRE treatment increased cotton yield when glyphosate plus *S*-metolachlor was applied to 4 or 6 node cotton. However, both rates of fomesafen PRE followed by the POST 8 node application timing (>10,000 kg ha-1) increased seed cotton yield compared to the 8 node POST treatment only (6800 kg ha). Data indicates that applying fomesafen PRE has the potential to provide preemergence control of various weeds early season allowing the first POST application to be delayed until 8 node cotton; however, if the POST is applied earlier then no PRE may be needed.

WEED CONTROL IN LIBERTYLINK AND ROUNDUP READY FLEX COTTON. J.A. Bond*,[1] D.M. Dodds,[2] D.B. Reynolds[2]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Starkville, MS

ABSTRACT

Modern cotton (*Gossypium hirsutum*) weed control is based on glyphosate. Ninety-nine percent of Mississippi cotton acres were Roundup Ready or Roundup Ready Flex in 2008. The reliance on glyphosate has placed an exorbitant amount of selection pressure on common weed species. To date, nine species have evolved resistance to glyphosate in the United States. Mississippi populations of horseweed (*Conyza canadensis*), Italian ryegrass (*Lolium perenne* ssp. *multiflorum*), johnsongrass (*Sorghum halepense*), and Palmer amaranth (*Amaranthus palmeri*) have been documented resistant to glyphosate. LibertyLink cotton was commercialized in 2004 and offers an alternative to Roundup Ready and Roundup Ready Flex for over-the-top weed control in cotton. The LibertyLink technology allows topical applications of glufosinate from cotton emergence through early bloom. The technology may also serve as a tool in a glyphosate resistance management program. To date, resistance to glufosinate has not been reported in weeds. Research was conducted in 2008 at the Plant Science Research Center in Starkville, MS, to (1) evaluate rates of glufosinate in sequential applications in a LibertyLink weed control system and (2) compare residual herbicides applied in programs with glufosinate in a LibertyLink weed control system. FiberMax 1735B2LL (LibertyLink) and Phytogen 485WRF (Roundup Ready Flex) were planted on May 7, 2008. The experimental design was a randomized complete block with four replications. To evaluate glufosinate rates, sequential applications of glufosinate were made to FiberMax 1735B2LL in the four- and 10-leaf cotton stages. Treatments included glufosinate at 0.45 followed by (fb) 0.45 kg ai ha^{-1}, 0.59 fb 0.59 kg ha^{-1}, 0.88 fb 0.88 kg ha^{-1}, and 0.88 fb 0.59 kg ha^{-1}. Phytogen 485 WRF received glyphosate at 0.86 fb 0.86 kg ae ha^{-1} at the four- and 10-leaf stages. In the residual component of the study, fluometuron (1.12 kg ai ha^{-1}) was applied preemergence and followed by two applications of glufosinate (0.45 fb 0.45 kg ha^{-1}) at the four- and 10-leaf stages. Additionally, pyrithiobac (0.056 kg ai ha^{-1}) or metolachlor (1.06 kg ai ha^{-1}) were tank-mixed with glufosinate at 0.45 kg ha^{-1} (four-leaf cotton) and then followed by glufosinate alone at 0.45 kg ha^{-1} (10-leaf cotton). Glufosinate at 0.45 fb 0.45 kg ha^{-1}, glyphosate at 0.88 fb 0.88 kg ha^{-1}, and a nontreated for each cultivar were included for comparison. Treatments were applied when a majority of plots in the study reached the designated growth stages. Cotton injury and weed control were visually estimated 16 days following the four- and 10-leaf cotton applications. Data were subjected to ANOVA with means separated by Duncan's multiple range test at $P = 0.05$. Extremely dry conditions persisted at the site through the early portion of the growing season and precluded weed emergence. Therefore, few differences in visual control of tall waterhemp (*Amaranthus tuberculatus*) and barnyardgrass (*Echinochloa crus-galli*) were detected. Furthermore, wet conditions during August reduced cotton yield. Glufosinate at 0.45 fb 0.45 kg ha^{-1} provided effective control of tall waterhemp and barnyardgrass. Tall waterhemp and barnyardgrass were controlled at least 91% when fluometuron, pyrithiobac, or metolachlor were used in programs with glufosinate. All LibertyLink weed control programs were as effective as two applications of glyphosate in a Roundup Ready Flex system.

COTTON TOLERANCE AND WEED CONTROL WITH STAPLE LX AND DUAL MAGNUM COMBINATIONS WITH GLYPHOSATE. D. Miller*,[1] D. Stephenson,[2] M. Mathews[1]; [1]LSU AgCenter, St. Joseph, LA, [2]LSU AgCenter, Alexandria, LA

ABSTRACT

A field study was conducted at the LSU AgCenter Northeast Research Station near St. Joseph, LA to evaluate cotton tolerance and weed control with glyphosate co-applied with Staple LX and Dual Magnum. The study was conducted on a silt loam soil with pH 6.5. Treatments were applied to each 6.67' x 25' plot with a CO_2 backpack sprayer at 15GPA. Cotton variety DP 164 B2RF was planted on April 30. Treatments were applied on May 26 to cotton at the 2 to 3 leaf growth stage. Treatments evaluated included Roundup Powermax at 22 oz/A alone or co-applied with Dual Magnum at 16 oz/A, Dual Magnum at 16 oz/A plus Staple LX at 1.7 oz/A, or with Staple LX at 1.7, 2.7, or 3.8 oz/A; Touchdown Total at 24 oz/A alone or co-applied with Dual Magnum at 16 oz/A or Dual Magnum at 16 oz/A plus Staple LX at 1.7 oz/A or Staple LX at 1.7 oz/A; and Sequence applied at 2.5 pt/A alone or co-applied with Staple LX at 1.7 oz/A. Parameter measurements included visual assessment of crop injury 7, 14, and 28 d after treatment (DAT), visual assessment of weed control 14 and 28 DAT, and seed cotton yield. Weeds evaluated included barnyardgrass, crabgrass, sicklepod, entireleaf morningglory, pitted morningglory, redroot pigweed, and goosegrass. Following the final visual rating, Roundup Powermax at 22 oz/A was applied to the entire test area. At 7 DAT, Sequence co-applied with Staple LX and Roundup Powermax co-applied with Dual Magnum plus Staple LX resulted in 15% injury, which was equal to the 14 and 9% injury observed with Roundup Powermax co-applied with Dual Magnum or Staple LX at 2.7 oz/A, and greater than all other treatments (1 to 8%). At 14 DAT, greatest injury of 18% was observed with Roundup Powermax co-applied with Dual Magnum plus Staple LX. Roundup Powermax co-applied with Dual Magnum and Sequence co-applied with Staple LX resulted in equivalent injury of 10%. All other treatments resulted in no greater than 5% injury. By 28 DAT, however, cotton injury was no greater than 4% for any treatment. At 14 DAT, control of barnyardgrass, crabgrass, sicklepod, pitted morningglory, entireleaf morningglory, and redroot pigweed was at least 91, 99, 80, 90, 89, and 94%, respectively, and equivalent among all treatments. Hemp sesbania control ranged from 89 to 100% with only slight differences noted among treatments. Results were similar 28 DAT as control of barnyardgrass, crabgrass, goosegrass, hemp sesbania, pitted morningglory, entireleaf morningglory, and redroot pigweed ranged from 70 to 86%, 95 %, 70 to 86%, 81 to 98%, 98 to 100%, 9 6to 100%, and 78 to 100%, respectively, and was equal for all treatments. Sickelpod control was no greater than 81% for the treatments evaluated. Differences in early season injury and slight differences in weed control were not manifested in significant yield reduction as seed cotton yield ranged from 1340 to 1744 lb/A and was equal for all treatments.

PEANUT PERFORMANCE AND WEED MANAGEMENT IN A HIGH RESIDUE COVER CROP SYSTEM. J.A. Kelton*,[1] A.J. Price,[2] K.S. Balkcom,[2] W.H. Faircloth,[3] D. Rowland[3]; [1]Auburn University, Auburn, AL, [2]USDA-ARS National Soil Dynamics Laboratory, Auburn, AL, [3]USDA-ARS National Peanut Research Laboratory, Dawson, GA

ABSTRACT

Previous research indicates conservation tillage is a viable option for successful peanut production, but more study is needed to help understand interactions between cover crop residues and peanut production. Specifically, additional information is needed about the effects of varying levels of biomass residue on the peanut crop. Varying responses may result depending on cover crop levels in terms of: residue interference of preemergence (PRE) herbicide activity, stand establishment, weed suppression, and yield. The objective of this study was to determine if these aspects of peanut production respond differently depending on various cover crop residue amounts and if any residue biomass level thresholds exist for the previously mention attributes. The experiment was conducted in Dawson, GA and Headland, AL during 2007 and 2008. The study consisted of a rye (*Secale cereale* L.) cover crop planted at three different dates as well as a stale seedbed for a total of four different residue levels. Cover crops were terminated with glyphosate or paraquat in mid-April. Pendimethalin was applied PRE at 1kg ai/ha across the entire experimental area just prior to planting of the Georgia 03-L peanut variety. Data collection included cover crop biomass weights, weed control ratings at 21 DAP and 45 DAP, yields and grade of peanut. Weed control ratings showed no significant difference between residue levels for the dominant weeds, Palmer amaranth (*Amaranthus palmeri*) and smallflower morningglory (*Jaquemontia tamnifolia*) except for the 2008 Dawson site. At 45 DAP, the high residue treatments achieved greater suppression of smallflower morningglory in comparison than fallow treatments, suggesting a potential for greater season-long weed control with high residue systems. Residue levels did not affect yields except for the 2007 test in Dawson. High residue treatments had higher yields than all other treatments during this drought year which could be indicative of reduced water loss under high residue systems.

THE IMPACT OF PEANUT (*ARACHIS HYPOGAEA*) MATURITY GROUP ON INJURY AND YIELD FROM POSTEMERGENCE HERBICIDE APPLICATIONS. J.A. Boyer*,[1] G. MacDonald,[1] J.A. Ferrell,[1] B.L. Tillman,[2] B.J. Brecke[3]; [1]University of Florida, Gainesville, FL, [2]North Florida Research and Education Center, Marianna, FL, [3]West Florida Research and Education Center, Milton, FL

ABSTRACT

Imazapic has been the standard for postemergence weed control in peanuts for several years. However, weed resistance and species shifts now require alternative postemergence herbicides for necessary weed control. Lactofen is one of the few options for postemergence weed control, but many producers are skeptical of this herbicide because of the extensive foliar burning that often results. Previous research with lactofen demonstrated no long term foliar injury and no impact on peanut yield. However, this research was conducted on a mid- season, now defunct cultivar, Florunner. To date, little research has been conducted on newer cultivars, especially on cultivars of differing maturity dates. The objective of this study was to evaluate the effect of lactofen application timing on peanut injury and yield as a function of peanut maturity type. Field experiments were conducted in Citra, FL in 2007 and 2008 on early (ViruGard, 120 - 135 day), medium (AP3, 135 - 145 day), and late (C99R, 145+ day) maturity varieties. The study was maintained weed free and insect and disease control were conducted as needed to maintain optimum growth. Herbicide treatments included lactofen (0.19 lb/A) applied at 4, 6, 8 and 10 weeks after planting (WAP). All treatments were applied with crop oil concentrate (1% v/v). Herbicide injury was visually evaluated at 7 and 14 days after treatment (DAT). Canopy width was also measured from the time of herbicide application until canopy closure. As expected, foliar injury was observed for all treatments relative to the untreated control at 7 and 14 days after treatment (DAT). Lactofen did not delay canopy closure relative to the untreated in 2007 except for the medium maturity variety at 4 WAP. No yield reduction was observed in 2007 except for a 23% decrease when lactofen was applied to the medium maturity variety at 8 WAP. In 2008, row closure was delayed relative to untreated in the early variety at 4, 6 and 8 WAP, and at 4 and 6 WAP for the medium and late maturity varieties. Significant yield reductions were observed in the early variety at 8 (14%) and 10 (19%) WAP, medium maturity variety at 8 (9%) and 10 (18%) WAP, and the late variety at 10 (12%) WAP. Although the current product label has a preharvest interval of 45 days, these data indicate that delayed lactofen applications may result in yield loss.

WEED CONTROL IN PEANUT WITH TANK MIXTURES CONTAINING FIVE COMPONENTS. G. Chahal*, D.L. Jordan, J. Burton, S.B. Clewis, R.L. Brandenburg, B.B. Shew; NC State University, Raleigh, NC

ABSTRACT

In peanut, the purpose of using different mixtures that may include herbicides, fungicides, insecticides, micronutrients, and adjuvants is to widen the spectrum of pest control and to increase efficiency of pest management. However, a wide range of interactions can occur when pesticides and other agrichemicals are applied simultaneously. While interactions of two components applied simultaneously are relatively well understood, data are limited with respect to interactions of three or more components in the same mixture. The objective of the research was to determine interactions of up to five agrichemicals co-applied with respect to weed control in peanut. Research was conducted during 2008 at various locations in North Carolina with the herbicides imazapic, clethodim, lactofen, or 2,4-DB applied alone or with various agrichemicals. Treatments included each herbicide, in separate experiments, applied with three fungicide treatments (none, chlorothalonil plus tebuconazole, pyraclostrobin), two insecticide treatments (none or lambda-cyhalothrin), three micronutrient treatments (none, boron, manganese), and two adjuvant treatments (nonionic surfactant or Class Act for imazapic, none or Class Act for 2,4-DB, crop oil concentrate or Class Act for clethodim and lactofen). Tall morningglory was controlled almost completely when 2,4-DB was applied regardless of co-applied agrichemcials. Fall panicum control ranged from 87-100% with combinations of clethodim and other agrichemicals. Imazapic applied alone or with fungicides, insecticides, micronutrients, and adjuvants controlled fall panicum 40-70%. Combinations of lactofen with other agrichemcials controlled eclipta no more than 66%. Several adverse interactions were observed when comparing fall panicum control by imazapic, eclipta control by lactofen, fall panicum control by clethodim, and tall morningglory control by 2,4-DB. Additional research is being conducted to evaluate interactions of these agrichemicals with respect to insect and disease control.

PEANUT CULTIVAR RESPONSE TO DAMAGE FROM TOBACCO THRIPS AND PARAQUAT INJURY. W. Drake*, D.L. Jordan, P.D. Johnson, B.R. Lassiter; NC State University, Raleigh, NC

ABSTRACT

The window of successful peanut production in the Virginia-Carolina Region of the United States is relatively narrow due to geographic location and growing degree days required for pod maturation. Peanut growers and their advisors in this region are often concerned about effects of tobacco thrips (*Frankliniella fusca*) damage and paraquat injury with regard to pod maturity, peanut yield, and market grades. Although research has focused on the interaction of tobacco thirp damage and injury from paraquat, the effect of cultivar on response to these treatments has not been determined for large-seeded Virginia market type peanut. Therefore, research was conducted in North Carolina during 2007 and 2008 at two locations to determine effects of paraquat and aldicarb on Virigina market type peanut cultivars. Treatments consisted of the cultivars Gregory, Perry, Phillips, and VA 98R planted with or without aldicarb (1.1 kg ai/ha) in the seed furrow. Each of these cultivar/aldicarb combinations was followed by a no paraquat control or paraquat (0.14 kg ai/ha) applied post-emergence within 28 days after peanut emergence. These cultivars generally differ from emergence to optimum maturity by as much as 15 days. Although in some instances aldicarb and paraquat affected peanut stunting, canopy width, days to row closure, the percentage of mature pods in mid September, and pod yield, these treatment factors did not interact with the cultivars used in this study. Damage caused by tobacco thrips affected peanut more than paraquat injury. Pod yield was higher in 3 of 4 experiments when aldicarb was applied. Under the weed-free conditions in this study, paraquat reduced pod yield in only 1 of 4 experiments when compared with no paraquat. When data for yields were pooled over experiments and cultivars, pod yield was lowest when paraquat was applied and peanut was damaged by tobacco thrips in absence of aldicarb. Regardless of paraquat treatment, pod yield was the highest when aldicarb was applied and peanut was protected from tobacco thrips damage. These data suggest that control of tobacco thrips is important in the Virginia-Carolina Region regardless of cultivar or whether or not paraquat is applied. Therefore, growers most likely do not need to consider cultivar when applying aldicarb or paraquat.

HYBRID RICE TOLERANCE TO IMAZETHAPYR AS AFFECTED BY PLANTING DATE AND SOIL CHARACTERISTICS. E.R. Camargo*,[1] G.N. McCauley,[2] S.A. Senseman,[1] J. Samford,[2] J.M. Chandler[1]; [1]Texas A&M University, Texas AgriLife Research, College Station, TX, [2]Texas AgriLife Research, Eagle Lake, TX

ABSTRACT

Commercial rice tolerance to imidazolinone herbicides is an important tool for controlling weeds, especially red rice. Incorporation of this technology on hybrids allows the use of highly productive genotypes on red rice infested areas. Hybrids are drill-seeded using a lower seeding rate, consequently, generating low plant density at the beginning of the season. This can result in greater phytotoxicity because each individual plant will be exposed to a higher herbicide dose. Additionally, the ability of a plant to recover from herbicide injury is associated with existing environmental conditions during and after herbicide application. Low temperatures can also occur during imazethapyr applications in early seeded fields increasing crop injury. The objective of this study was to evaluate rice injury and yield in an imazethapyr-tolerant hybrid seeded in March and April using different seeding rates. The experiments were conducted during 2008 at the Texas A&M AgriLife Research and Extension Center located at Beaumont and Eagle Lake. The two locations had distinct soil characterization. Beaumont soil is classified as a Morey silty clay loam having 19.4% of sand, 45.3% of silt, 35.5% of clay, 1.32% of organic matter, and pH of 7.3. Eagle Lake soil is a Nada fine sandy loam with 61.4% of sand, 31.2% of silt, 7.4% of clay, 0.75% of organic matter, and pH of 6.1. The experimental design was a randomized complete block with a factorial arrangement. The treatments included three seeding rates of "CL XL730" hybrid rice (25, 35 and 45 lb/A) as one factor, and eight imazethapyr applications (0.5, 1, 1.5, or 2 oz/A applied at 1- to 2- leaf (first application) followed by either 1 or 1.5 oz/A applied at 4- to 6- leaf (second application)) as the other factor. Treatments were replicated four times. The experiments were seeded on March 26th and April 23th in Beaumont and March 24th and April 16th in Eagle Lake. Crop management practices were followed according to the 2008 Texas Rice Production Guidelines. Rice injury was estimated visually using a scale of 0 to 100% where 0= no rice injury and 100= rice death. Rice grain was harvested with a mechanical plot harvester when grain moisture was approximately 20%. Final grain yield was adjusted to 12% moisture. The data were subjected to analysis of variance (ANOVA) testing all possible interactions. Means for significant effects were separated using Tukey's test at α=0.05. Early rice injury was observed in trials at Eagle Lake for both planting dates. In the experiment seeded in March, evaluations made 12 days after imazethapyr application on 1- to 2- leaf showed 22% injury in the treatments with the higher dose (2 oz/A). Injury decreased with lower imazethapyr rates. The lowest dose of imazethapyr (0.5 oz/A) demonstrated only 2 to 3% injury at this evaluation. Rice injury was 14% at the lower seed rate being 2% higher than the other seeding rates tested (35 and 45 lb/A). However, in assessments conducted one month after the first application plants had recovered from previous injury and showed no significantly imazethapyr damage. Similar observations were collected from the experiment seeded in April. Evaluations conducted 20 days after the first application demonstrated injury from 10 to 15% at the higher rates and also higher injury at the lowest seeding rate (15%). However, no injury was observed in subsequent evaluations. Nitrogen application and establishment of permanent flood apparently helped the injured rice overcome any disadvantage from early imazethapyr injury especially on sandy soils. No significant injury was observed in experiments conducted at the Beaumont Station. The higher amount of silt, clay, and organic matter at Beaumont reduced plant availability of imazethapyr. Herbicide treatments did not affect rice yield in any of the experiments conducted at either location. Eagle Lake yield was 8455 and 9235 lbs/A from experiments seeded in March and April, respectively. Even though imazethapyr injury occurred early in the season the yield was not affected. Experiments conducted at Beaumont obtained yields of 4270 and 3931 lbs/A when planted on March and April, respectively. Seeding rates affected yield only at Beaumont when rice was planted in March. In this experiment, the lowest yield was obtained at seeding rate of 25 lbs/A. In summary, imazethapyr rice injury occurred in sandy soils when high imazethapyr rates were applied both in early or normal planting dates. However, this early injury did not translate into yield loss. Seeding rates affected plant injury early. Plants were able to recover from injury after nitrogen addition and permanent flood.

HYBRID RICE TOLERANCE TO CLOMAZONE AS AFFECTED BY PLANTING DATE AND SOIL CHARACTERISTICS. S.A. Senseman*,[1] E.R. Camargo,[1] G.N. McCauley,[2] J. Samford,[2] J. M. Chandler[1]; [1]Texas A&M University, Texas AgriLife Research, College Station, TX, [2]Texas AgriLife Research, Eagle Lake, TX

ABSTRACT

Clomazone has been successfully used to control weeds in rice, but crop injury is a potential problem, especially on sandy soils. Also, crop injury can be intensified when hybrid rice is cultivated. Hybrids are drill-seeded using a lower seeding rate. Consequently, hybrids generate low plant densities at the beginning of the season. This can result in greater phytotoxicity because of greater exposure to herbicide doses on a per plant basis. Additionally, the ability of plants to recover from herbicide injury is associated with existing environmental conditions during and after herbicide application. Low temperatures can also exacerbate clomazone injury in early seeded fields. The objective of this study was to evaluate rice injury from clomazone and yield in a hybrid seeded in March and April using different seeding rates. The experiments were conducted during 2008 at the Texas A&M AgriLife Research and Extension Center located at Beaumont and Eagle Lake. The two locations had distinctly different soil characteristics. The Beaumont soil was classified as a Morey silty clay loam having 19.4% of sand, 45.3% of silt, 35.5% of clay, 1.3% of organic matter, and pH of 7.3. The soil at Eagle Lake was a Nada fine sandy loam with 61.4% of sand, 31.2% of silt, 7.4% of clay, 0.75% of organic matter, and pH of 6.1. The experimental design was a randomized complete block with a factorial arrangement. The treatments included three seeding rates of "XL723" hybrid rice (25, 35 and 45 lb/A) as one factor, and seven clomazone rates as the other factor. Clomazone rates were adjusted by location due to soil characteristics, but in both locations the first application was applied preemergence (PRE) and the second was applied at 1- to 2- leaf stage (EPOST). At Beaumont rates ranged from 0.3 to 0.5 lbs/A PRE and from 0 to 0.5 lbs/A EPOST while at Eagle Lake rates ranged from 0.25 to 0.375 PRE and from 0 to 0375 lbs/A EPOST. Treatments were replicated four times. The experiments were seeded on March 26th and April 23th in Beaumont and March 24th and April 16th in Eagle Lake. Crop management practices were followed according to the 2008 Texas Rice Production Guidelines. Rice injury was estimated visually using a scale of 0 to 100% where 0= no rice injury and 100= rice death. Rice grain was harvested with a mechanical plot harvester when grain moisture was approximately 20%. Final grain yield was adjusted to 12% moisture. The data were subjected to analysis of variance (ANOVA) testing all possible interactions. Means for significant effects were separated using Tukey's test at α=0.05. Early rice injury was observed in trials at Eagle Lake for both seedling dates. In the experiment seeded in March, evaluations made 12 days after clomazone application on 1- to 2-leaf showed average injury of 26% among treatments. At this growth stage, greater injury was observed in treatments with higher total doses, especially in those which the highest proportion of the rate was applied EPOST. Treatments that received 0.25 and 0.3 lbs/A PRE plus 0.375 lbs/A EPOST resulted in 35 and 39% injury, respectively. Injury was between 22 to 30% among the other clomazone treatments, except when the lowest rate was applied PRE (0.375 lbs/A) (4% injury). No significantly injury differences were observed among seeding rates. However, in assessments conducted one month after EPOST applications plants had recovered from previous injury and showed no significantly clomazone damage. Similar observations were collected from the experiment seeded in April. Evaluations conducted 11 days after the EPOST application demonstrated injury from 4 to 9% among herbicide treatments and also higher injury at the lowest seeding rate (10%). However, no discernible injury was observed in subsequent evaluations. Higher injury was observed in experiments seeded in March. Despite the higher herbicide doses applied at the Beaumont Station, no significant injury was observed at either seeding date. The higher amount of silt, clay, and organic matter at Beaumont reduced plant availability of clomazone. Herbicide treatments did not adversely affect rice yield in experiments conducted at Eagle Lake, although clomazone injury occurred early in the season. At this location, average yield was 7703 and 8815 lbs/A from experiments seeded in March and April, respectively. Experiments conducted at Beaumont had yields of 4681 and 4345 lbs/A when planted on March and April, respectively. Herbicide rates affected yield at Beaumont in both planting dates. Yield was reduced at the lower total clomazone rates (0.5 and 0.675 lbs/A) probably due to the poor weed control and high grass pressure in those plots. In summary, clomazone rice injury occurred in sandy soils when high clomazone rates were applied at both plating dates, but, was more severe at the early planting dates. However, this early season injury did not translate into yield loss. In Beaumont rates of clomazone did not cause rice injury at any planting date.

ECONOMICS OF CLEARFIELD RICE PRODUCTION. T.P. Carlson*, E.P. Webster, J.B. Hensley, S.L. Bottoms; LSU AgCenter, Baton Rouge, LA

ABSTRACT

Imidazolinone-resistant (IR) rice, which was developed in 1993, offers an opportunity to effectively control red rice with little effect on the crop. The target herbicide for use in IR rice is imazethapyr which is in the imidazolinone herbicide family. Several studies have evaluated the efficacy of imazethapyr on red rice resulting in 93% red rice control with a single postemergence (POST) application and up to 99% control with a sequential application. However, because of costs and total weed control concerns surrounding the most effective imazethapyr timing, the objective of this research is to evaluate the weed control, crop response, cost, yield and economical return of imazethapyr at various application timings throughout the growing season. This study was conducted in 2008 using Clearfield 'CL 161' rice drilled-seeded at 75 lb/A. This study was arranged in a randomized complete block design on a Crowley silt loam soil. Plot size was 5 by 20 feet and each treatment was replicated four times. Imazethapyr was applied at emergence, 1 week after emergence (WAE), 2 WAE, 3 WAE, or 4 WAE followed by an application of imazethapyr 14 days after the initial application on a given treatment. A nontreated was also added for comparison purposes. Imazethapyr was applied at 0.0625 lb ai/A as Newpath at 4 oz/A at all timings. A crop oil concentrate (COC) was added in each application at 1% v/v at all timings. Since all herbicide treatments consist of two applications of Newpath plus a COC, the cost for each herbicide treatment is the same for this study. Therefore, rice yield and quality will play the biggest role in maximizing profit. When the initial application of Newpath was applied at emergence or 1 WAE rice yields were 7010 and 7260 lb/A, respectively compared with the nontreated with a yield of 1240 lb/A. When Newpath was applied at emergence or 1 WAE red rice control was 97%. However, when the initial application was delayed to 2 or 3 WAE, yields were reduced approximately 50% to 3610 and 3450 lb/A, and red rice control decreased to 42 and 50%. When delaying the initial application of Newpath to 4 WAE yields were reduced approximately 75% compared with treatments that received a Newpath application at emergence or 1 WAE. Furthermore, milling and rice grade were also reduced when delaying the initial treatment to 2 WAE or later. The data evaluated in this study suggest that delaying the initial herbicide application can be detrimental to rice production. To maximize profit initial applications should be applied within the first two weeks of rice emergence. Delaying initial application to two weeks after emergence or later would result in reduced profit due to yield, milling, and grade reductions.

STRADA (ORTHOSULFAMURON) COMBINATIONS FOR BROAD-SPECTRUM WEED CONTROL IN CLEARFIELD RICE. C. Leon*; Isagro, Madison, MS

ABSTRACT

Clearfield™ rice production technology has been rapidly adopted by Mid-South rice producers since its introduction. The backbone herbicide in Clearfield rice is imazethapyr, which primarily targets grasses such as red rice and barnyardgrass, but is weak on weeds belonging to the Fabaceae family such as jointvetch and sesbania spp. in addition to various broadleaf weeds in other families. The objective of this research was to identify imazethapyr plus orthosulfamuron tank mixture combinations that would provide broad-spectrum control of the most common weeds found throughout the Mid-South rice production region.

EFFECTS OF LOW RATES OF GLYPHOSATE AND GLUFOSINATE ON RICE. B.M. Davis*,[1] R.C. Scott,[1] N.D. Pearrow,[1] J.K. Norsworthy[2]; [1]University of Arkansas, Cooperative Extension Service, Lonoke, AR, [2]University of Arkansas, Fayetteville, AR

ABSTRACT

A study was conducted to assess the injury caused by low rates of glufosinate and glyphosate on rice. The experiment was conducted near Lonoke, AR in 2007. Wells and XP723 varieties were grown using conventional tillage practices. Herbicide treatments consisted of glyphosate applied at 0 kg ae/ha, 0.13 kg ae/ha, 0.26 kg ae/ha, and 0.53 kg ae/ha. Glufosinate was applied at 0 kg ai/ha, 0.07kg ai/ha, 0.15 kg ai/ha, and 0.31 kg ai/ha. These represent 0x, 1/2x, 1/4x and 1/8x rates, respectively. Treatments were applied at the 3-4 lf, ¼ inch panicle initiation (PI), and boot stages using Roundup Weathermax® (glyphosate) and Ignite280® (glufosinate). Applications were made using a pressurized CO_2 backpack sprayer with a four-nozzle boom delivering a spray volume of 93 liters per hectare. The study design was a randomized complete block with four replications. Visual injury, visual stunting, canopy heights (cm) (taken at heading), heading dates, flag leaf length, and days to heading were recorded for all treatments. Yields were obtained using a small plot combine and adjusted to 12.5% moisture. In general, both varieties responded similarly to glyphosate and glufosinate. Visual injury from the 3-4 lf timing for glufosinate ranged from 0-83% depending on rate at 2 weeks after treatment (WAT). Glyphosate injury at the 3-4lf timing ranged from 0-45% injury. At the ¼ inch PI timing glufosinate injury ranged from 16 to 78% and glyphosate injury ranged from 5 to 10% at 2 WAT. Injury at the boot timing for glufosinate ranged from 15 to 85%. Glyphosate at the boot timing did not show any increase in injury at any rate. By comparison glufosinate caused 15-85% more visual injury at the boot timings than glyphosate. Canopy height was reduced the greatest when both herbicides were applied at the PI timing. Glyphosate reduced canopy height at the PI timing from 5-26 cm. Glufosinate applied at the PI timing reduced canopy heights from 7-24 cm. Flag leaf length was not affected by either herbicide when applied at the 3-4lf timing. Glufosinate reduced flag leaf length from 12- 30 cm when applied at ¼ PI. Glyphosate reduced flag leaf length from 3-21 cm when applied at ¼ PI. Both herbicides did not affect flag leaf length when applied at boot due to the emergence of the flag leaf prior to application. Days to heading were not affected by either herbicide when applied at the 3-4 lf timing. However, days to heading was delayed by both herbicides when applied at the PI and boot timings. The greatest delay in heading occurred at the boot timing with glufosinate delaying heading from 34 to 44 days. Glyphosate delayed heading at the boot stage from 27-44 days. Glufosinate applied at 0.31 kg ai/ha reduced the yield of Wells by 37% and XP723 by 29% when applied at the 3-4 lf timing. Glyphosate applied at 0.53 kg ae/ha reduced yields at the 3-4 lf timing of Wells by 65% and XP723 by 91%. When herbicides were applied at the PI timing yields were reduced from 9-70%. Glufosinate at 0.31 kg ai/ha reduced yield of Wells by 55% and XP723 by 39%. Glyphosate applied at 0.53 kg ae/ha reduced yields of both cultivars by 70%. Yields were reduced the greatest when herbicides were applied at the boot timing. Glufosinate applied at 0.31 kg ai/ha reduced yield of Wells by 93% and XP723 by 91%. When glyphosate was applied at 0.53 kg ae/ha yields were reduce by 93% for Wells and 95% for XP723.

DIETHOLATE ALLOWS INCREASING CLOMAZONE RATE IN RICE CROP ACCORDING TO SOIL CHARACTERISTICS. L.A. de Avila*,[1] D.M. Sanchotene,[1] N.D. Kruse,[1] S.L. Machado,[1] M.M. Trezzi,[2] G.A. Nicolodi[1]; [1]University Federal of Santa Maria - UFSM, Santa Maria, Brazil, [2]University Technological Federal of Parana - UFSM, Pato Branco, Brazil

ABSTRACT

Clomazone use in rice at higher rates can constitute an alternative to the 'Clearfield' system and also to control perennial grasses tolerant to other herbicides. However, to achieve this, clomazone selectivity to rice must be improved. Dietholate, an herbicide extender, has been shown to enhance clomazone selectivity when treated on rice seeds. Dietholate probably acts as an inhibitor of clomazone activation in rice plants. To determine the extent that the clomazone rate can be increased and potential interaction with rice cultivars and soil characteristics was the objective of this work conducted in Rio Grande do Sul, Brazil in 2007 and 2008. Dose-response curves were made using 0; 0.156; 0.312; 0.625; 1,250; 2,500; 5,000 and 10,000 g a.i. ha-1 of clomazone applied pre-emergence (1.4-L pots) with IRGA 409 and IRGA 417 rice cultivars seeds treated with 0 and 500 g of dietholate 100 kg of rice seeds-1 (8 plants pot-1), in a sandy (16% clay; 1.6% O.M.) and in a clay (43% clay; 3.2% O.M.) soil. Rice plant injury (%), fresh weight and dry weight (g pot-1) showed that both cultivars tolerated approximately double the clomazone rate when treated with dietholate in two of the soils tested. The clay soil allowed more than twice clomazone rate compared with the sandy soil (dry weight GR50 279 and 782 g i.a. ha-1 of clomazone for without and with dietholate, respectively in sandy soil; 941 and 2051 g i.a. ha-1 in clay soil). These results suggest that it is possible to use dietholate as a safener for clomazone use in rice and that the rate needs to be adjusted accordingly with soil texture.

EFFECT OF POSTFLOOD TIMING AND SINGLE VERSUS SEQUENTIAL CLINCHER APPLICATIONS ON BARNYARDGRASS CONTROL IN RICE. J.A. Still*, J.K. Norsworthy, S. Bangarwa, M.J. Wilson, G. M. Griffith, R.C. Scott, L.E. Estorninos; University of Arkansas, Fayetteville, AR

ABSTRACT

Clincher (cyhalofop) is often applied postflood in rice for control of barnyardgrass. As a result of the postflood timing, barnyardgrass is generally large at the time of application and failure of cyhalofop to provide consistent control with a single application is common. Research was conducted in 2007 and 2008 at the Rice Research and Extension Center in Stuttgart, AR, to determine the influence of postflood timing and compare single and sequential cyhalofop applications for barnyardgrass control. 'Wells' rice was drill-seeded at 24 seed/ft of row on April 18, 2007, and May 1, 2008, in 7.5-in-wide rows. The test site contained a natural infestation of barnyardgrass and was flooded both years at the 5- to 6-leaf stage of rice. Herbicide treatments included cyhalofop at 0.28 lb ai/A applied 1 d prior to flooding (PREFL), 7 d postflooding (POSTFL), 14 d POSTFL, and 21 d POSTFL. Additional treatments included the previous timings followed by a second application of cyhalofop at 0.19 lb/A at 14 d after the initial treatment. All cyhalofop treatments contained crop oil concentrate at 1% v/v and were applied at 10 gal/A. A nontreated control was included. Crop injury and barnyardgrass control were rated weekly beginning 2 wk after the PREFL application. In 2007, end-of-season control of barnyardgrass was similar between single and sequential applications for all timings, except the single 14-d POSTFL application. Excluding the 14-d POSTFL application, barnyardgrass control in all cyhalofop treatments was at least 98% in 2007. Conversely in 2008, due in part to the later planting of rice, barnyardgrass exhibited more robust early-season growth and was more difficult to control with cyhalofop. Cyhalofop applied PREFL controlled barnyardgrass only 68% at 2 WAT. Control further declined throughout the season and end-of-season control was only 28% when a single cyhalofop application was made before flooding. Delaying the single application of cyhalofop to 7 d POSTFL improved barnyardgrass control, with end-of-season control averaging 91%. Barnyardgrass declined with further delays in application timing, with end-of-season ratings averaging 78 and 10% when cyhalofop was applied at 14 and 21 d POSTFL. Following the PREFL with a POSTFL application improved late-season control to 89%, which was comparable to other sequential applications that were made 7 and 14 d POSTFL (90% control). Sequential applications that began 21 d POSTFL were not effective in controlling barnyardgrass, which averaged 46% control late in the season. No rice injury was observed in either year. Due to the high level of control in 2007, rice yields were comparable among herbicide treatments, ranging from 152 to 169 bu/A. In 2008, delaying cyhalofop applications, including sequential applications, to 14 or 21 d POSTFL reduced rice yield. Single and sequential applications, with the first application made PREFL or 7 d POSTFL, resulted in comparable yields.

HIGH RESIDUE WINTER COVER CROPS DEPLETE WINTER ANNUAL WEED SEED ACROSS A LANDSCAPE IN A LONG-TERM TILLAGE STUDY. J.A. Kelton*,[1] E. van Santen,[1] J.N. Shaw,[1] A.J. Price,[2] F.J. Arriaga,[2] K.S. Balkcom,[2] R.L. Raper,[2] D.W. Reeves[3]; [1]Auburn University, Auburn, AL, [2]USDA-ARS National Soil Dynamics Laboratory, Auburn, AL, [3]USDA-ARS J. Phil Campbell Sr. Natural Resource Conservation Center, Watkinsville, GA

ABSTRACT

Cover crops combined with conservation agriculture systems have the potential to maximize environmental benefits achieved when practicing reduced tillage. A greenhouse study was conducted in 2006 through 2008 to determine the effects of cover crops on weed seed density within the soil seedbank under varying farming practices and topographical conditions. In mid-October, 2006, soil samples were collected from an on-going field-scale study located at the E.V. Smith Research and Extension Center, Alabama, USA. A factorial arrangement of the experiment included conventional and conservation tillage, with and without manure applications, under a cotton-corn rotation with both crops present during the growing season. Landscape positions identified as treatments included summit, backslope, and drainage way. Cover crops included a crimson clover, fodder radish (*Raphanus sativus* L.), and white lupin (*Lupinus albus* L.) mix preceded corn and a rye-black oat mixture preceded cotton in the conservation tillage plots. Covers were planted in late fall; termination of the clover, radish, lupin cover occurred in mid-March; termination of the rye-black oat cover occurred in mid-April. Six replications were made in the field and subsequently divided into equal cells with 3 replications of each treatment grouping being sampled for the study. Soil cores were divided into an upper (0-0.076m) and lower (0.076-0.152m) sample. Samples were placed in the greenhouse, allowed to germinate, and seedlings were identified until germination ceased at approximately five months. Samples were then chilled at 36°F to five months and the process repeated two additional times. Weed seed density consisted of over 80 % henbit (*Lamium amplexicaule* L.) throughout the experiment. Data analysis found that weed seed density was decreased in conservation tillage when compared to conventional tillage at both the upper and lower soil levels. Species richness and evenness were influenced by tillage only in the lower sample, with richness and variation being greater in conventional tillage. Additionally, density of the seedbank was reduced in the upper sample of no-till cotton with rye-oat cover in comparison with no-till corn plots with the clover-radish-lupin cover. These findings indicate that high residue cover crops could be incorporated into farming systems as an effective aid in suppressing winter weed seed germination.

DO WEED-SUPPRESSIVE RICE LINES MAINTAIN WEED CONTROL AT REDUCED PLANTING DENSITIES? D.R. Gealy*, W. Yan; USDA-ARS, DBNRRC, Stuttgart, AR

ABSTRACT

Weed interference and control have long been major costs to U.S. rice production systems and are even more challenging and unpredictable in reduced-herbicide-input systems. Although conventional cultivars typically suppress weeds very little, indica lines and commercial hybrid cultivars have frequently suppressed barnyardgrass (*Echinochloa crus-galli*) and other grasses substantially at traditional planting rates. We hypothesized that cultivars with proven natural weed suppression or high tillering traits would maintain superior weed suppression capabilities, even at low planting densities. Thus, a field study was undertaken to determine the degree to which reduced planting rates used in commercial hybrid rice production would affect natural weed suppression of conventional and weed suppressive cultivars. The experimental design was a split plot with five cultivars by three planting densities as the main plots, two weed levels (weed-free; or weedy, with barnyardgrass) as the sub plot, and four replications. Cultivars included the non-suppressive conventional long-grain, 'Wells', the weed-suppressive or high-tillering Asian indicas, 'PI312777', '4484-1693' ('Rondo'), and '4612', and the commercial hybrid 'XL723'. Rice planting densities of 160, 320, and 480 seeds/m^2 were established. The lowest was similar to that used for hybrid cultivars and the highest was approximately the maximum recommended for drill seeding of traditional cultivars in Arkansas. Uniform barnyardgrass stands were established in weedy plots using the natural infestation in the soil supplemented with a broadcast seeding at planting. Experiments were planted May 7, 2007 and May 19, 2008 at Stuttgart, AR. Weed-free plots were sprayed post-emergence with propanil + quinclorac (4.4 + 0.275 kg ai/ha) and hand-weeded to prevent weed growth. Weedy plots were sprayed post-emergence with a 1/4X rate of propanil (1.1 kg ai/ha; to provide mild stunting of barnyardgrass) and with 0.55 kg ai/ha bentazon to kill broadleaf weeds. Weed control was rated visually at midseason; 100% indicated complete weed control and 0% indicated no weed control relative to a weedy plot without rice. Rough rice grain yield and other biological variables for rice were expressed as a percentage of weed-free rice plots. Biological variables for weeds were expressed relative to their levels in weedy plots with no rice present. Over all planting densities and years, maximum yield potential in weed-free plots was greatest for XL723, averaging 9860 kg/ha, and was lowest for Wells, averaging 8120 kg/ha. Generally, tillering density potential was lowest for Wells and highest for PI 312777, which averaged 31% more than Wells over the two years. In 2007, XL723 had greater natural weed suppression and maintained greater yield performance in weedy plots (as percent of weed-free) than all other cultivars at all planting densities, and weed suppression and grain yields also increased with planting density. In 2008, these trends continued, except that the cultivar responses were usually indistinguishable. Overall, weed control ratings ranged from 38% (4484-1693 at 160 seeds/m^2) to 73% (XL723 at 480 seeds/m^2) in 2007 and from 31% (Wells at 160 seeds/m^2) to 64% (XL723 at 480 seeds/m^2) in 2008. Similarly, rice yield (as percent of weed-free) ranged from 39% (4484-1693 at 160 seeds/m^2) to 82% (XL723 at 480 seeds/m^2) in 2007. In 2008 however, the yields followed a somewhat unexpected pattern, ranging from 26% for XL723 at 160 seeds/m^2 to 83% for Wells at 480 seeds/m^2. Although somewhat variable for the two years, PI 312777 appeared to maintain relatively stable suppression of weeds and yield production under weed pressure compared to Wells, which was among the cultivars most sensitive to planting density. This observation is consistent with both the proven allelopathic activity of PI 312777 and its high tillering potential. Overall, these results indicate that at low planting densities, even the high tillering or allelopathic lines did not consistently provide weed suppression or maintain high yields in the presence of uncontrolled weed pressure. However, PI 312777 and XL723 performed relatively well compared to the conventional cultivar, Wells, which tended to lose weed suppression activity dramatically at low planting densities. Moderate to high planting densities are likely to remain necessary for consistent weed suppression in reduced-herbicide-input systems.

BROADLEAF WEED CONTROL ON ARKANSAS RICE LEVEES. S.K. Bangarwa*, J.K. Norsworthy, R.C. Scott, J. Still, M.J. Wilson, G.M. Griffith, L.E. Estorninos; University of Arkansas, Fayetteville, AR

ABSTRACT

Until recently, weed control on rice levees has not been a component of weed management research programs in rice. However, weed management on levees is critical to many rice farmers, especially for those whose levees comprise a large percentage of the overall field and ultimately of rice yield. The objective of this research was to develop effective late-season control options for managing broadleaf weeds on rice levees. Field experiments were conducted on a RCB design replicated four times at Lonoke and Stuttgart, AR, in 2007 and 2008. Rice levees were constructed using standard practices and were broadcast seeded with 'Wells' rice and various broadleaf weed species. Propanil, triclopyr, 2,4-D, acifluorfen, carfentrazone, penoxsulam, quinclorac, halosulfuron, bentazon, and bispyribac were evaluated alone and in combination with propanil or quinclorac. All herbicides were applied POST at labeled rates, and the combinations that resulted in double the labeled rates for propanil or quinclorac were excluded. Hemp sesbania (Sesbania herbacea) and prickly sida (Sida spinosa) were evaluated at both locations both years, whereas Pennsylvania smartweed (Polygonum pensylvanicum) and Palmer amaranth (Amaranthus palmeri) were evaluated at a single site for at least one year. Visual ratings for rice injury and weed control were recorded at 2 and 4 wk after treatment (WAT). Rice injury was minimal (≤5%) following all herbicide treatments at 2 WAT, and no injury was observed at 4 WAT. Propanil, triclopyr, 2,4-D, acifluorfen, and carfentrazone applied alone and all herbicides in combination with propanil and quinclorac controlled hemp sesbania >90% through 4 WAT. Prickly sida was selectively responsive to 2,4-D and was controlled 83 to 85% with 2,4-D applied alone or with quinclorac. Pennsylvania smartweed was controlled >90% by 2,4-D, acifluorfen, and carfentrazone applied alone or in combination with propanil or quinclorac. Additionally, halosulfuron with propanil and penoxsulam with quinclorac were effective on Pennsylvania smartweed. Palmer amaranth was the weed most difficult to control, with a maximum of 78 and 73% control achieved with 2,4-D and acifluorfen applied with propanil. Overall, considering the diverse weed flora, including all of the above broadleaf weed species, 2,4-D alone or in combination with quinclorac is the best option for rice levee weed control.

USE OF RICEPYR FOR BROADLEAF WEED CONTROL ON RICE LEVEES. M.J. Wilson*, J.K. Norsworthy, S. Bangarwa, G. Griffith, J. Still, R. Scott; University of Arkansas, Fayetteville, AR

ABSTRACT

Weed control on rice levees is one of the one of the most daunting tasks rice producers face each year. Saturated soil on levees is conducive for continual weed emergence, even after establishment of the permanent flood within bays. Often, two or more herbicides applied jointly are needed to maintain a high level of weed control on levees. RicePyr LC®, a mixture of propanil (3 lb ai/gal) and triclopyr (0.33 lb ai/gal), will be marketed in rice in 2009 for economical, broad-spectrum control of broadleaf weeds on levees. An experiment was conducted at three sites in 2008 to evaluate the spectrum of control and effectiveness of RicePyr LC for broadleaf weed control on levees. The experiment was conducted at Lonoke, Pine Tree, and Stuttgart, AR. 'Wells' rice was broadcast seeded on 2-ft tall levees at 120 lb/acre, with 10 ft between levees. Plots were 30 ft in length and replicated four times. Herbicide treatments evaluated were RicePyr LC at 2 qt/A (propanil at 1.5 lb/A plus triclopyr at 0.165 lb/A), RicePyr LC at 3 qt/A (propanil at 2.25 lb/A plus triclopyr at 0.25 lb/A), and a standard treatment of SuperWham at 2 qt/A plus Grandstand at 0.67 pt/A (propanil at 2.0 lb/A plus triclopyr at 0.25 lb/A). Crop oil concentrate was added to all herbicide treatments at 1% (v/v), and herbicides were applied at 15 or 20 gal/A. A nontreated control was included. Treatments were applied when the largest weed was 6 to 12 in tall or had 6- to 12-in runners (morningglories). Weed control and crop injury were rated at 2 and 4 weeks after treatment. Hemp sesbania, eclipta, Pennsylvania smartweed, and pitted morningglory were present at Lonoke. At Lonoke at 4 WAT, the low rate of RicePyr LC was not as effective as the standard treatment for control of pitted morningglory, eclipta, and hemp sesbania. The high rate of RicePyr LC provided weed control at 4 WAT comparable to the standard treatment, except for eclipta. Control of all weeds with the high rate of RicePyr LC was >80% at Lonoke at 4 WAT. At Stuttgart, hemp sesbania and ivyleaf morningglory were evaluated. Control of both weeds was comparable between the high rate of RicePyr LC and the standard treatment at 4 WAT, with RicePyr LC providing at least 89% control. Weeds present at Pine Tree included hemp sesbania, entireleaf morningglory, eclipta, and Palmer amaranth. Control of all weeds with the highest rate of RicePyr LC was comparable to the standard treatment at 4 WAT. The high rate of RicePyr LC controlled hemp sesbania 89%, entireleaf morningglory 75%, eclipta 68%, and Palmer amaranth 81% at 4 WAT. No rice injury was observed at each site. In summary, RicePyr LC at 3 qt/A generally provided equivalent weed control to our selected standard treatment, but weed control with RicePyr LC at 2 qt/A was often less than the standard treatment.

IMPACT OF SUMMER RAINFALL TO WEED INFESTATION OF RAINY SEASON RICE UNDER DIFFERENT MANAGEMENT PRACTICES IN WEST BENGAL, INDIA. G. Saha*, K. Brahmachari, R. kundu; Bidhan Chandra Krishi Viswavidyalaya, Kolkata, India, India

ABSTRACT

As Indian population has been hiking annually 1.2%, while the average growth rate of total food grain production is nearby 0.8%. so the only option to us is to produce more and more food for people. A number of factors have the responsibility for reducing the yield of crop like insect - pest , severe infestation of weeds. The average yield reduction from weeds in India ranges 12-78 % ; in transplanted rice 30-40 % and in drilled rice it is 70-80%. So , to study the correlation between the amount of summer rainfall and population and growth behavior of weeds in rice field before harvesting an attempt was made in Bidhan Chandra Krishi Viswavidyalaya (Lat:$22^0 57^/$ N , Long:$88^0 20^/$E and Altitude : 7.8m) Kalyani, West Bengal , India in two consecutive years during 2005 and 2006 kharif seasons(Rainy season) with nine treatments replicated thrice. The treatments details were R_1 = un weeded control, R_2 = Hand weeding at 20 DAT , R_3 = Hand weeding at 20 DAT and 40 DAT,R_4 = Butachlor @ 1.5kg/ha at 4 DAT, R_5= Pendimethalin @1.5kg/ha at 4 DAT, R_6= Oxadiargyl @0.1kg/ha at 4DAT, R_7 = Hand weeding at 20 DAT + Butachlor @ 1.5kg/ha at 4 DAT, R_8= Pendimethalin @1.5kg/ha at 4 DAT + Hand weeding at 20 DAT, R_9 = Oxadiargyl @0.1kg/ha at 4DAT + Hand weeding at 20 DAT. All the weed management practices significantly decreased the number of grasses, sedge and broad leaf weed over the treatment of un weeded control (R_1). At 30 DAT R_9 treatment recorded the lowest number of all sorts of weeds. At harvest the lowest density of weeds was observed in R_3 treatment. At 30 DAT the treatment(R_9) recorded the lowest weed biomass. The weed population was monitored during July - September in both the years. The highest level of rainfall , which was highly favorable for weed development and dissemination was observed between 1 july to 30th September during both the years. The major weed species were *Echinochloa crusgalli, Leersia hexandra ,Leptochloa chinensis* (Grassy weed), *Cyperus iria , Cyperus difformis* (Sedges) , *Eclipta alba , Marsilea quadrifolia* (broadleaf weed) where mechanical and chemical weed control significantly reduced the level of weed infestation . Weed bio mass in rainy seasons (Monsoon season) rice plots before harvesting increased 1.6gm /m^2 (Grass),1.5gm /m^2 (sedges) and 6.4gm/m^2 (broad leafs) for every 100 mm increase in rainfall. Maximum temperature ranges 32 -36.9^0 C , Minimum temperature 25 -26.8^0 C and Relative humidity 93-98.9 % (Max.) also influenced greatly to the production of harvest- time bio mass of the weeds. This will guide to the weed scientist to develop weather based growth model of various weeds in future. Identification of weed seed bank under various climatic condition with proper management practices will be the another line of recent thinking.

BERMUDAGRASS TOLERANCE AND WEED CONTROL IN PASTURES WITH COMBINATIONS OF NICOSULFURON AND METSULFURON. E.K. Kraka*, J.D. Byrd, J.M. Taylor; Mississippi State University, Mississippi State, MS

ABSTRACT

Many native and non-native plants pose a threat in pastures. Typical examples are johnsongrass *(Sorghum halepense)* which contain glycoside and when it breaks down results in production of prussic acid (hydrocyanic acid) and the aerial parts of horsenettle (*Solanum carolinense*) which contain solamine that is toxic to cattle and sheep. In 2006, 2007 and 2008 field experiments efficacy of nicosulfuron and metsulfuron combinations were evaluated for bermudagrass tolerance and weed control. In the first experiment knootroot foxtail *(Setaria parviflora),* johnsongrass *(Sorghum halepense)* and horsenettle (*Solanum carolinense*) were visually evaluated at 44 DAIT (Days After Initial Treatment) and 101 DAIT after herbicide applications on June 20, 2006 and September 11, 2006. Rubus spp, johnsongrass and horsenettle were visually evaluated 65 DAIT after herbicide applications made July 03, 2007 and August 23, 2007 for the second experiment. In the third experiment, 1- and 4-5 tiller barnyardgrass *(Echinochloa crus-galli)* control was visually evaluated 7, 25, 43 and 67 DAIT following two herbicide applications on May 29, 2008 and July 16, 2008. "Tifton 44" injury and yield reduction were also evaluated following herbicide applications on July 03, 2007 and August 23, 2007. "Tifton 44" injuries were evaluated 20, 29, 65 and 79 DAIT while yield reduction was evaluated once at 31 DAIT. Treatments in all the experiments consisted of untreated and treated. All herbicides were applied with NIS (0.5%) except Accent + Cimarron + MSO at 0.844 + 0.225 oz/A for barnyardgrass control. The experimental design in each experiment was a randomized complete block. Treatments were evaluated visually with a 0 (no control) to 100% (fully control) scale. Data were converted to percent control and were compared with untreated. The data were subjected to ANOVA and means were separated by Fishers Protected LSD P= (0.05). Numerically, knotroot foxtail control with all Accent combinations were lower ranging from 30 to 45% at 44 DAIT than 50 to 68% at 101 DAIT, except Plateau at 1.5 oz ai/A which provided 30% control at 44 DAIT but decreased to 23% by 101 DAIT. All herbicides applied showed similar control of johnsongrass which ranged from 85 to 95% by 44 DAIT. However, without the second sequential application Accent + Cimarron at 0.623 + 0.10 oz ai/A, 0.782 + 0.125 oz/A, 0.938 + 0.15 oz/A or a three way mix of Accent + Cimarron + Karmex at 0.623 + 0.10 +12.8 oz/A and Plateau at 1.5 oz/A, control decreased from 93 to 30%, 93 to 73%, 90 to 60%, 85 to 30% and 90 to 65%, respectively, at 101 DAIT. The level of johnsongrass control with the sequential applications of Accent + Cimarron at 0.623 + 0.10 oz/A or 0.782 + 0.125 oz/A, rendered 90 and 88% johnsongrass control at 101 DAIT, respectively. Horsenettle control with a single application of Accent combinations ranged from 78 to 91% at 44 DAIT. Horsenettle control with or without sequential applications increased at the later evaluation timing to 93 to 100% control at 101 DAIT. Although Accent + Cimarron + Karmex at 0.623 + 0.10 + 12.8 oz/A was not followed by sequential application like Accent + Cimarron at 0.782 + 0.125 oz/A, both rendered similar 90 and 98% control of horsenettle at 44 and 101 DAIT respectively. However, Plateau at 1.5 oz/A control of horsenettle was significantly lower than almost all Accent combinations at only 75% and 73% at 44 and 101 DAIT, respectively. In the second experiment in 2007, Rubus spp., johnsongrass and horsenettle control were 100% with sequential applications of Accent + Cimarron at 0.623 + 0.10 oz/A or Accent + Cimarron at 0.782 + 0.125 oz/A at 65 DAIT. Barnyardgrass control was excellent when treated at the 1-tiller growth stage. Application of all Accent combinations rendered 73% to 95% control of barnyardgrass at 7 DAIT and 85 to 95% at 25 DAIT. However, barnyardgrass control decreased because of new germination. The new germinating barnyardgrass was retreated at 4 - 5 tiller stage and sequential applications with Accent + Cimarron 0.563+0.15 oz/A and Accent + Cimarron at 0.844 + 0.225 oz/A rendered 48% and 65% control at 67 DAIT, respectively, while other Accent combinations provided 0 to 8% control. At 67 DAIT, Accent + Cimarron at 0.563 + 0.15 oz/A, Accent + Cimarron at 0.703 + 0.188 oz/A and Outrider at 1.0 oz ai/A without sequential application provided no control of barnyardgrass. Journey applied at 6.75 oz ai/A caused significant injury (68%) to “Tifton 44” at 20 DAIT while all Accent combinations caused injury that ranged from 28 to 43% and Outrider caused only 5%. At 29 DAIT, it was observed that Journey, Accent combinations and Outrider “Tifton 44” injury was reduced to 58%, 10 to 18%, and no injury, respectively. At 79 DAIT, none of the herbicides applied caused injury to “Tifton 44” except Journey which was still 23%. The lowest percentage of “Tifton 44” yield reduction occurred with Outrider, 6% while all Accent combinations caused injury that ranged between 22 and 30% at 31 DAIT. There were no significant differences among the all Accent combination effects on “Tifton 44” yield reduction. However, Journey rendered the highest significant yield reduction of 84% at 31 DAIT.

PERENNIAL PEPPERWEED RESPONSE TO SHEEP GRAZING. J.E. Creech*, J.C. Davison; University of Nevada Cooperative Extension, Fallon, NV

ABSTRACT

Two studies were conducted in Reno, Nevada to determine the effect of grazing on perennial pepperweed growth. Each trial was established to investigate a different grazing strategy; 1) short duration intensive grazing (small plot trial) and 2) longer duration, less intensive grazing (large plot trial). Both studies were initiated in 2005 and consisted of two treatments, grazed and non-grazed. Individual treatments were replicated three times and were applied to plots that measured 0.5 acres in the small plot trial and approximately 10 acres in the large plot trial. Grazing in each study occurred three times per year for three consecutive years. Perennial pepperweed density and biomass was reduced in the grazed plots compared to the nontreated check in the small plot trial. In this trial, however, nongrazed plots had significantly greater species diversity than grazed plots. No significant differences existed among grazed and nongrazed plots in the large plot trial. These results suggest that grazing for perennial pepperweed management should be intensive and short in duration. One drawback to this approach is potential injury to nontarget perennial species.

SELECTIVE BURNDOWN OF COMMON MILKWEED (*ASCLEPIAS SYRIACA*) AND HEMP DOGBANE (*APOCYNUM CANNABINUM*) IN A LEGUME-RICH TALL FESCUE (*FESTUCA ARUNDINACEA*) HAYFIELD. R.S. Chandran*; West Virgnia University, Morgantown, WV

ABSTRACT

Selective management of common milkweed (*Asclepias syriaca* L.) and hemp dogbane (*Apocynum cannabinum* L.), perennial broadleaf weeds in cool season pastures and hayfields, without killing desirable legumes, is a common grower concern. To address this, field experiments were conducted in Morgantown, West Virginia, in an established tall fescue (*Festuca arundincea* Schreb.) hayfield containing red clover (*Trifolium pretense* L.) and orchardgrass (*Dactylis glomerata* L.) as desirable forage species. Herbicide treatments consisted of carfentrazone at 34.75 g ai/Ha with or without 2,4-DB at 560 g ai/Ha, along with or without methylated seed oil (MSO) as an adjuvant at 0.5 or 1% (vol/vol). Herbicides were applied after first cutting of hay on August 7, 2008, using a CO_2-pressurized backpack sprayer calibrated to deliver 281 L/Ha. Weeds were 30 to 45 cm tall, and at the pre-bloom to full-bloom stage at the time of herbicide application. Weed control ratings and red-clover injury ratings were recorded up to two months after treatment (MAT). Results indicated that carfentrazone applied by itself or in combination with 2,4-DB provided good control (>80%) of the weeds at 2 MAT. Similar treatments without MSO failed to provide good control of either weed. A tank-mixture of the two herbicides along with a reduced rate (0.5%) of MSO also controlled the weeds. Weed control was observed as early as one week after herbicide application. Mild to moderate (1 to 5 on a 0-10 scale; where 0 = no injury and 10 = plant kill) legume injury was recorded in plots that received the effective herbicide treatments, however, new growth was observed at six weeks after treatment, regardless of the herbicide treatment. Tall fescue and orchardgrass were not injured by any of the treatments. Common milkweed at the full-bloom stage was not controlled as effectively as the weed at the pre-bloom stage.

UTILITY OF SAFLUFENACIL FOR BROADLEAF WEED CONTROL IN NON-CROP USE PATTERNS.

J. Zawierucha*, G. Oliver, J. O'Barr, L. Charvat, B. Guice, L. Newsom, C. Youmans, W. Thomas, S. Willingham; BASF Corporation, Research Triangle Park, NC

ABSTRACT

Saflufenacil is a new herbicide being developed by BASF for annual broadleaf weed control in a variety of crop and non-crop areas. Saflufenacil provides rapid postemergence "knockdown" of broadleaf weeds as well as rate dependent residual control. BASF testing has demonstrated saflufenacil to have potential in several non-crop markets including: industrial, rights-of-way, turfgrass, as well as aquatic weed management. For industrial "bareground" applications, saflufenacil has been tested at rates up to 400 g ai/ha for control of a broad spectrum of weeds including horseweed (*Conyza canadensis*), kochia (*Kochia scoparia*), Russian thistle (*Salsola kali*), and pigweed (*Amaranthus spp*.). Field trials have demonstrated that a number of perennial grasses are tolerant to saflufenacil. This grass selectivity provides the potential for use in rights-of-way areas to control weeds such as horseweed and giant ragweed (*Ambrosia trifida*) while maintaining desirable grasses for erosion control. In utility applications, research has demonstrated that mixtures of saflufenacil and glyphosate can effectively control volunteer pine (*Pinus spp*.). Research results suggest that saflufenacil should become a versatile herbicide for non-crop weed control applications.

TALL FESCUE SEED HEAD SUPPRESSION WITH METSULFURON PLUS AMINOPYRALID. W.W. Witt*; University of Kentucky, Lexington, KY

ABSTRACT

Tall fescue is frequently infected with the endophytic fungus, *Neotyphodium coenophialum*, which grows in tillers, culms, and inflorescence. Grasses infected with the endophyte produce ergot alkaloids which frequently cause bovine and equine toxicosis. The endophyte provides a biological advantage to tall fescue in that transmission of the endophyte through tall fescue seeds protects the plant against pests. Prevention of tall fescue seeds by herbicides and other plant growth regulators also causes a reduction in tall fescue forage. Also, as tall fescue growth is reduced it loses vigor and competitiveness which allows weeds to establish and grow. Research conducted in 2007 and 2008 Lexington KY evaluated mixtures of metsulfuron and aminopyralid for weed control, seed head suppression, forage injury and forage yield in mixed stands of tall fescue, Kentucky bluegrass, and orchardgrass. The grasses in the experimental sites were established for over 10 years. A formulated mixture of GF-2050 (Dow AgroSciences) containing 52.5% aminopyralid and 9.45% metsulfuron was applied at "green up" in early April of both years. Aminopyralid at 56 g ae ha^{-1} plus metusulfuron at 10 g ae ha^{-1} or aminopyralid at 92 g ae ha^{-1} plus metsulfuron at 16 g ae ha^{-1} reduced tall fescue seed heads by 65 to 72% in 2008 and 89 to100% in 2007 compared to untreated controls. Kentucky bluegrass and orchardgrass seed head production was not reduced by the herbicides. Some chlorosis of tall fescue was noted from 7 to 21 days after herbicide treatment; however, normal color returned for the rest of the growing season. Tall fescue yield was reduced from the herbicide treatments in 2007 but not in 2008, compared to the untreated control. Orchardgrass and Kentucky bluegrass yield was not reduced. Broadleaf weed control was excellent in all treatments.

NATIVE GRASS TOLERANCE TO AMINOPYRALID AND DPX- KJM44. J.D. Vassios, C. Douglass, M. Bridges, B. Lindenmayer*, S. Nissen; Colorado State University, Fort Collins, CO

ABSTRACT

Restoration of disturbed lands often involves a re-vegetation component that seeks to build a diverse native plant community; however, perennial and annual weeds can often out compete restoration species. Commercially available Milestone (aminopyralid) and currently experimental DPX-KJM44 (aminocyclopyrachlor) are herbicides that could be used to control invasive or noxious weeds in rangeland, pasture, and natural areas, while allowing certain native grass species to become established. The objective of our study was to determine how application timings and herbicide rates affect the establishment of warm and cool season native grasses. Pre-plant herbicide treatments were applied in June and September 2007 and seven cool and eight warm season grasses were seeded in February 2008. Post-emergence applications were applied to seedling and fully tillered grass in the spring and summer of 2008. At each timing, aminopyralid and aminocyclopyrachlor were applied at two rates. In general, warm season grasses were more tolerant than cool season grasses to both herbicides regardless of rate or application timing. Cool season grasses were most sensitive to aminocyclopyrachlor when applied post-emergence at the seedling stage; however, warm season grasses were most sensitive to aminopyralid when soil-applied in September. Both warm and cool season grasses were tolerant when herbicides were applied pre-plant in June. Across all grasses, herbicide timing was more important than herbicide rate. These data suggest that pre-plant applications made nine month prior to grass seeding allowed for better establishment of restoration species, with warm season grasses being slightly more tolerant to both herbicides.

LONG-TERM RESPONSE OF AFRICAN RUE (*PEGANUM HARMALA*) AND ASSOCIATED VEGETATION TO HERBICIDES. T.M. Sterling*, L.B. Abbott, N. Klypina, K.S. Branum; New Mexico State University, Las Cruces, NM

ABSTRACT

African rue is an invasive herbaceous perennial that primarily invades disturbed areas. This species is toxic to cattle and sheep, and has been reported in 8 western states, with its largest center of distribution is southern New Mexico and West Texas. Established populations are persistent and difficult to control. We evaluated the long-term response of African rue and associated vegetation to 3 herbicides (hexazinone, imazapyr, and metsulfuron). We tested the effects of herbicide type, application date, and plant moisture stress on necrosis, African rue seedling density, and density of associated grasses and forbs at 2 locations in southern New Mexico. Herbicides were applied in Spring, Summer, or Fall 2004, and evaluated annually through 2007. At both sites, target plants sprayed with hexazinone and imazapyr were at least 30 to 40% more necrotic after 3 growing season relative to non-sprayed controls. Early necrotic response to metsulfuron was short-lived, and was not sustained after 2 growing seasons. Hexazinone was most effective when sprayed in June, whereas effects of application date were site-dependent for imazapyr. Imazapyr and metsulfuron reduced African rue seedling density after the first growing season, but this effect was short-lived. Density of African rue seedlings was significantly reduced by hexazinone, and a reduction of at least 50% was sustained through 3 growing seasons. Metsulfuron was least damaging to associated grasses and forbs. Both hexazinone and imazapyr significantly reduced associated vegetation. Supplemental water had negligible effect on herbicide efficacy. Overall, hexazinone provided the most effective control of mature plants and seedlings of African rue, but was also most detrimental to associated vegetation.

KUDZU SUPPRESSION BY HERBICIDES IN TWO-YEAR FIELD TRIALS. M.A. Weaver*, M.E. Lyn, C.D. Boyette, R.E. Hoagland; USDA ARS, Stoneville, MS

ABSTRACT

Herbicides are currently the principle means of halting the spread of kudzu (*Pueraria montana* var lobata) and reclaiming kudzu-infested lands. The efficacy of several herbicides on this invasive weed has been well-established, but these chemicals can be prohibitively expensive, come with significant use restrictions or have unacceptable non-target toxicity. The present field study evaluated amniopyralid, fluroxypyr, glyphosate, metsulfuron, and triclopyr for suppression of kudzu at 3 sites in west-central Mississippi over one or two growing seasons. Herbicides were applied to mature stands of kudzu at their maximum label rate in 61 L ha -1 total volume with 0.25% Silwet L-77 nonionic surfactant. A single application of commercial formulations of amniopyralid, fluroxypyr, metsulfuron, and triclopyr gave greater than 95% reduction in kudzu above-ground biomass 28 days after the initial application for at least one site. Glyphosate provided 70 to 80 percent suppression of kudzu 28 days after the initial application. After the second season of application 98% suppression or greater was achieved in at least one site after treatment with amniopyralid, fluroxypyr, metsulfuron, or triclopyr. Integration with mechanical, cultural or biological control tactics may be necessary to achieve eradication of kudzu because chemical control requires sustained efforts over several years.

FIELD SANDBUR CONTROL AND HERBICIDE INJURY IN COMMON BERMUDAGRASS PASTURES. A.N. Brewe*,[1] D.S. Murray,[1] N.C. Talley,[1] R.N. Rupp[2]; [1]Oklahoma State University, Stillwater, OK, [2]DuPont Crop Protection, Willmington, DE

ABSTRACT

Field sandbur (*Cenchrus incertus*) commonly infests bermudagrass pastures in Oklahoma, which decreases the value of the bermudagrass quality and decreases the utility of bermudagrass pastures for livestock producers. In previous experiments, nicosulfuron+mestsulfuron methyl+diuron has shown excellent control of field sandbur with a minimal decrease of forage production in comparison to imazapic+glyphosate combination. During the past 2 or 3 years, fertilization appeared to play a roll in sandbur management. Therefore, in May 2008, three experiments were established in various locations throughout Oklahoma to evaluate field sandbur control, bermudagrass injury and bermudagrass yield using nicosulfuron, metsulfuron methyl and diuron combinations. Some of these experiments included an N fertilization factor. Location one evaluated sandbur control only, location two evaluated sandbur control, bermudagrass injury and bermudagrass yield. At both of the locations rates of 0, 100, 200, 300 lbs N as NH_4NO_3 (34-0-0) was included. Experiments one and two were designed as factorial experiments. Location three evaluated bermudagrass injury and bermudagrass yield and had a single top-dress application of 100 lbs N as NH_4NO_3 (34-0-0). Treatments included nicosulfuron+metsulfuron methyl (0.563+0.15 or 0.75+0.25 or 0.844+0.255 or 1.125+0.375 oz ai/A) applied alone or with diuron (6.4 or 12.8 or 16 oz ai/A), imazapic+glyphosate (0.56+1.125 oz ai/A), and an untreated check. At location one, sandbur was controlled 90 to 100% 3 weeks after treatment (WAT) with all treatments; but by 8 WAT, control varied from 50 to 100%. At locations one and two both 3 and 8 WAT sandbur control was observed which occurred with imazapic+glyphosate regardless of N treatment. At location two, 6 and 9 WAT, imazapic+glyphosate caused more injury than all other treatments. At locations two and three, when diuron was tank mixed with nicosulfuron+metsulfuron methyl, decreased injury to bermudagrass occurred. At location two bermudagrass treated with nicosulfuron+mestsulfuron methyl+diuron and nicosulfuron+mestsulfuron methyl yielded more than imazapic+glyphosate in all treatments regardless of N treatment. Further evaluation of herbicide interaction will be continued in 2009.

THE PRESENCE OF ERIOPHYID MITES ON NATIVE AND WEED *CIRSIUM* SPECIES IN NORTH AMERICA. R. Hansen,[1] R. Ochoa,[2] G. Bauchan,[3] J. Amrine,[4] M. Lekveishvili,[5] J.D. Wells,[5] G.J. Michels,[6] R. Petanović,[7] J. Lydon*[8]; [1]USDA-APHIS-PPQ-CPHST, National Weed Management Laboratory, Fort Collins, CO, [2]USDA/ARS/Systematic Entomology Lab, Beltsville, MD, [3]USDA/ARS/Soybean Genomics & Improvement Lab, Beltsville, MD, [4]Division of Plant & Soil Sciences, West Virginia Univ., Morgantown, WV, [5]Dept. of Biology, West Virginia Univ., Morgantown, WV, [6]Texas A&M Univ. Agricultural Research and Extension Center, Bushland, TX, [7]Institute for Plant and Food Protection, Dept. of Entomology, Univ. of Belgrade, Belgrade, Serbia, [8]USDA/ARS/Sustainable Agricultural Systems Lab, Beltsville, MD

ABSTRACT

Aceria anthocoptes is an eriophyid mite that is known to feed on Canada thistle (*Cirsium arvense*). While this mite species has been considered to be host specific, a detailed evaluation of its host range has yet to be determined. To assess the risks associated with using this mite as a biological control agent for Canada thistle, a study to assess the natural distribution of eriophyid mites on *Cirsium* species was conducted. Live mite specimens were transferred from plant tissue to either mounting plates for microscopic evaluation or pressed into Flinders Technical Associates (FTA) cards. Specimens were collected from Canada thistle growing in three different geographical locations (Boston, Massachusetts, Beltsville, Maryland, and Ft. Collins, Colorado) and from four native *Cirsium* species growing in the Fort Collins, Colorado area. The mounting plates were stored under liquid nitrogen until examined and the FTA cards were held at room temperature until used in PCR. The morphological characteristics of the mites on mounting plates were examined using low-temperature (LT) scanning electron microscopy (EM). A 1.2 mm disc punched from the FTA cards was used as a source of templet DNA in PCR amplifications of the 18S-28S rDNA region or for amplifications of mitochondrial DNA. Clustal-W was used in the multiple alignment of the 18S-28S DNA sequence data from *C. arvense*, *C. scariosum*, and *C. canescens*, as well as from three species of Aceria that have hosts of other genera. Analysis of the LT scanning EM images indicated that the eriophyid mites found on C. arvense, *C. scariosum*, *C. canescens*, *C. ochrocentrum*, and *C. scopulorum* were of the same species. A phylogenetic tree generated from the Clustal-W alignment demonstrated that multiple 18S-28S regions likely exist within the genomes of the mite species examined, and that there was considerable overlap of the sequence for these regions across mites from *Cirsium* species such that it appears that the mites are of the same species. While sequence data based on mitochondrial genes still needs to be evaluated, the preliminary results indicate the host range of A. anthocoptes is genus but not species specific. Several native *Cirsium* species exist in the Western states, some of which are endangered. Consequently, these results indicate that the use of A. anthocoptes as a biological control agent of Canada thistle will likely require geographical restrictions which could greatly limit its utility.

SOIL INCORPORATION OF SICKLEPOD SEEDS INFECTED WITH *ALTERNARIA CASSIAE* AND ITS EFFECTS ON THIS WEED CONTROL. R.A. Pitelli*,[1] R.L. Pitelli,[2] F.d. Simoni,[1] F.M. Claudia[1]; [1]University of State of Sao Paulo, Jaboticabal, Brazil, [2]OuroFino Química Ltda, Ribeirão Preto, Brazil

ABSTRACT

In the last decade, the excessive use of chemical control resulted in changes in the weed communities, which led to strong shifting in their population and finally in resistance to several herbicides. This is a very good opportunity to use biological management as a complementary method to control the selected weeds. Sicklepod seeds colonized by *Alternaria cassiae* were amended to the soil to control *Senna obtusifolia* plants. Two experiments were conducted under greenhouse conditions, where the colonized seeds (inoculum) were applied to the soil by dispersal over its surface and incorporation in the 2-3 cm layer. After fungal application, *S. obtusifolia* seeds previously scarified with sulfuric acid were sown in pots. The experimental design was the completely randomized with four replications. A factorial arrangement of treatments was used and the variables were: a) two granulations of inoculum (whole and chopped colonized seeds); b) four inoculum concentrations (10, 6.5, 3.3, and 1.7 ton/ha); c) control plot without any inoculum incorporation. The evaluated parameter were counting of the number of emerged plants and weighing of dry matter accumulation in the aerial and roots tissues of the reminiscent plants. In both trials, there was a tendency to reduce the number of reminiscent plants and of the dry matter accumulation at aerial parts, as the amount of inoculum was increased. There were no important differences between the inoculum constituted by whole or chopped seeds.

SURFACTANTS AFFECT THE EFFICACY OF *ALTERNARIA CASSIAE* CONTROLLING SICKLEPOD SEEDS. C.F. Franco*, F.M. Claudia, R.A. Pitelli, R.L. Pitelli; University of State of Sao Paulo, Jaboticabal, Brazil

ABSTRACT

A Brazilian isolate of *Alternaria cassiae* was collected in Brasília, Brazil, from seedlings showing symptoms of necrotic lesions on leaves and petioles. Several studies done in Brazil and USA showed that this fungus has very good potential as bioherbicide candidate. For field applications, some spraying technology development is necessary. So, the objective of this research was to evaluate (i) the effects of the surfactant Energic (0.1 and 0.2%), Agral (0.025 and 0.05%), Herbitensil ((0.1 and 0.2%) and Citowett (0.1 and 0.2%) on *A. cassiae* conidia germination and (ii) the effects of spores concentrations (10^4 and 10^5 spores/mL), surfactants (same products and concentrations) and dew period (0, 6, 12 and 24 hours) on disease development and control of sicklepod plants. The spore suspension was disposed over water-agar media enriched with the surfactants treatments. Conidia germination was not affected by surfactants at the tested doses. The effects of surfactants only were significant in the lower spore concentration. Citowett and Agral promoted faster disease development when compared with the other two surfactants. Energic (0,2%) reduced the sicklepod control sprayed with 10^4 spores/mL. Dew periods of 8, 12 and 24 hours promoted 100% plant mortality while the absence of artificial induced dew period the sicklepod control was only 20%.

DRYING AND FORMULATION OF *MYCOLEPTODISCUS TERRESTRIS*: A MICROBIAL BIOHERBICIDE OF *HYDRILLA VERTICILLATA*. C. Dunlap*, M. Jackson; NCAUR, Peoria, IL

ABSTRACT

Mycoleptodiscus terrestris is a natural plant pathogen of the invasive aquatic weed, *Hydrilla verticillata*. Previous research has shown *M. terrestris* to be effective aquarium and field assays in controlling the invasive weed. For *M. terrestris* to become a commercially feasible method of Hydrilla control requires developing methods to produce, formulate and disperse infective propagules. Our current research tackles these scale up issues as we go from lab to large scale production. Microsclerotia of *M. terrestris* are produced in liquid culture fermentation, processed and dried for enhanced survival. Methods and handling parameters have been developed to produce uniform sized particles, which are amenable to the drying process. Different drying processes has been evaluated to optimize drying survival. In addition, analysis of the chemical composition of the microsclerotia suggests the membrane stabilizers, trehalose and mannitol, are important to its drying tolerance and may be useful as quality control indicators.

INFECTION AND CONTROL OF HEMP SESBANIA (*SESBANIA EXALTATA*) BY *COLLETOTRICHUM GLOEOSPORIOIDES* F.SP. *AESCHYNOMENE* FORMULATED IN AN INVERT EMULSION. C.D. Boyette*, A.J. Bowling, K.C. Vaughn, R.E. Hoagland, K.C. Stetina; USDA-ARS, Stoneville, MS

ABSTRACT

Colletotrichum gloeosporioides f. sp. *aeschynomene* (CGA) is a highly virulent pathogen of the leguminous weed northern jointvetch [*Aeschynomene virginica* (L) B.S.P.], but another leguminous weed, hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. Ex A.W. Hill], is considered immune to this fungus. Research has shown that the host range of some fungi can be altered through formulation. In greenhouse studies, we found that a 1:1 (v/v) CGA:invert emulsion formulation resulted in 100% infection and mortality of hemp sesbania seedlings over a 21 day period. Microscopic examinations revealed that the fungus proliferated within the cells of hemp sesbania and produced anthracnose lesions containing acervuli on infected stems. The fungus was re-isolated from infected hemp sesbania tissues, and found to infect and killed northern jointvetch seedlings, thus fulfilling Koch's postulates for disease identification. These results, and preliminary results in field trials, suggest that this invert emulsion expands the host range of *C. gloeosporioides* f. sp. *aeschynomene*, and improves the bioherbicidal potential of this pathogen.

PERFORMANCE OF TWO BIOLOGICAL CONTROL AGENTS ON SUSCEPTIBLE AND FLURIDONE-RESISTANT GENOTYPES OF THE AQUATIC WEED HYDRILLA, *HYDRILLA VERTICILLATA*. T.A. Schmid*, J.P. Cuda, G.E. MacDonald, J.L. Gillmore; University of Florida, Gainesville, FL

ABSTRACT

Hydrilla (*Hydrilla verticillata* (L.f.) Royle: Hydrocharitaceae) is a submersed aquatic plant that is widely distributed in warmer regions of the world, and occurs in both dioecious and monoecious strains. A dioecious female strain of hydrilla was introduced into Florida from Sri Lanka in the early 1950s through the aquarium trade. This aggressive submersed plant spread rapidly and now occurs in every watershed along the coastal United States from Maine to Washington. Efforts to control hydrilla currently rely on herbicides such as fluridone and non-selective biological control using the grass carp (*Ctenopharyngodon idella* Val.: Cyprinidae). The Florida Fish and Wildlife Conservation Commission (formerly Department of Environmental Protection) annually spends $12-15 million on hydrilla control mainly with herbicides. The recent development of fluridone resistance in Florida hydrilla populations has resulted in the inability to economically control large areas of this invasive aquatic weed. The loss of fluridone as a major tool for hydrilla control is forcing aquatic plant managers and researchers to consider development of new herbicides, evaluation of new use patterns for registered contact herbicides, and development of novel biological controls. The objective of this study was to compare the performance of two established insect biological control agents-a stem mining midge (*Cricotpus lebetis* Sublette: Chironomidae) and a leaf mining fly (*Hydrellia pakistanae* Dionier: Ephydridae)- on susceptible and two fluridone resistant genotypes. The stem mining midge is an adventive species that was discovered attacking hydrilla in Crystal River, Florida in 1992 and the leaf mining fly was introduced into Florida in 1987. Terminal shoots of susceptible, medium resistant, and highly resistant hydrilla genotypes (~5 cm length) were obtained from the Weed Science Field lab at the University of Florida. Resistance levels were determined by biochemical and phenological assays that addressed changes in carotenoid levels and growth compared to susceptible hydrilla genotypes. Each shoot (n=10 per genotype) was placed into a culture tube (2 cm diam. x 15 cm ht.) containing well water and covered with a perforated plastic cap for ventilation and to confine emerging adults. Two neonate larvae of each biocontrol agent were transferred to individual culture tubes, which were placed in a rack using a randomized complete block design with 3 replications per insect. The culture tubes with developing larvae were checked daily under a microscope for mortality and adult emergence. Survival and sex of the emerged adults were recorded. The data were analyzed using the Analysis of Variance (ANOVA) procedure. Proportional data were arcsin transformed, and the means were separated using Tukey's post-hoc test at $p = 0.05$. The results showed that the two biocontrol agents differed in their ability to accept the different hydrilla genotypes. Survival of the leaf mining fly *H. pakistanae* was similar on all three Florida genotypes tested. Percent emergence of *H. pakistanae* adults on the susceptible, medium resistant, and highly resistant genotypes was 46.7%, 56.7%, and 50.0%, respectively. The results also showed that there were no differences in the emergence of male *H. pakistanae* among the three genotypes tested but survival of females on the medium resistant genotype was significantly higher (33.3%) compared to the susceptible and highly resistant hydrilla strains (10.0% and 16.7%). In contrast, the stem mining midge *C. lebetis* exhibited significantly lower emergence when reared on the medium and highly resistant genotypes (3.3 % and 1.7%, respectively) compared to the susceptible hydrilla genotype (38.3%). Percent emergence of male and female midges also was similar on the susceptible genotype (52.5% and 47.5%) but only males emerged on the two resistant gentoypes. These findings highlight the importance of examining insect performance on all plant genotypes present in the invaded range when selecting effective biocontrol agents.

EFFECTS OF BIOLOGICAL CONTROL AGENTS ON CHEMICAL CONTROL OF WATERHYACINTH (*EICHHORNIA CRASSIPES*) WITH PENOXSULAM, GLYPHOSATE AND TRICLOPYR IN FIELD TANKS. P.J. Moran*; USDA-ARS, Weslaco, TX

ABSTRACT

Waterhyacinth (*Eichhornia crassipes*) remains a major economic and ecological problem in the southern U.S., despite the release of exotic biological control agents and the availability of numerous chemical control tools. The use of chemical controls at sublethal doses in the presence of background or augmented populations of waterhyacinth weevils (*Neochetina* spp) and fungal plant pathogens (*Cercospora piaropi* or others), could lead to additive or synergistic effects on efficacy and reduce costs. Waterhyacinth weevils (1-2 weevils per shoot) and spores of *C. pioropi* (1×10^6 ml^{-1}) were added to populations of 10-20 waterhyacinth plants in 300-L field tanks, while other tanks were protected from biological control agents. The herbicide penoxsulam applied to water (5-50 ppb) or as a foliar spray (0.035-0.35 kg ai ha^{-1} with 0.58 L ha-^{1} MSO/organosilicone surfactant) caused plant death within six weeks at all rates tested, but death occurred one week earlier in tanks containing waterhyacinth weevils and *C. piaropi* than in tanks containing protected plants. Application of the herbicides triclopyr and the isopropylamine salt of glyphosate (0.42 kg ae ha^{-1} and 0.56 kg ae ha^{-1}, respectively) below label-recommended rates did not lead to the death of waterhyacinth plants within six weeks in the presence or absence of biological control agents, but biocontrol agent damage increased triclopyr-related plant browning by 20-30% within six weeks, while having no effect on the impacts of glyphosate. Direct exposure to penoxsulam did not kill waterhyacinth weevils or inhibit growth of the *C. piaropi* fungus on media within one week of treatment, while triclopyr and glyphosate caused 50% weevil mortality. Augmentation or natural concentration of biological control agents could facilitate herbicide applications at reduced rates, and/or lead to increases in dose-dependent efficacy on waterhyacinth in the field, leading to faster and more sustainable control.

COMPARISION OF FALLOW TILLAGE SYSTEMS IN PACIFIC NORTHWEST ENVIRONMENTS. D.S. Riar*,[1] J.P. Yenish,[1] D.A. Ball,[2] S.B. Wuest,[2] M.K. Corp[2]; [1]Washington State University, Pullman, [2]Oregon State University, Pendleton

ABSTRACT

Research is being conducted for two fallow- winter wheat cropping seasons (2007-2008 and 2008-2009) under 360 and 445 mm annual precipitation near Davenport, WA and Helix, OR, respectively. Experiments were arranged in a randomized complete block design with four replications. The six fallow treatments included conventional tillage with disc or chisel followed by rod-weeding, chemical fallow with broadcast herbicide application, chemical fallow with Laser-activated sensor-controlled (LASC) herbicide application, sweep undercutter tillage with broadcast herbicide application, sweep undercutter tillage with LASC herbicide application, and sweep undercutter tillage followed by rodweeding. Weed density, biomass, soil moisture and wheat yield parameters were recorded. Tumble pigweed, Russian thistle, wild oat and downy brome were the main weed species at Davenport and prickly lettuce and Russian thistle at Helix during year 1 of the study. At Davenport, tumble pigweed had greater densities and biomass in non-rodweeded compared to rodweeded treatments with no differences for other weed species. Most of the weeds in non-rodweeded treatments were in the sprayer or tractor wheel track. At Helix, there was a greater density of Russian thistle in plots using the LASC sprayer because dust conditions appeared to greatly impact weed control with that sprayer and rodweeding did provide slightly better control than the LASC. More effective weed control resulted in higher wheat yields in rodweeded treatments at both locations in year 1. During year 2, Russian thistle, prickly lettuce and kochia were the primary species at Helix with significantly greater densities of Russian thistle in undercutter treatments and greater prickly lettuce densities in chemical fallow. Tumble pigweed and wild oat were the primary species at Davenport with greater densities of tumble pigweed in undercutter treatments compared to chemical fallow. Seed zone soil moisture was similar in all treatments at both sites during both years. Deep water storage data showed variable results among treatments in both years at both sites. The upper 60 cm of the soil profile showed more greater moisture compared to lower soil depth profiles at Davenport in both years, however, in Helix there was less or similar moisture in upper soil profile.

THE RESPONSE OF WILD OAT (*AVENA FATUA*) TO DIFFERENT HERBICIDES SOLUTION. A. Mousavi Nik*,[1] M. Mollaei Kandelous,[2] E. Zand,[1] A. Abas Nejad,[1] N. Hosseyni Faradonbe[3]; [1]Department of Weed Research, Plant Protection Research Institute, Tehran, Iran, Islamic Republic of, [2]University of Tehran, Tehran, Iran, Islamic Republic of, [3]Birjand univ. Iran, Birjand, Iran, Islamic Republic of

ABSTRACT

This study was conducted in greenhouse of Weed Research Department, Plant Protection Research Institute, Tehran, Iran during spring 2008, to assess the effect of different materials that exist in water normally, in different doses on wild oat (*Avena fatua*). The experiment was arranged in randomized complete block design with six replications (the effect of each treatment was evaluated separately). In this experiment factors consist of: Clodinafop propargyl (Topik) (0.8 gai/ha), Ph solutions in 11 different doses including: (3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8), clay in 11 various solution (0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500), CaCo3 solution in 11 different doses (0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500), CaCo3 and NH4So4 solution in 11 different doses (0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500), NaHco3 solution in 11 various doses (0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500), NaHco3 and NH4No3 solution in 11 different doses (0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500). All plants were sprayed when they had 2-4 leaf and to assess the effect of different treatments on each weeds, fresh and dry weight, the number of alive plant per pot after spraying and EWRC scoring, were assessed 30 days after spraying. Statistical analysis showed that all dose of Ph had a good effect on weed control and there weren't significant difference among different doses, unless in Ph 3, that couldn't control weed well. Different solution of clay didn't have significant difference; just in dose 300 the lowest control was seen. In CaCo3 solutions, all treatments didn't show significant difference, except in 100 and 300 doses, which were shown lower control. In CaCo3 and NH4So4 treatments and NaHco3 trails there weren't significant difference among different doses. In NaHco3 and NH4No3 solutions in most cases significant difference weren't seen. To sum up, existing different materials in tank mixture don't have significant effect on herbicides efficiency.

TEACHING OLD DOGS NEW TRICKS: ENHANCED DIQUAT GRAMINICIDE EFFECT ON LOLIUM AND AVENA SPECIES USING TANK-MIXED ADJUVANTS. M. Fernandez-Cerejido, F. Bastida, J. Menendez*; Universidad de Huelva, Palos de la Frontera, Spain

ABSTRACT

Paraquat and diquat are two popular, non-selective, bipyridylium herbicides commonly used in agriculture. However, since paraquat has been forbidden in the EU, and diquat traditionally has been used to control broad-leaved weeds, an increase in diquat toxicity against grasses may be desired. The effectiveness of dicuat as gramicide can be enhanced if it is used combined with adjuvants. The aim of this study has been to determine under laboratory controlled conditions the effect of use of lower spraying volume and the addition of five different adjuvants to the tank mixture on the effectiveness of diquat as graminicide on ryegrass (Lolium rigidum) and wild oat (Avena fatua). It also has been determined the herbicide mixture adherence and the contact angle for the different treatments, as increments of herbicide leaf adherence due to the presence of adjuvants in the spraying solution usually leads to increments of herbicide phytotoxicity. The adjuvants used on the experiment were a mixture of methyl oleate and palmitate, a dodecylbenzene ammonium sulphonate, a paraffinic oil, a poly-1-p-menthene, and an alkylglycol ester. Plants were grown in growth chambers with a 14-h photoperiod at 24 C day/18 C night temperature. The herbicide was applied alone at a 400 L ha^{-1} carrier volume and alone or combined with the different adyuvants at at a 150 L ha^{-1} carrier volume using a precision lab track sprayer. Half effective doses (ED_{50}) were recorded 28 days after treatment. All the treatments assayed at 150 L ha^{-1} succeeded in increasing the effect of diquat on both ryegrass and wild oat compared to diquat applied alone at 400 L ha^{-1} (1159,97±640,11 g a.i.ha^{-1} and 1140±162 g a.i.ha^{-1} respectively), being the alkylglycol ester (14,62±4,42 g a.i.ha^{-1}) and the mixture of methyl oleate and palmitate (54,37±11,9 g a.i.ha^{-1}) the most effective adjuvants for ryegrass, and the mixture of methyl oleate and palmitate (19,69±5,91 g a.i.ha^{-1}), the alkylglycol ester (59,82±10,96 g a.i.ha^{-1}), and the paraffinic oil (108,66±56,13 g a.i.ha^{-1}) the most effective ones for wild oat. A dyed spray solution containing diquat at 400 g a.i. ha^{-1} alone or mixed with adjuvants was applied to plants at the three- to four-leaf stage using a laboratory track sprayer delivering 150 L ha^{-1}. A 400 g a.i. ha^{-1}/400 l ha^{-1} diquat dyed spraying solution was used as reference. After the spray had dried on the foliage, the plants were cut off at ground level and rinsed in a Triton X-100 (0.25% v/v solution). Readings were made in a spectrophotometer. Three replicates with 12 plants each were carried out for each treatment. Results were expressed as mL spraying solution g^{-1} DW. On ryegrass, the adherence of the treatment applied at 400 L ha^{-1} (0,44±0,05) was twice the adherence of any of the treatments applied at 150 L ha^{-1}, with no significative differences among these treatments. No such differences between carrier volumes were observed in wild oat treatments, the best adherence results being observed with the alkylglycol ester (0,15±0,02) and the dodecylbenzene ammonium sulphonate (0,13±0,01)adjuvants. Undyed diquat mixtures as prepared in adherence assays were applied on both the adaxial and abaxial surfaces of the fourth leaf as 0.5 µL droplets using a microsyringe and microapplicator. Individual droplets were photographed 20 seconds after deposition. Seven replicates with four droplets each were carried out for each treatment. Contact angles of every single droplet were analysed using image processing software. Data showed that all adjuvants reduced the contact angle in both species compared to diquat applied alone at any spraying volume. The dodecylbenzene ammonium sulphonate and the alkylglycol ester for ryegrass and the alkylglycol ester and the paraffinic oil for wild oat rendered the lower contact angle values. Our data show that lower carrier volumes increase diquat effectiveness in both grasses tested. On ryegrass, the results at 150 L ha^{-1} show that there is no relationship between the increase in the effectiveness obtained with the use of the adjuvants and the adherence of these treatments. In these terms, contact angle and effectiveness are related for the alkylglycol ester adjuvant, but not for the mixture of methyl oleate and palmitate. In wild oat, the increase in the effectiveness of the herbicide when it was applied with the alkylglycol ester is correlated with the results obtained in both the adherence and contact angle assays. As oil derivatives, the success of the paraffinic oil and the mixture of methyl oleate and palmitate in increasing diquat effectiveness on wild oat may be hypotesiced in terms of herbicide penetration.

EFFECT OF ADJUVANTS ON RAINFASTNESS OF DIFFERENT GLYPHOSATE FORMULATIONS. S. Singh*, M. Singh, S.D. Sharma; University of Florida, Citrus Research and Education Center, Lake Alfred, FL

ABSTRACT

Studies were conducted to examine the effect of adjuvants on the rainfastness of different formulations of glyphosate (Glycel Super, Mera-71- NT and Weathermax) applied to grasses and broadleaf weeds at the University of Florida, Citrus Research and Education Center, Lake Alfred, FL under greenhouse conditions maintained at day/night temperature of 25/16 C (±0.5 C), relative humidity of 70/100%, and natural day light conditions. The greenhouse reduced photosynthetically active radiation to 1200 umol/m^2/s at midday. Weed seeds were sown/transplanted in 10 X 15 cm plastic pots in potting medium during summer 2008. Applications of different formulations with and without adjuvants were followed by a simulated rainfall at 30 minutes, 1 hr and 2 hr which is similar to the typical heavy intensity of rainfall events in Florida. Visual percent control was recorded after 2-3 weeks after herbicide applications. Results indicated that all the formulations found effective in controlling the grass weed Johnson grass (*Sorghum helepense)* and broadleaf weed Florida pusley (*Richardia scabra)*. When averaged over glyphosate formulations all adjuvants (Optima, Kinetic, Induce at 0.1% and 0.25%, RPC-1 and RPC-2) significantly increased the control of both grassy and broadleaf weeds over the sole application of different formulations. Optima, Induce (0.25%) and RPC-1 were found equally effective in enhancing the efficacy of herbicides on grasses and proved significantly superior over Induce (0.10%). RPC-1 was found better than RPC-2 in enhancing the efficacy of herbicides. When averaged over glyphosate formulations and adjuvants, percent control of weeds reduced significantly with decrease in rain free time from 2 hrs to 1 hr and from 1 hr to 30 minutes. Rainfall after two hrs did not influence weed control over no rain. Different adjuvants effectively provided complete rainfastness to herbicides at rain free period 2 hrs after herbicide applications. The efficacy of adjuvants was in the order of Optima > Induce (0.25%) > RPC-1 > RPC-2 > Kinetic > Induce (0.10%). Optima and Induce (0.25%) provided significantly higher control compared to other adjuvants at rain free period of 2 hrs and with no simulated rainfall application.

USING SHIKIMIC ACID AS A TOOL FOR SURFACTANT EVALUATION. C.A. Massey*,[1] D.R. Shaw,[1] J.A. Huff,[1] J.W. Weirich,[1] M.B. Wixson[2]; [1]Mississippi State University, Mississippi State Mississippi, MS, [2]Helm Agro, Memphis, TN

ABSTRACT

With an increase in the cost of developing new herbicides, more attention is being focused on improving formulations rather than create new active ingredients. Surfactants play a vital role in foliar uptake of herbicides and distribution of herbicides within the plant. The objective of this study was to develop a screening procedure to evaluate surfactant effectiveness. An efficacy study was conducted on soybeans [*Glycine max* (L.) Merr.] comparing glyphosate efficacy from 21 surfactants as well as 4 glyphosate/surfactant pre-formulated products. The study also included a technical glyphosate and a pre-formulated product plus ammonium sulfate treatments. Soybean was planted on August 8, 2008 and glyphosate plus one of the surfactants or a pre-formulated product was applied at 0.88 kg ae/ha on September 7, 2008 at the V7 stage. Visual ratings were conducted 7, 14, and 21 days after treatment (DAT). 21 DAT all glyphosate/surfactant pre-formulated products reached 100% control of rice flatsedge (*Cyperus iria* L.) and barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.]. Surfactants HAI 1022-1 and HAI 1022-2 exhibited the least control of rice flatsedge (74%) and barnyardgrass (85% and 88% respectively) at 21 DAT. An initial rate titration was set up using velvetleaf [*Abutilon theophrasti* (L.) Med.] to determine a reduced rate of glyphosate that would be useful to establish different efficacy. Velvetleaf was planted in plastic pots that contained a 1:1 v/v mixture of soil/peat moss. Plants were sprayed with various rates ranging from 1/32 of the labeled rate of glyphosate to 1/2 the labeled rate; also an untreated check was included for comparison purposes. The third and fourth leaf from each plant were collected three days after treatment for shikimate analysis. Absorbance was measured at 380 nm using a spectrophotometer. Shikimate data will be used to quantify data from the soybean efficacy trial.

TEMBOTRIONE EFFICACY AS INFLUENCED BY ADJUVANT CLASS AND PRODUCTS WITHIN A CLASS. M. Bernards*,[1] R. Zollinger,[2] B. Young[3]; [1]University of Nebraska-Lincoln, Lincoln, NE, [2]North Dakota State University, Fargo, ND, [3]Southern Illinois University-Carbondale, Carbondale, IL

ABSTRACT

Tembotrione is a new HPPD-inhibitor herbicide. It is labeled for use in corn and has postemergence activity on many broadleaf and grass weeds. The activity of many postemergence herbicides can be increased by selecting an appropriate adjuvant as a tank-mix partner. Our objectives in this study were to 1) screen common commercial non-ionic surfactants (NIS), crop oil concentrates (COC), methylated seed oils (MSO), and high surfactant oil concentrates (HSOC) to determine if there were differences within adjuvant classes and between adjuvant classes in enhancing the activity of tembotrione, 2) compare a NIS, COC, and MSO adjuvant tank-mixed with the postemergence HPPD-inhibitors tembotrione, mesotrione, and topramezone to determine if the herbicides responded similarly to the adjuvant classes; and 3) compare tembotrione tank-mixed with a NIS, COC, or MSO adjuvant at spray solution pH's of 5.0, 7.0, and 9.0 to determine the effect of pH. Greenhouse experiments were conducted at the University of Nebraska-Lincoln to complement field studies. Herbicide treatments were broadcast at rates equivalent to 10 gpa. Tembotrione (0.0273 lb ai/a), mesotrione (0.0312 lb ai/a), and topramezone (0.00547 lb ai/a) were applied at 1/3 the recommended use rates. The weed species varied by location, and were a minimum of 6-8 inches at the time of application. The response to adjuvant class (e.g., NIS, COC, MSO, and HSOC) varied by species. There was a wide range of response between adjuvants within each adjuvant category. The general trend between adjuvant categories was NIS ≤ COC = MSO = HSOC. Tembotrione, mesotrione, and topramezone responded similarly to the three adjuvant classes. On species were there was a response to adjuvants, phytotoxicity increased in the order of NIS < COC ≤ MSO. Weed control activity of tembotrione increased as spray solution pH increased from pH 5 to pH 7. There was little or no response as pH increased from 7 to 9. Weed control activity in response to adjuvant categories was consistent across pH levels, and was again NIS < COC ≤ MSO.

NEW TANK-MIXED ADJUVANT SOLUTIONS TO IMPROVE NICOSULFURON DRY FLOWABLE FORMULATIONS. D. Camacho, F. Bastida, J. Menendez*; Universidad de Huelva, Palos de la Frontera, Spain

ABSTRACT

Dry flowable commercial sulfonilurea herbicides such as Accent 75WG (nicosulfuron at 75% w/w) lack the ability to incorporate a wide range of adjuvants to their formulations. This shortage in Accent formulation has been usually fulfilled by adding an isodecyl alcohol ethoxylate (Trend 90) to the tank mixture. By developing a series of dose-response assays and contact angle measurements, our objectives were to test several commercial adjuvants as better alternatives to the use of Trend 90 in Accent formulations, checking the effect of the adjuvants assayed on some of the physical properties of nicosulfuron spraying solution (i.e. contact angle) as well. Plants of maize, large crabgrass (*Digitaria sanguinalis*), quackgrass (*Elymus repens*), common lambsquaters (*Chenopodium album*), and black nightshade (*Solanum nigrum*) were used as experimental model. Adjuvants used were Silwet L-77 (a nonionic organosilicone (trisiloxane) wetter and spreader), Surf 2000 (a semi-cationic surfactant based on a mixture of modified tallow amines plus a polysorbate spreader), Dash HC (a mixture of fatty acid (oleic and linolenic acid) methyl esters plus a surfactant blend). Trend 90 was used as reference adjuvant. Herbicide rates used were 20, 40, and 60 gr a.i. ha^{-1} nicosulfuron. Adjuvant rates ranged from 0.01 to 1.0 % (v/v). Regarding maize dose-response results, and arbitrarily considering growth values lower than 88% as inacceptable crop injury, only Dash HC felt well below the limit at both 40 and 60 g ai ha^{-1} herbicide dose. These data highlight Dash HC mixtures as phytotoxic to corn at the recommended herbicide rates and exclude them from further comparisons. Surf 2000 was the lesser phytotoxic mixture, while Trend 90 was phytotoxic at 40 g ai ha^{-1} no matter the adjuvant concentration used. Large crabgrass dose-response assays proved that the most effective adjuvant tested was Surf 2000. Interestingly, Surf 2000 showed no significant differences between 40 and 60 g ai ha^{-1} nicosulfuron treatments. The suggested order of effectiveness in DIGSA treatments would be: Surf 2000 > Silwet L-77 ≥ Trend 90. Quackgrass dose response assays showed that all the Accent mixtures tested were extremely effective in controlling AGRRE. Best results were again obtained with Surf 2000, although Trend 90 was not statistically different from the former adjuvant. The suggested order of effectiveness in AGRRE treatments would be: Surf 2000 = Trend 90 > Silwet. Data from these two assays seems to point toward a better effect of penetrant or penetrant + wetting agents (Surf 2000) than pure wetters (Silwet L-77 and Trend 90) in grass weeds. Regarding the broadleaved species, common lambsquaters dose-response assays showed that both Surf 2000 and Silwet L-77 were the most effective adjuvants at 40 g a.i. ha^{-1} nicosulfuron. Surprisingly, Trend 90 displayed the best result at the highest nicosulfuron rate although the usefulness of this last result using a so high nicosulfuron rate is controversial. On the other hand, all the Accent mixtures failed in controlling black nightshade at any of the nicosulfuron rates tested. Unlike previous data, best results were obtained with pure wetters. In these terms, and although a good control was not achieved, Silwet L-77 was the best adjuvant tested at all the Accent rates assayed, with Trend 90 and Surf 2000 being in second place. Data from contact angle experiments were quite consistent, since adjuvants showing lower angle values displayed this characteristic no matter the species studied. In these terms, a classification of the adjuvant tested by wettability power would be (from most wetting to less wetting): Silwet L-77 > Trend 90 > Surf 2000 > Dash HC > CONTROL. As expected, lower contact angles were related to pure wetters such as Silwet L-77 (a superwetter) and Trend 90 (a nonionic surfactant), while higher angles were related to oil-based adjuvants such as Dash HC. Non-amended Accent was the herbicide treatment with less wetting power. In three of the four weed species tested (large crabgrass, quackgrass, and lambsquaters), Accent formulations with the lowest contact angle values did not presented corresponding lowest growth values. This fact seems to point out that adherence (considered as surface tension reduction) does not play a mayor role as Accent enhancer in these three weeds. Other variables must be the limiting factors whose modification may be traduced into herbicide enhancement. Regarding black nightshade, this species is the sole weed with a positive correlation between wetting power and growth, so it is plausible to affirm that an increment in herbicide adherence is the cause of Accent enhancement.

THE INFLUENCE OF DIFFERENT SURFACTANTS ON AMINOCYCLOPYRACHLOR (DPX-MAT-28) AND AMINOCYCLOPYRACHLOR METHYL ESTER (DPX-KJM-44) ABSORPTION IN CANADA THISTLE (*CIRSIUM ARVENSE* L.).

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ABSTRACT

DPX-MAT28 (amincyclopyrachlor, AMCP, DuPont®) is a new herbicide effective on many perennial broadleaf weed species, including Canada thistle (*Cirsium arvense* L.). Two formulations of aminocyclopyrachlor are being evaluated in the field: the free acid (AMCP) and the methyl ester (DPX-KJM44, ACMP-ME). The objective of this research was to determine how different surfactants and spray adjuvants influence AMCP and AMCP-ME absorption by Canada thistle. The surfactants tested were 1) 1 % (v/v) methylated seed oil (MSO), 2) 1% (v/v) crop oil concentrate (COC), 3) 0.25% (v/v) non-ionic surfactant (NIS), 4) 0.25% NIS plus ammonium sulfate (AMS) (1.2 g/100 ml) and 5) 0.25% NIS plus urea ammonium nitrate (UAN) (1 mL/100 mL). Radiolabeled AMCP or AMCP-ME were added to each surfactant/adjuvant combination and 20 0.5 uL droplets were applied to fully expanded Canada thistle leaves (plants were rosette stage). Leaves were harvested 96 h after treatment (HAT). The leaves were washed to remove non-absorbed herbicide, and amount of radioactive material absorbed was calculated as the difference between total radioactivity applied and radioactivity recovered in the leaf wash. The experiment was a randomized complete block design with four replicates for each application solutions.AMCP-ME absorbed was higher than AMCP in the absence of any surfactant or adjuvant (57.9% ± 3.1 versus 36.7% ± 2.2). Adding NIS increased AMCP absorption (55.3% ± 3.4), but did not enhance AMCP-ME absorption. Adding UAN and AMS to NIS further increased AMCP absorption, but had no affect on AMCP-ME absorption. The best surfactants for both AMCP and AMCP-ME were MSO and COC. AMCP absorption was 74.6% (±4.6) and 65.6% (±6.6) with MSO and COC, respectively, while AMCP-ME absorption was 90.2% (±1.6) and 86.4% (±3.7) when applied with MSO and COC, respectively. These results suggest that MSO and COC are the best surfactants to maximize foliar absorption of AMCP and AMCP-ME in Canada thistle and current field efficacy studies accurately reflect the biological activity of these new active ingredients.

LECITHIN AND ALKYL POLYSACCHARIDE-BASED ADJUVANTS AS NEW TOOLS TO INCREASE GLYPHOSATE ACTIVITY: DIFFERENTIAL EFFECT ON TWO *CONYZA* SPECIES. M. Fernandez-Cerejido, F. Bastida, J. Menendez*; Universidad de Huelva, Palos de la Frontera, Spain

ABSTRACT

A plethora of new products termed "green adjuvants" are multifunctional ecofriendly spray adjuvants that are designed to make handling and application easier with improved performance. These usually include blended adjuvants such as alkylpolysaccharide derivatives with reported increase of bioefficacy of herbicides, and to increase deposition and retention; and modified lecithins also known as phosphatidylcholines used as penetrant/wetting agents. These blended adjuvants with a lower ecotoxicological profile, could be postulated both as an aide to decrease the herbicide rates used in classical glyphosate formulations. The objective of the present study was to investigate the effect of several new blended adjuvants coming from agricultural renewable sources on glyphosate effectiveness, physicochemical properties and its foliar absorption on the species *C.albida* and hairy fleabane (*C.bonariensis*). A commercial tallow amine-free glyphosate formulation (Asteroide 36 SL) was used alone and combined with the adjuvants ADE 702 (an all-green adjuvant based on soya lecithins, and an alkyl polypentoside surfactant coming from wheat straw and beet industry), ADE 804 (a 70% rapeseed methyl ester concentrate with an alkyl polypentoside emulsifier coming from wheat straw), and LI 144 (a lecithin + methyl esters of fatty acid + alcohol ethoxylate surfactant based product), plus the commercial adjuvant LI 700 (a lecithin + propionic acid + alkyl polyoxyethylene ether surfactant based product) which was used as a reference product. In dose-response assays, the herbicide was applied alone or combined with the different adyuvants at a 150 L ha^{-1} carrier volume using a precision lab track sprayer. Half effective doses (ED_{50}) were recorded 28 days after treatment. All the adjuvants assayed succeeded in increasing the effect of glyphosate on *C.albida*, being LI 700 (13,73±4,55 g a.i.ha^{-1}) the most effective compared to Asteroide (41,66±6,71 g a.i.ha^{-1}). On the contrary, only the treatment with LI 144 (11,44±1,64 g a.i.ha^{-1}) increased the effectiveness of glyphosate (14,07±2,36 g a.i.ha^{-1})on hairy fleabane, showing most of the other adjuvants an antagonistic effect on the herbicide efficacy. In adherence assays, a dyed spray solution containing commercial glyphosate at 1080 g a.i. ha^{-1} plus adjuvants was applied to plants at the three- to four-leaf stage using a precision lab track sprayer delivering 150 L ha^{-1}. Results were expressed as mL spraying solution g^{-1} DW. On *C.albida*, all the adjuvants increased the adherence compared to glyphosate applied alone (0,42±0,01), being ADE 702 (0,56±0,01) the best one. Remarkably, this adjuvant was the worst of all on hairy fleabane, showing ADE 804 (0,77±0,02) the best results compared to glyphosate alone (0,54±0,04). In contact angle assays, non-dyed glyphosate mixtures as used on the adherence experiments were applied on the adaxial surfaces of the fourth leaf as 0.5 µL droplets using a microsyringe and microapplicator. All the adjuvants assayed reduced the contact angle compared to glyphosate applied alone, being LI 700 (53,48±1,18 and 56,58±1,11) and LI 144 (56,97±1,58 and 64,22±1,14) the best values compared to controls (75,37±1,37 and 78,89±1,26) on both *C.albida* and hairy fleabane respectively. In penetration assays, a radiolabeled ^{14}C-glyphosate treatment solution corresponded to 1080 g a.i. ha^{-1} of glyphosate in a spraying volume of 150 L ha^{-1} was applied as four 0.5 µL droplets on the adaxial surface of the third leaf of each plant. Four replicates were made. The experiment was repeated twice. On *C.albida*, only LI 144 increased glyphosate penetration while the other adjuvants assayed resulted in a reduction of the herbicide uptake. All the adjuvants failed in showing better performance on hairy fleabane than non-additivated formulation. Our data show that there is an increase on the effectiveness of glyphosate on *C.albida* when the herbicide is applied with these adjuvants. This fact can be explained in terms of adherence and contact angle enhancement, as the results obtained for all the products assayed were better than the results obtained for glyphosate applied alone. It can be also partially explained in terms of penetration, as LI 144 improved the herbicide penetration. On the contrary, the effectiveness of glyphosate on hairy fleabane when it is applied with LI 144 cannot be explained in terms of herbicide adherence and/or penetration.

SAFLUFENACIL: A NEW HERBICIDE FOR PREPLANT BURNDOWN AND PREEMERGENCE DICOT WEED CONTROL. S. Bowe*,[1] W. Patzoldt,[1] T. Holt,[1] R. Liebl,[1] H. Walter,[2] B. Sievernich[2]; [1]BASF, RTP, NC, [2]BASF, Limburgerhof, Germany

ABSTRACT

Saflufenacil (BAS 800H) is a new herbicide being developed by BASF for burndown and residual dicot weed control in multiple agricultural production systems and specialty markets. Saflufenacil is a protoporphyrinogen-IX-oxidase (PPO) inhibitor belonging to the pyrimidinedione class of chemistry. Saflufenacil is readily absorbed by foliage, root and shoot tissue of plants. Once absorbed, saflufenacil is predominantly translocated via the xylem, with limited movement via the phloem. Selectivity is conferred by physical placement and rapid metabolism of saflufenacil. Research indicates that saflufenacil applied at 18 to 25 g ai/ha can be used alone or mixed with glyphosate and applied preplant for rapid and complete burndown of weeds prior to emergence of crops including corn, soybean, cereals, and selected legumes. Saflufenacil complements glyphosate by controlling difficult to control weeds such as horseweed (*Conyza canadensis*) and prickly lettuce (*Lactuca serriola*). Research has shown that in corn, saflufenacil can be used preemergence at 50 to 125 g ai/ha for residual control of most dicot weeds including large-seeded species such as velvetleaf (*Abutilon theophrasti*), common cocklebur (*Xanthium strumarium*), ragweed (*Ambrosia* spp.), common sunflower (*Helianthus annuus*) and morningglory (*Ipomoea* spp.). Saflufenacil's combination of broad dicot spectrum, complementarity with glyphosate, and preplant crop tolerance make it well suited for preplant burndown and residual weed control in many production systems.

CHLORPYRIFOS INTERACTIONS WITH ALS-INHIBITING HERBICIDES IN SOYBEAN. G. E. Powell*, C. L. Sprague, M. R. Jewett, C. D. DiFonzo; Michigan State University, East Lansing, MI

ABSTRACT

Field trials were established in East Lansing, MI in 2006 and 2007 to evaluate possible interactions between postemergence applications of chlorpyrifos and ALS-Inhibiting herbicides in glyphosate-resistant and glyphosate-resistant/sulfonylurea tolerant (GR/ST) soybean. Chlorimuron + thifensulfuron + crop oil concentrate was applied at two rates, 6 g ai ha^{-1} + 1.8 g ai ha^{-1} + 1% v/v and 12.1 g ai ha^{-1} + 3.6 g ai ha^{-1} + 1% v/v when soybean was at the V4 growth stage. Chlorpyrifos at 1.12 kg ai ha^{-1} was applied 14 and 7 days prior to, tank-mixed with, and 7 and 14 days after herbicide application. Soybean injury was less than 20% with the low herbicide rate in the GR/ST soybean. When chlorpyrifos was tank-mixed with the high herbicide rate soybean injury was 26% in the GR/ST soybean, 7 days after treatment (DAT). GR/ST soybean recovered from this injury by 14 DAT. Soybean injury from the herbicide-chlorpyrifos combination, regardless of chlorpyrifos timing did not reduce yield. In the non-ST soybean, injury ranged from 68 to 83% when chlorpyrifos was applied with the herbicide, yield was also significantly reduced. When chlorpyrifos was applied 7 or 14 days before or after the herbicide application soybean injury was less than 35% and soybean yield was not affected.

GRANULAR APPLICATIONS OF TRIFLOXYSULFURON FOR WEED CONTROL IN BERMUDAGRASS TURFGRASS. J.M. Taylor*, J.D. Byrd; Mississippi State University, Mississippi State, MS

ABSTRACT

Granular herbicides are used in many applications for weed control in turfgrass and other sites. Most turfgrass granular herbicides are used preemergence and activated through irrigation or rainfall or if they are used postemergence are applied to wet foliage in order to be absorbed by the foliage and translocated throughout the plant. In the studies described here, trifloxysulfuron, which is normally applied postemergence and depends mainly on foliar activity was applied on various granular carriers to dry foliage and then watered in. The main type of carriers evaluated were DG-Lite, peanut hull (PNUT), and fertilizer. Also different average particle size or SGN (size guide numbers) were evaluated. The objective was to observe control of weeds through root uptake of trifloxysulfuron and determine if prodiamine was impregnated as well on the carrier with trifloxysulfuron, any preemergence control observed. In Experiment 1, treatments were applied to annual sedge on September 15, 2005. Trifloxysulfuron at 21 or 29 g ai/ha was applied on a DG-Lite 100 or peanut hull (PNUT) 75 carrier. Treatments were formulated to be applied at 435 kg/ha of product with the active ingredient either 0.015 or 0.011%. Control at 33 DAT (days after treatment) was 95% with the 29 g/ha rate on either carrier, or 83 to 85% control with 21 g/ha. The spray formulation of 29 g/ha provided 100% control. In Experiment 2, Annual bluegrass was treated on December 6, 2005 with the same treatments and rates that were in Experiment 1 plus DG-Lite or PNUT granular carriers formulated to apply 29 and 560 g ai/ha trifloxysulfuron + prodiamine, respectively. All granular products were applied at 435 kg/ha. At 83 DAT, the best treatment was the trifloxysulfuron spray treatment with 100% control. The DG-Lite carrier with 29 g/ha trifloxysulfuron provided similar control of 90%. The granular treatments that contained both trifloxysulfuron and prodiamine provided equivalent control of 93 to 90%. At 98 DAT, all treatments provided similar control of 95 to 100% except 21 g/ha trifloxysulfuron applied on PNUT carrier which provided 83% control. In Experiment 3, the same treatments were applied as in Experiment 2 with the addition of 29 + 560 g/ha trifloxysulfuron + prodiamine applied on 5-5-25 fertilizer carrier with SGN sizes of 75, 150, and 250. All treatments were applied to annual bluegrass on December 5, 2006. The trifloxysulfuron or trifloxysulfuron + prodiamine treatments on the PNUT carrier did not perform well for postemergence control of annual bluegrass. The highest control with these carriers was 63% at 55 DAT and was reduced after that. The DG-Lite carrier with trifloxysulfuron alone or in combination with prodiamine performed statistically as well as the sprayable formulation from 55 through 135 DAT. With the fertilizer carriers control tended to decrease as particle size increased. Control with trifloxysulfuron + prodiamine on fertilizer was 93, 78, and 68% with 75, 150, and 250 SGN size, respectively. In the fourth experiment, granular treatments were applied to dormant bermudagrass with winter weeds present on March 2, 2006. Trifloxysulfuron + prodiamine were applied on a DG-Lite carrier or PNUT carrier and were applied at 29 + 560 or 43 + 840 g/ha trifloxysulfuron + prodiamine. In addition, mesotrione was impregnated on the carriers and additional treatments of 29 + 560 + 280 g/ha trifloxysulfuron + prodiamine + mesotrione, respectively, were applied using both carriers. All treatments provided 100% control of henbit at 49 DAT. White clover control was better with the higher rates of trifloxysulfuron + prodiamine with 95 to 100% control at 49 DAT compared to 50 to 73% with the lower rates. The addition of mesotrione increased control of white clover with the lower rates to 85 to 98%. Corn speedwell control was also better with the higher rates of the granular treatments with 75 to 83% control compared to 23 to 40% with the lower rates. When mesotrione was added to the lower rates control increased to 68 to 78%. All treatments provided good to excellent control of dandelion and yellow woodsorrell at 75 DAT. Crabgrass control was good to excellent with all treatments. The granular treatment on DG-Lite was better than the equivalent rates of the sprayable treatments at 137 or 169 DAT. Control with 29 + 560 g/ha trifloxysulfuron + prodiamine sprayable formulation was 80% at these dates while crabgrass control with the DG-Lite formulation at the same rates was 93 to 98%.

RELATIVE SALINITY TOLERANCE OF FOXTAIL BARLEY (*HORDEUM JUBATUM*) AND DESIRABLE PASTURE GRASSES. K.R. Israelsen*,[1] C.V. Ransom,[1] B.L. Waldron[2]; [1]Utah State University, Logan, UT, [2]USDA-ARS Forage and Range Research Unit, Logan, UT

ABSTRACT

A greenhouse study was conducted during 2008 to determine the relative salinity tolerance of foxtail barley and seven desirable pasture grasses. Grass species included in the study were 'Palaton' reed canarygrass (*Phalaris arundinacea*), 'Climax' timothy (*Phleum pratense*), 'Mustang' altai wildrye (*Leymus angustus*), 'Fawn' tall fescue (*Festuca arundinaceae*), 'Alkar' tall wheatgrass (*Thinopyrum ponticum*), 'Potomic' orchardgrass (*Dactylis glomerata*), 'Garrison' creeping foxtail (*Alopecurus arundinaceus*), and foxtail barley. Grasses were planted in Cone-tainers with 70-grit silica sand on January 8, 2008. Plants were hand watered daily with tap water until seedlings emerged. During the week prior to salt treatments, grasses were submerged twice in 20% nutrient solution for 2 minutes and cut to a uniform height before salt treatments were initiated. Grasses were immersed in tanks of salt solution twice each week for 2 minutes. Salt treatments began February 26, 2008 with an electrical conductivity (EC) of 6 dS m^{-1} NaCl solution. A salt solution of NaCl and $CaCl_2$ was increased by 3 dS m^{-1} increments every 2 weeks until EC 24 dS m^{-1} was reached, at which time the EC was increased by 3 dS m^{-1} increments every week. Salt treatments were continued until EC 45 dS m^{-1} was reached July 11, 2008. Plant biomass was collected after 6, 9, 12, 15, 18, and 21 dS m^{-1} EC intervals and once at the conclusion of the study. Increasing EC concentrations significantly reduced plant biomass production for all species. Beginning April 25, 2008 at EC 18 dS m^{-1}, the number of dead plants was recorded each time grasses were immersed in the salt solution. Plant survival in response to increasing EC days was fit to a logistic dose response curve. To account for the time and salt concentration a plant was grown under; a cumulative linear value was calculated that related the number of days a plant was grown at each salt concentration. This value is expressed as EC days. EC days were calculated by multiplying the EC concentration by the number of days at that concentration and summed cumulatively over time. Salinity tolerance varied significantly among grass species. Reed canarygrass and timothy were most susceptible, with 50% plant death occurring at 983 and 1080 EC days, respectively. Orchardgrass, creeping foxtail, and tall fescue exhibited moderate tolerance with 50% plant death occurring at 1999, 2026, and 2551 EC days, respectively. Foxtail barley, altai wildrye and tall wheatgrass expressed the greatest tolerance. Mortality of foxtail barley was 17%, with altai wildrye and tall wheatgrass both expressing only 2% mortality at the tested maximum 3111 EC days.

THE GIANT SALVINIA ERADICATION PROGRAM IN NORTH CAROLINA. S.L. True*,[1] R.J. Richardson,[1] W. Batten,[1] R. Iverson,[2] R. Emens,[3] M. Heilman[4]; [1]North Carolina State Univ., Raleigh, NC, [2]North Carolina Dept. Agric., Raleigh, NC, [3]North Carolina Dept. Env. Health and Natural Resources, Raleigh, NC, [4]SePRO Corporation, Whitakers, NC

ABSTRACT

Giant salvinia (*Salvinia molesta* D.S. Mitchell) is a federal noxious weed first reported in North Carolina in 1998 at the state fair. In 2000, this plant was identified at several locations in southeastern North Carolina. In response, the Southeast North Carolina Giant Salvinia Task Force was formed to develop and implement an eradication program. The task force consisted of individuals from state and federal agencies, North Carolina State University, North Carolina cooperative extension, and private industry. This effort secured a NFWF Pulling Together Initiative grant to fund management efforts, surveyed and delineated areas of infestation, and implemented control strategies. Survey and delineation efforts indicated that giant salvinia has infested ten unique sites in North Carolina and reached a maximum infestation level of around 40 acres. Infestations were diminished during winter, but salvinia did over-winter readily. Management efforts in North Carolina have included foliar and in-water applications of the aquatic herbicides diquat, fluridone, and penoxsulam, and release of the salvinia weevil (*Cyrtobagous salviniae* Calder & Sands). The salvinia weevil did slow growth of salvinia, but did not stop spread or reduce infestation levels. Therefore, biocontrol efforts were abandoned in 2007 and release areas treated with herbicide. As a result of eradication efforts, a single site of approximately 10 acres with minimal plant density is the only known current infestation. This site is currently under treatment with water concentrations of fluridone and penosulam that will be maintained until winter. Treatments will resume early in 2009 until giant salvinia is eradicated from the current site of infestation.

A RISK ASSESSMENT FOR *CAYRATIA JAPONICA*. A.M. West*, R.J. Richardson; North Carolina State Univ., Raleigh, NC

ABSTRACT

The USDA-APHIS template entitled "Weed-Initiated Pest Risk Assessment Guidelines for Qualitative Assessments" was used to develop a risk assessment for the invasive weed bushkiller [*Cayratia japonica* (Thunb.) Gagnep]. Components of the model include plant biology, climatic tolerance, pest status, consequences of introduction, spread and dispersal potential, economic impact, environmental impact, and other criteria. Ratings of negligible, low, medium, and high along with associated point values are assigned to various subcategories which are then used to calculate the final assessment. Within the native range, bushkiller tolerates winter temperatures as low as -7 C and summer temperatures greater than 42 C and average annual precipitation from 60 to 1,100 cm. Native range data was used to project potential range in the United States using the CLIMEX model. Model output suggested that bushkiller could survive minimum temperatures across most of the continental United States A limitation to spread of buskiller in the United States is lack of viable seed production. However, bushkiller may be spread by vegetative means and has done so in North Carolina. Bushkiller would be expected to reduce crop yield and quality on infested sites, and would lower commodity value, but would not result in a loss of foreign markets due to quarantine. Bushkiller reduced community structure and plant diversity on affected sites, thus resulting in high environmental impact. As a final result, bushkiller was ranked as medium-high risk potential to the United States, and should be listed at the Federal level, the state level (North Carolina), or both.

IMPACTS OF SEVERAL HERBICIDES ON PALE SWALLOW-WORT (*CYNANCHUM ROSSICUM*) AND OTHER VEGETATION. T.L. Mervosh*,[1] C. Boettner[2]; [1]Connecticut Agricultural Experiment Station, Windsor, CT, [2]U.S. Fish and Wildlife Service, Sunderland, MA

ABSTRACT

Pale swallow-wort (PSW) [*Cynanchum rossicum* (Kleopov) Borhidi or *Vincetoxicum rossicum* (Kleopov) Barbar.] is an invasive herbaceous perennial in the milkweed family (Asclepiadaceae). PSW is spreading rapidly in parts of New England. Few research papers have been published regarding the activity of herbicides in controlling swallow-wort species. In cooperation with the Silvio O. Conte National Fish and Wildlife Refuge (U.S. Fish and Wildlife Service), an experiment was initiated on Conte Refuge property in 2007. The study site is within a PSW incursion on a former ski slope on Mt. Tom, near Holyoke, MA. Refuge officials are concerned about the threat that PSW poses to rare native plants found on the mountain. The objective is to identify herbicide treatments that control PSW with minimal harm to other plants present. Plots (1.53 m by 2.75 m) were established in May 2007 in randomized complete blocks with three replicates per treatment. Pre-treatment assessments were recorded for the prevalence of PSW and other plants in each plot. Herbicides were sprayed over plots in a broadcast manner, using a hand-held, CO_2-pressurized three-nozzle spray boom (TeeJet 8003VS tips). Spray volume was 234 L ha^{-1}. Treatments were sprayed over whole plots on June 15, 2007; the lower halves of the same plots were sprayed on August 29, 2007. In addition to untreated check plots, treatments consisted of ammonium salt of imazapic (Plateau) at 0.105 or 0.210 kg ha^{-1} ai, metsulfuron methyl (Escort XP) at 0.042 or 0.084 kg ha^{-1} ai, triethylamine salt of triclopyr (Garlon 3A) at 1.26 or 2.52 kg ha^{-1} ae, triclopyr at 1.26 kg ha^{-1} ae plus metsulfuron methyl at 0.042 kg ha^{-1} ai, isopropylamine salt of glyphosate (Accord Concentrate) at 1.12 or 2.24 kg ha^{-1} ae, and triclopyr at 1.26 kg ha^{-1} ae (on June 15) plus glyphosate at 1.12 kg ha^{-1} ae (on August 29). A non-ionic surfactant (0.5% v/v) was included in each spray bottle. Plots were evaluated several times in 2007 and 2008 for treatment effects on PSW and other vegetation. Separate ratings and data were collected from upper and lower halves of each plot. Visual estimates were taken of percentage of area covered by PSW and other plants, and ratings of PSW vigor. These evaluations plus quantitative data for PSW heights and follicle (pod) production were factors in assigning overall PSW control ratings (0 to 10 scale). Plots were evaluated for the last time in August 2008. Imazapic treatments and the low dose of metsulfuron had little effect on PSW growth in 2008. Each herbicide treatment provided greater reduction in PSW cover and total weight of pods when applied twice (June and August 2007) than when applied in June only. Except for imazapic treatments, the higher dose of each herbicide was more effective than the lower dose in reducing PSW in 2008. Glyphosate and triclopyr provided greater PSW control than did the other herbicides. Triclopyr applied once at the low dose reduced total weight of PSW pods by 66% and had a control rating of 7.0 in August 2008; the low dose of triclopyr applied twice reduced pods by 87% with a control rating of 8.3. At the high dose, triclopyr applied once reduced pod weight by 73% and had a control rating of 8.2; the high dose of triclopyr applied twice reduced pods by 96% with a control rating of 9.3. Glyphosate applied once at the low dose reduced total weight of PSW pods by 71% and had a control rating of 7.8 in August 2008; the low dose of glyphosate applied twice reduced pods by 97% with a control rating of 9.5. At the high dose, glyphosate applied once reduced pod weight by 75% and had a control rating of 8.8; the high dose of glyphosate applied twice reduced pods by 98% with a control rating of 9.7. Triclopyr was more selective than glyphosate in terms of effects on other vegetation. In particular, perennial grasses were much more prevalent in triclopyr-treated plots than in glyphosate-treated plots in 2008.

BEACH VITEX (*VITEX ROTUNDIFOLIA*) SOIL SEED BANK CHARACTERIZATION. T. Whitwell*, M.M. Cousins, J.A. Briggs; Clemson University, Clemson, SC

ABSTRACT

Beach Vitex (BV) (*Vitex rotundifolia* L. f.) is an invasive plant of primary dune areas along the Carolina coast. This plant causes immense damage to the dune ecosystem by outcompeting many native erosion preventing species and creating monocultures. BV is also thought to impede sea turtle nesting efforts. As a result of the negative effects of BV, many resources have been dedicated to it's removal. As a companion to these control programs, a better understanding of the ability of BV to recover following removal has become an essential component in the eradication effort. This study sought to characterize the soil seed bank of BV and gain an understanding of how this seed bank degrades in the seasons following vegetation removal. This three-year study investigated the depth and scope of Vitex seed in primary sand dunes on Pawley's Island and Litchfield beaches near Georgetown SC. A significant soil seed bank was discovered. Additionally, it was learned that viable seeds remain in the substrate an excess of 3 seasons following removal and initial control efforts. The study found 196 drupes with viable seeds per square meter after 3 seasons. The presence of a seed bank of this type means that control efforts will be required for at least 4 seasons following initial vegetation removal for successful eradication.

INVESTIGATIONS INTO MECHANISMS OF COGONGRASS (*IMPERATA CYLINDRICA*) COMPETITION AND RHIZOME DORMANCY. J. Wang, G.E. MacDonald*, J.A. Ferrell; University of Florida, Gainesville, FL

ABSTRACT

Cogongrass (*Imperata cylindrica*) is an exotic, invasive perennial grass species that infests over 1.5 million acres in Florida. Once found only in disturbed areas, cogongrass is an increasing problem in bahiagrass pastures. To evaluate possible mechanisms for this invasion, replacement series competition studies were evaluated under greenhouse conditions at two different soil pH regimes. This study utilized single node rhizomes for cogongrass and 2-leaf bahiagrass seedlings as plant source material. These were planted at proportions of 40:0, 20:1, 10:2, 1:4 and 0:8 for bahiagrass and cogongrass, respectively. Plants were allowed to compete for a period of 8 weeks, then harvested and dry weights determined. To determine competitiveness, relative yield and relative crowding coefficients were calculated. At soil pH 4.5, the relative competitiveness between cogongrass and bahiagrass was similar, as both species contributed equally to total relative yield. At a soil pH of 6.8, bahiagrass seedlings showed significantly greater competitiveness against cogongrass ramets. Relative crowding coefficient also showed approximately 2X the aggressivity of cogongrass under low pH conditions as compared to pH 6.8. For bahiagrass, aggressivity values were 2X to 3X higher under pH 6.8 compared to pH 4.5. Therefore, as soil pH shifted from low to high, bahiagrass seedling competitiveness was increased while cogongrass competitiveness was decreased. Conversely, as soil pH decreases, the competitive ability of bahiagrass is decreased, and cogongrass becomes the more competitive species. This indicates that decreases in soil pH, often associated with poor soil fertility, is a probable contributing factor for cogongrass invasion into bahiagrass pastures.

COMMON REED: *PHRAGMITES AUSTRALIS* (CAV.) TRIN. EX STEUD: LIFE HISTORY IN THE MOBILE RIVER DELTA, ALABAMA. J.C. Cheshier*, J.D. Madsen; Mississippi State University, Mississippi State, MS

ABSTRACT

Common reed (*Phragmites australis*) is a non-native invasive perennial grass that is a nuisance in aquatic and riparian environments across the United States. The ability of common reed to reproduce quickly combined with its ability to cycle nutrients has made it an aggressive invader of aquatic environments. Common reed often forms monotypic stands that displace native vegetation which provide food and cover for wildlife. In order to help maintain native habitats and manage the populations of common reed in the United States, a complete understanding of its life cycle is needed. Twelve, 0.1 m^2, samples were taken from four sites throughout the Mobile River delta, in southern Alabama every month from January 2006 to December 2007. Samples were separated into aboveground and belowground biomass, dried and weighed. Above ground biomass peaked from September through December at 3400 g/m^2 whereas the below ground biomass (2500 g/m^2) stayed constant throughout the entire year. This understanding will provide insights into the relationships between common reed and the environment and will help improve current management strategies.

SOFT RUSH (*JUNCUS EFFUSUS*) CONTROL IN PASTURES. N. Rana*,[1] B.A. Sellers,[2] J. Ferrell[1]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Ona, FL

ABSTRACT

Soft rush (*Juncus effusus* L.) is a perennial, tussock-forming plant that often infests low-lying areas within grazing systems in Florida. Experiments were conducted to determine the most effective herbicides for control of soft rush when water was not present within pastures. Herbicide treatments included triclopyr + fluroxypyr at 0.43 + 0.15 and 0.86 + 0.30 kg ai/ha, 2,4-D amine at 1.12 and 2.24 kg ai/ha, 2,4-D amine + carfentrazone at 1.12 + 0.02 and 2.24 and 0.02 kg ai/ha, aminopyralid at 0.12 kg ai/ha, and 2,4-D amine + dicamba at 1.61 + 0.56 kg ai/ha and were applied to soft rush with and without mowing to a 15-cm stubble height. Herbicide treatments were applied in the month of April in 2006 and 2007, which is during the dry season in Florida. Except for aminopyralid, all treatments provided superior control of soft rush when soft rush was mowed prior to herbicide application 1 month after treatment (MAT). When mowed prior to application, treatments containing 2,4-D provided at least 81% control of soft rush. In contrast, control was no greater than 59% when treatments were applied without mowing soft rush. At 12 MAT, herbicides treatments provided similar levels of soft rush control regardless of the mowing treatment. Applications of 2.24 kg/ha 2,4-D provided at least 90% control 12 MAT, but this was not significantly different from 2,4-D + dicamba or 2.24 + 0.02 kg/ha 2,4-D + carfentrazone treatments. Triclopyr + fluroxypyr and aminopyralid provided the lowest levels of control, ranging from 14 to 24% 12 MAT. Therefore, effective control of soft rush can be obtained with the use of 2,4-D amine or products that contain 2,4-D amine. Additionally, mowing prior to herbicide treatment does not increase control and is not necessary.

TALL IRONWEED AND CANADA THISTLE CONTROL WITH ROPE-WICK AND BROADCAST TREATMENTS. D.M. Fryman*, W.W. Witt, J.A. Tolson; University of Kentucky, Lexington, KY

ABSTRACT

Tall ironweed (*Vernonia altissima*) and Canada thistle (*Cirsium arvense*) control in cool season grass pastures was evaluated in 2007 and 2008. Tall ironweed was evaluated at two locations both years and canada thistle was evaluated at one location both years. The tall ironweed studies were in Fayette and Boone Counties and the canada thistle study was conducted at Spindletop Research Farm. Herbicides applied selectively with a rope-wick were compared to a broadcast foliar spray. Both locations consisted of one broadcast treatment, Forefront R&P (aminopyralid at 0.1 kg a.e. /ha + 2, 4-D at 0.7 kg a.e. /ha) and six rope-wick treatments: Milestone (aminopyralid) at 1, 10 and 20% concentrations, Roundup WeatherMax (glyphosate) at 50% concentration, and Remedy Ultra (triclopyr) and Stinger (clopyralid) at 20% concentration. The Boone County location had an additional five broadcast foliar treatments: Milestone (aminopyralid at 53, 70 and 88 g a.e. /ha), PastureGard (triclopyr at 0.5 kg a.e. /ha + fluroxpyr at 0.2 kg a.e. /ha) and Crossbow (2,4-D at 1.1 kg a.e. /ha + triclopyr at 0.6 kg a.e. /ha). The treatments for the Canada thistle study consisted of the same six rope-wick treatments as the Fayette County tall ironweed study in 2007. A foliar broadcast treatment of Milestone (aminopyralid at 70 g a.e./ha) was included in 2008. Tall ironweed and Canada thistle control was evaluated 1, 2, 3, 4, 8 and 52 WAT. Tall ironweed population counts were taken before treatment and one year after treatment. ForeFront R&P provided 86% control of tall ironweed 52 WAT. Milestone at 20% v/v controlled 65% of tall ironweed. All other rope-wick treatments ranged from 22 to 36% control 52 WAT. Tall ironweed population was reduced 86 and 81% for ForeFront R&P at Fayette and Boone Counties, respectively. Control for five additional foliar broadcast treatments 52 WAT varied from 10 to 83%. Canada thistle control 52 WAT ranged from 0 to 25% control for the six rope-wick treatments.

RESPONSE OF RUSSIAN KNAPWEED (*ACROPTILON REPENS*) AND PERENNIAL PEPPERWEED (*LEPIDIUM LATIFOLIUM*)) TO SUMMER AND FALL HERBICIDE APPLICATIONS. C.V. Ransom*, S.A. Dewey; Utah State University, Logan, UT

ABSTRACT

Russian knapweed and perennial pepperweed are deep rooted perennial weeds that are troublesome across the Western U.S. Trials were established in 2004 in Oregon and 2006 in Utah to evaluate herbicides applied in the summer and the fall for Russian knapweed and perennial pepperweed control. Summer applications were made to Russian knapweed in July and August and to perennial pepperweed in June. Fall applications to both species were made in October, November, or December, depending on location. Treatments evaluated at all locations included imazapyr (70, 105, 140, 210, 280, 420, and 560 g/ha) and imazapic (140 and 210 g/ha). Russian knapweed trials in Utah also included picloram (560 g/ha), clopyralid (420 g/ha), and aminopyralid (105 g/ha). Perennial pepperweed trials in Utah included treatments of metsulfuron (42 g/ha) and chlorsulfuron (53 g/ha). All treatments included methylated seed oil at 1.25% v/v. Treatments were arranged in a randomized block design with four replicates. Plots measured 3 m wide and 9 m long. Herbicide treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 187 l/ha at 207 kPa pressure. Trials were evaluated for weed control one and two seasons after treatment. When applied in the summer, only the highest rate of imazapyr provided greater than 90% Russian knapweed control one season after application and control fell to 35% or less the second season after application. When applied in the fall, imazapyr rates of 280 g/ha or higher provided 94% or greater control one season after application. Imazapyr at 420 and 560 g/ha provided 76 to 95% Russian knapweed control two seasons after application, while long term control with imazapic was low. Control with picloram, clopyralid, and aminopyralid was consistent regardless of application timing. Aminopyralid applied either in the summer or fall provided 93% or greater Russian knapweed control two seasons after application. For all herbicides, perennial pepperweed control with summer applications was 95% or greater one season after application and 80% or greater two seasons after application. Perennial pepperweed control in response to fall herbicide applications averaged 59, 88, and 94% at the three sites and dropped to 6, 63, and 72% two seasons after application. Imazapyr rates of 105 g/ha or greater and 210 g/ha imazapic applied in the summer and imazapyr rates of 420 g/ha or imazapic at 210 g/ha applied in the fall in Utah were required to maintain 90% or greater perennial pepperweed control two seasons after application. Fall herbicide applications in Oregon provided 45% or less control of perennial pepperweed two seasons after application. Metsulfuron and chlorsulfuron provided 88 to 100% pepperweed control one season after application. Chlorsulfuron control when applied in the fall remained at 95% or higher two seasons after application and metsulfuron control fell to 25% or less at when applied in the fall. It appears that in general, fall herbicide applications are more effective for Russian knapweed control and summer applications are more effective for perennial pepperweed control. However, control of Russian knapweed with aminopyralid and picloram and control of perennial pepperweed with chlorsulfuron and higher rates of imazapyr or imazapic were quite consistent regardless of application timing, with the exception of fall applications on perennial pepperweed in Oregon.

FACTORS AFFECTING NATALGRASS (*MELINIS REPENS*) SEED GERMINATION. C.A. Stokes*, G.E. MacDonald, C. Reinhardt Adams; University of Florida, Gainesville, FL

ABSTRACT

Natalgrass (*Melinis repens*) is an exotic invasive grass species introduced as a forage to Florida in the late 1800s. Natalgrass was shown to have little utility as a forage, but has persisted in Florida. Recently, natalgrass has become an increasing problem in central and south central Florida, particularly in areas of active restoration. Natalgrass has the ability to quickly invade and colonize an area, with infestations occurring over a period of two to three years. Due to the rapid infestation levels, this appears to be seed-vectored. Therefore, a better understanding of seed germination characteristics will greatly aid land managers in the control of this species. Natalgrass seed were collected in the late fall/early winter of 2008 from a severe infestation in central Florida. Two distinct types of seed were collected. The first was shed seed from large deposits on the ground; the second, seed collected from mature plants. Preliminary study indicated that germination and percent viability from the seed on the ground was approximately 50%, with little to no dormancy. In contrast, seed collected directly from plants showed low levels of germination. However, further studies indicate that the germination of this seed has increased over time. This indicates a possible afterripening phenomenon for natalgrass. To further define seed germination characteristics, studies on temperature, light, pH and osmotic potential were conducted. Natalgrass was found to germinate between 20 and 35 degrees C, with optimum germination occurring at 30 degrees C. The seeds do not appear to require light for germination. In studies of the effect of pH, natalgrass germination was optimum at pH 7, with no germination at pH levels above this level and very low germination below. Natalgrass also appeared to be greatly affected by water stress, with no germination observed at osmotic potentials less than -0.2 MPa. Natalgrass has been shown to flower and produce seed in less than two months, and the lack of dormancy and the ability to germinate over a wide range of temperatures provide evidence to support the rapid invasion potential seen under field conditions.

LEAFY SPURGE CONTROL WITH DIFFERENT TANK-MIXES OF IMAZAPIC AND BAS 800H. S. Knezevic,[1] R. Rapp*,[1] A. Datta,[1] J. Scott,[1] L. Charvat,[2] J. Zawierucha[3]; [1]UNL, Concord, NE, [2]BASF Corporation, Lincoln, NE, [3]BASF Corporation, Raleigh, NC

ABSTRACT

Saflufenacil (BAS 800H) is a new herbicide being primarily developed for pre-plant and PRE broadleaf weed control in field crops (corn, soybean, sorghum, and wheat)**.** Leafy spurge is a serious weed problem in North America infesting over five million ha of rangeland and pasture. Imazapic is commonly used for leafy spurge control as a fall treatment only, because spring applications do not provide satisfactory control. Our hypothesis was that there might be synergism between imazapic and saflufenacil if applied in spring. Therefore, field experiments were conducted during spring of 2007 and 2008 with the objective to describe dose response curves of imazapic and salfufenacil applied alone and tank-mixed. Study was arranged in a RCBD with 21 treatments and three replications at O'Neill (North Central Nebraska). Treatments were applied to plots of 3×9 meters with a back sprayer delivering 187 L/ha aqueous solution through TeeJet 11003 flat fan nozzles at 234 kPa. Saflufenacil rates were: 0, 12.5, 25, 50, and 100 g ai/ha, and imazapic rates were: 0, 52.6, 105, and 158 g ai/ha. Dose-response curves based on log-logistic model were used to determine the ED_{90} (effective dose that provides 90% control) values of saflufenacil for each imazapic level utilizing the visual injury response variable. In general, none of the imazapic rates applied alone provided satisfactory leafy spurge control. In contrary, saflufenacil applied alone provided excellent leafy spurge control for about 30-90 DAT depending on the rates used, then the spurge started re-growing. The level of leafy spurge control was much longer lasting in the tank-mixes of the two herbicides, especially as the rates of both herbicides increased. The ED_{90} values of saflufenacil in the tank-mix with imazapic rate of 52.6 g ai/ha increased from 30 g to 340 g ai/ha with later rating dates, indicating that spurge was slowly regrowing over time (25-457 DAT). However, the ED_{90} values of saflufenacil in the tank-mix with imazapic rate of 105 g ai/ha were much more stable, and stayed around 25-30 g ai/ha for control up to 380 DAT, whereas 50 g ai/ha rate was needed for longer control up to 457 DAT. Similar trend occurred for ED_{90} values of saflufenacil tank-mixed with 158 g ai/ha rate of imazapic. Preliminary curve analysis suggested that the longest control of leafy spurge (400 DAT) was achieved with suflufenacil ED_{90} rate of about 25 g ai/ha tank mixed with 105 g ai/ha of imazapic. There was also cool season grass injury (10- 30%) with 158 g ai/ha of imazapic, which lasted for six weeks only. Results from this study indicated that indeed there is a synergism between the two herbicides, however additional studies are needed to determine the mechanism of such synergy. sknezevic2@unl.edu

ENHANCED ATRAZINE DEGRADATION: A SURVEY OF CROP FIELDS IN NORTH-EASTERN COLORADO. R. Khosla*,[1] D. Shaner,[2] B. Bosley,[3] A. Helm[3]; [1]Colorado State University, Fort Collins, CO, [2]USDA-ARS Water Management Unit, Fort Collins, CO, [3]Cooperative Extension Colorado State University, Fort Collins, CO

ABSTRACT

When it comes to weed management, logically, farmers have a very low tolerance for weed infestations since it can cause significant damage to their crop yields. However, over application of pesticides for any infestation has a serious consequence. Recently, farmers in the north-eastern Colorado reported that Atrazine was not giving the residual control as expected. This could be a cause of concern for many reasons because Atrazine is widely used in Colorado for controlling many broadleaf and certain grass weeds in corn (Zea mays L.) and other crops. A survey was conducted in 2007-2008 to determine the extent of fields showing enhanced Atrazine degradation. Soils were collected from several fields in various counties, such as Kit Carson, Larimer, Logan, Morgan, Philips, Washington, Weld and Yuma counties. Soil samples were collected from the fields had been planted in maize, wheat or were fallow at the time of collection. Our soil analysis indicates that approximately 30% of the fields tested showed enhanced Atrazine degradation. All of the fields with enhanced Atrazine degradation had a history of Atrazine use. Our survey findings suggest that Atrazine degrades rapidly in fields in Colorado where the herbicide has been continuously used for 3 or more years. This rapid degradation leads to loss of residual weed control as reported by farmers.

EFFECT OF CROPPING PATTERN AND CROP RESIDUE ON HERBICIDE BINDING TO SOIL. D. Shaner*,[1] N. Hansen,[2] L. Wiles[1]; [1]USDA-ARS, Fort Collins, CO, [2]Colorado State University, Fort Collins, CO

ABSTRACT

The binding of herbicides to soil is dependent on many factors, including soil texture, organic matter, and pH. In 2007 we were conducting an experiment to determine the effect of cropping patterns on atrazine efficacy and fate, and found that there was a significant relationship between cropping pattern and the binding of atrazine to soil from the top 7.5 cm. Atrazine bound more tightly to soil from plots where the previous year's crop was corn compared to soil where the previous year's crop was wheat. In 2008 these same differences were also observed. Three other herbicides, metribuzin, sulfentrazone and metolachlor, also bound more tightly to soil where the previous crop had been corn compared to wheat. The differences in binding could not be attributed to differences in soil texture, organic matter or pH. Surface crop residue was measured in 2008 and there was no difference in the total mass amongst the crop rotations. However, when the binding of these herbicides to aged crop residue removed from the corn plots and the wheat plots was measured, there were significant differences between the residues. All of the herbicides bound more tightly to corn residue compared to wheat residue. Thus, it appears that the type of crop residue in the soil was a major determinant of herbicide binding. These differences could have an impact on the herbicide efficacy as well as leaching behavior.

ECONOMIC VIS-À-VIS MICROBIOLOGICAL IMPACT ASSESSMENT OF DIFFERENT WEED MANAGEMENT PRACTICES IN RICE-RICE CROPPING SYSTEM IN NEW ALLUVIAL SOIL OF WEST BENGAL. K. Brahmachari*, R. Kundu, G. Saha; Bidhan Chandra Agril. Univ., Kalyani, India

ABSTRACT

Rice (wet season) - rice (summer) cropping sequence places itself in the second highest position from the area point of view; keeping rice- wheat sequence in the first position in this aspect. A number of factors have the responsibility for reducing the yield of this crop; like various insects, disease pathogens and severe infestation of weeds in rice fields causes barrier in achieving its higher yield. Weeds vie with the rice crop during its different growth stages in almost all the rice growing seasons for sunlight, space, water and nutrients. So, management of this dreadful weeds becomes a crying need in the production of rice *vis a vis* other crops in rice based cropping systems. Keeping this view in the background with a broader objective of identifying the different weed flora of transplanted rice ecosystem, standardizing the agro-techniques for their management, assessing different weed control measures with respect to their effects on yield of the crops in the cropping sequence, magnitude of losses due to weed infestation, their cost effectiveness vis-à-vis effects on soil microflora, a field experiment was carried out in wet season (2005-06) and summer season (2006-07) rice (cv. IET-4786) at Bidhan Chandra Krishi Viswavidyalaya, Kalyani (Latitude: $22^0$57′E, Longitude: $88^0$20′N and Altitude: 7.8m), West Bengal, India. The experiment was laid out in Randomised Block Design (RBD) with nine treatments replicated thrice. The treatment details were T_1- Unweeded control; T_2- Hand weeding (HW) at 20 days after transplanting (DAT); T_3- HW at 20 and 40 DAT; T_4- Butachlor @ 1.5 kg ha^{-1} at 4 DAT; T_5- Pendimethalin @ 1.5 kg ha^{-1} at 4 DAT; T_6- Oxadiargyl @ 0.1 kg ha^{-1} at 4 DAT; T_7- Butachlor @ 1.5 kg ha^{-1} at 4 DAT + HW at 20 DAT; T_8- Pendimethalin @ 1.5 kg ha^{-1} at 4 DAT + HW at 20 DAT and T_9- Oxadiargyl @ 0.1 kg ha^{-1} at 4 DAT + HW at 20 DAT. The most predominant weeds were *Echinochloa crusgalli*, *Leersia hexandra*, *Leptochloa chinensis* and *Paspalum distichum* as grassy weeds; *Cyperus iria*, *Cyperus difformis* and *Fimbristylis miliacea* as sedges and *Eclipta alba*, *Marsilea quadrifolia*, *Ludwigia parviflora* and *Oxalis corniculata* as broadleaf weeds. At 30 DAT in the wet season rice and summer rice, the treatment T_9 recorded the lowest number of all sorts of weeds, the lowest weed biomass and the highest weed control efficiency. On the other hand, at 60 DAT and the time harvest the treatment T_3 recorded the lowest number of weeds, minimum weed biomass and the highest weed control efficiency. The calculated weed indices of different treatments revealed that the unweeded control (T_1) recorded the highest weed indices, whereas the lowest indices were registered in the treatment T_9. The treatment T_3 produced the maximum grain yield of wet and summer season rice. Among the combined treatments and sole herbicidal treatments, combination of hand weeding and chemical herbicides produced better result. The treatment T_9 was found to be superior amongst the combined treatments. In both the seasons of consecutive two years, among all weed management practices the highest value of return per rupee invested was obtained in the treatment T_9 and the lowest one was found in the treatment T_1. Studies on the effect of herbicides on the proliferation of microorganisms like total bacteria, actinomycetes and fungi in the rhizosphere soil of both wet season and summer rice revealed that initially after the herbicidal application, all the herbicides under investigation e.g. Butachlor, Pendimethalin and Oxadiargyl reduced the population of total bacteria and fungi; though with the advent of time their population increased. But unlike the effect of Butachlor and Oxadiargyl on the population of total bacteria and fungi, Pendimethalin exhibited differently on actinomycetes population. Here, Butachlor and Oxadiargyl decreased the population of actinomycetes initially and increased its population in the later course of time; whereas, Pendimethalin never decreased the population of actinomycetes i.e. this herbicide improved the population of actinomycetes from the very begining after its application to the rice soil. The crop response was rated in the scale of 1 to 9 by using the European Weed Research Council Rating System, to record herbicides toxicity on crop stand and growth. It was found that any of the 9 treatments used did not show any visual phytotoxicity or crop injury symptoms in both wet and summer season rice at 40 DAT in both the years of experimentation.

ASSESSMENT OF INHERITANCE AND STABILITY OF GLYPHOSATE-RESISTANCE IN PALMER AMARANTH (*AMARANTHUS PALMERI*). D.N. Ribeiro*,[1] D.R. Shaw,[1] B.A. Baldwin,[1] J.A. Huff,[1] S.O. Duke,[2] V.K. Nandula[3]; [1]Mississippi State University, Starkville, MS, [2]USDA/ARS, Oxford, MS, [3]Delta Research and Extension Center, Stoneville, MS

ABSTRACT

The herbicide glyphosate is considered by many as the most important herbicide ever developed. Resistance to glyphosate has been reported in fifteen weed species, including Palmer amaranth, which was first reported in Georgia and North Carolina in 2005. In the summer and fall of 2007, seeds of 35 suspected resistant populations were collected across the Mississippi Delta region. A preliminary glyphosate-resistance screening study detected that several populations survived a glyphosate treatment of 0.42 kg ae ha^{-1} (glyphosate formulated as Roundup® Weathermax, 0.54 kg ae L^{-1}). These populations were further screened for glyphosate resistance by treating 3- to 6-leaf stage plants with glyphosate at 0.84 kg ae ha^{-1} and percent control and survival measured 2 wk after treatment. Twelve (first controlled cross, X1 generation) of the 35 populations were resistant to glyphosate with control ranging from 10 to 50% and survival from 55 to 99%. Subsequently, a second controlled cross (X2 generation) was developed with the aim to proceed with studies of inheritance and stability of the glyphosate-resistance trait in Palmer amaranth. Palmer amaranth is dioecious, consequently male and female plants from a given population were grown together in isolation from other populations in different greenhouses to ensure genetic purity of the X2 generation. In the process, 22 unique biotypes across the 12 resistant biotypes were developed as the X2 generation.

GENETIC LOAD AND COMPETITION EFFECTS RESULTING FROM TRANSGENE FLOW FROM CANOLA TO FIELD MUSTARD: EVENT SPECIFIC INTROGRESSION AND TRANSGENIC MITIGATION. C.N. Stewart*,[1] C.W. Rose,[1] R.J. Millwood,[1] H.S. Moon,[1] M.R. Rao,[1] M.D. Halfhill,[1] P.L. Raymer,[2] S.I. Warwick,[3] H. Al-Ahmad,[4] J. Gressel[5]; [1]University of Tennessee, Knoxville, TN, [2]University of Georgia, Griffin, GA, [3]Ag and Agrifood Canada, Ottowa, ON, Canada, [4]An-Najah National University, Nablus, Palestinian Territory, Occupied, [5]Weizmann Institute of Science, Rehovot, Israel

ABSTRACT

Fitness effects of hitchhiking crop alleles with transgenes as they become introgressed with into weedy genomes (genetic load) is one theorized explanation for the poor performance of *Brassica napus* (crop) × *Brassica rapa* (weed) transgenic hybrids. In order to measure the effects of genetic load, hybrid performance and productivity data (i.e., seed yield and biomass) were correlated to crop and weed specific AFLP genomic markers. In the absence of interspecific competition, transgenic hybrids benefited from more crop markers. There was a positive correlation between fitness performance and *B. napus* (crop) specific AFLP markers [(seed yield vs. marker ($r = 0.54$, $P < 0.0003$) and vegetative dry biomass vs. markers ($r = 0.44$, $P < 0.0046$)]. However, under interspecific competition--more weed-like conditions--there was a positive correlation between *B. rapa* specific markers and seed yield ($r = 0.70$, $P < 0.0001$). When genetic load was directly incorporated into a genome by inserting a fitness-mitigating gene (one that is beneficial for crops but bad for weeds), using a dwarfing gene, there was a dramatic decrease of transgenic hybrids persisting in a competitive environment. Our data suggest that while the natural introgression of crop alleles results in a small relative reduction of transgenic hybrid performance correlating with genetic load, transgene mitigation strategies will be more effective in decreasing unwanted transgene persistence in weedy genomic backgrounds.

OUTCROSSING INTERACTIONS OF EARLY-FLOWERING STRAWHULL AND LATE-FLOWERING BLACKHULL RED RICE (*ORYZA SATIVA*) WITH COMMERCIAL RICE VARIETIES. D.R. Gealy*; USDA-ARS, Stuttgart, AR

ABSTRACT

Red rice continues to be a challenging weed pest in the southern U.S. rice, in part due to the diversity of biotypes and its significant outcrossing potential with herbicide-resistant rice. The outcrossing interactions between red rice and true-breeding rice cultivars are generally well established, but little is known about such interactions with hybrid cultivars. A field experiment was planted at Stuttgart, AR on June 7, 2006 to evaluate outcrossing between early- (71 DAE) or late-flowering (84 DAE) red rice biotypes and four hybrid rice cultivars in comparison to true-breeding cultivar standards. The 18-row plots were 3.2-m wide by 4.6-m long and were isolated 3 to 5 m from adjacent plots. Red rice at a reduced planting density occupied 4 of the rows, each flanked by several rows of rice. This resulted in a heavy, uncontrolled red rice infestation (17%) intended to maximize natural outcrossing with rice. StgS (PI 653423) and #8 (PI 653425) red rice began flowering 3-6 days before and 4-10 days after hybrid rice flowering, respectively and flowering of rice and red rice overlapped about 1 week in most plots. In 2007, red rice and rice seeds harvested from plots in 2006 were planted in 12-m-long plots to identify putative red rice x rice hybrids. These were identified, either as survivors of three imazethapyr applications (for red rice seedlings originally obtained from imidazolinone-resistant rice plots), or by various phenotypic traits depending on the rice and red rice parents (e.g. tall plants, pubescent leaves, red pericarp, seed shape). DNA was extracted from leaves of putative crosses. True rice-red rice hybrids were confirmed using molecular markers (RM234, RM232, RM5, RM253, and Rid12) which differentiated between rice and red rice alleles. Outcrossing rates for the hybrid cultivars were typically greatest with rice serving as the female, averaging >5 times the rates in the reverse direction. Outcrossing rates also averaged >10 times more with StgS than with #8 as the red rice parent. With StgS red rice as the pollen donor, the outcrossing rate for only one of the hybrid cultivars tested was greater than that for a true-breeding standard, imidazolinone-resistant CL121 (1.1% vs. 0.35%). With rice as the pollen donor, however, outcrossing rates for three of the hybrid cultivars with StgS were greater than for the standard (0.20%, 0.34%, and 0.23% vs. 0.0045%). In the past, the impacts of outcrossing from true-breeding cultivars in red rice-infested fields have typically been greatest when non-shattering, herbicide-resistant cultivars were the predominant pollen donors for highly shattering red rice plants, which automatically reseeded the fields. Hybrid cultivars, however, have been observed to shatter more than traditional true-breeding cultivars in some situations. Thus, agronomic impacts from the production of red rice hybrids from red rice as a major pollen donor could potentially increase if the use of shatter-prone hybrid cultivars continues.

MATERNAL AND HORMONAL REGULATION OF SEED DORMANCY IN PALMER AMARANTH.

P. Jha*, J.K. Norsworthy; University of Arkansas, Fayetteville, AR

ABSTRACT

The effects of maternal shading and seed location on the mother plant on Palmer amaranth seed dormancy were investigated. Increasing the maternal shading from 0 to 87% increased seed dormancy from 75 to 88%. The endogenous gibberillic acid (GA) content of seeds that matured under 47 or 87% shade was 49.7 ng g^{-1} dry seed when compared with 50.5 ng g^{-1} in dry seed that matured under 0% shade (full sunlight). Abscisic acid (ABA) content of progeny seeds increased from 13.3 ng g^{-1} dry seed with 0% shade to 19.1 ng g^{-1} dry seed with 87% shade. Seeds from plants grown under full sunlight or 47% shade had similar endogenous ABA contents. Shading of the maternal plant did not influence the 1000-seed weight of Palmer amaranth. Seed that matured in the bottom third of the mother plant had 91% dormancy compared with 84 to 85% dormancy of those that matured in the top and middle third location of the mother plant. Endogenous GA content of seeds did not differ between locations on the mother plant. However, the ABA content of seeds that were produced in the bottom third of the mother plant was 17.8 ng g^{-1} dry seed, which was higher than the 11.2 and 12.2 ng g^{-1} dry seed in those that were produced at the top and middle portions on the plant, respectively. Seed location on the mother plant had no effect on the 1000-seed weight of Palmer amaranth. Endogenous ABA or GA content of seeds and seed weight had no relationship with seed dormancy over and above the maternal treatment effects. Thus, it is concluded that Palmer amaranth seed dormancy is partially regulated by maternal shading and seed location on the mother plant.

MAINTAINING THE ISOGENIC NORTH AMERICAN *STRIGA ASIATICA*. C.L. Brommer*,[1] A. Palmer,[2] Y. Liu,[1] N. Kinger,[1] M. Chen,[1] D.G. Lynn[1]; [1]Emory University, Atlanta, GA, [2]University of Wisconsin, Madison, WI

ABSTRACT

The parasitic members of the genus *Striga* remain a substantial burden to agricultural yields throughout much of the developing world. The *Striga asiatica* infestations in the Carolinas of North America represent a unique isogenic seed line, a valuable resource for the development of novel pest management strategies. However, the available seed stocks from USDA-APHIS are dwindling in number and viability. To preserve this valuable resource for future research we have developed an approach for growing *Striga asiatica* inside an environmental chamber on its common host *Zea mays*. Via the direct inoculation of subsurface corn roots with seeds of *S. asiatica* we were able to conserve the limited seed supply as well as to permit specific roots to be targeted for parasitism. Under the conditions presented here successful germination, attachment, and growth of *Striga* was observed in 20% of the inoculated corn seedlings. *Striga* heights were approximately 35 cm, with an average of 26 flowers per plant, and an estimated 410 seeds per pod. All parasites yielded viable seeds, as confirmed by their response to known host derived signals (xenognosins) for germination and development of the host attachment organ, the haustorium. Both germination and haustorium development percentages in the seeds harvested from these Environmental chamber assays were improved relative to seeds harvested from field plots from 1995. These seedlings required substantially reduced pretreatment times to optimize the initiation of these developmental transitions. These methods establish the critical elements necessary to maintain, and propagate, the unique isogenic strain of *Striga asiatica* found in North America and extends the objectives of the Emory Center for Parasitic Plant Research to include viable seed production of these agriculturally important obligate hemi-parasites. Furthermore, these studies provide the foundation for the direct evaluation of interactions between host and parasite, a protocol with important implications for evaluating the success of new pest management strategies.

ESTABLISHMENT CAPABILITIES OF ALFALFA (*MEDICAGO SATIVA* L.) SOWN IN A GRASS SWARD SUBJECTED TO DIFFERENT DISTURBANCES. M.V. Bagavathiannan*,[1] R.H. Gulden,[1] R.C. Van Acker[2]; [1]University of Manitoba, Winnipeg, MB, Canada, [2]University of Guelph, Guelph, ON, Canada

ABSTRACT

An experiment was initiated in 2006 to investigate the establishment potential of alfalfa in a grass sward after being subjected to different disturbance treatments including herbicide spray, mowing and sward scarring. Sowing was done two times, once in spring (early May) and the other in fall (early September) to represent seed spill/dispersal in the road verges. Herbicide spray (2, 4-D), mowing and sward scarring was carried out such that they mimic the real time scenario in the road verges. Mowing was done twice (late July and late August) and the herbicide was sprayed in mid July. Sward scarring was done in early June. A well-tilled seed bed (control) and an untreated control were also included in the experiment. The experiment therefore consisted of 10 treatments (spring and fall sowing) and was replicated four times. Each plot measured 2x3 m^2 and the sowing rate was 1500seeds m^{-2}. Among the times of sowing, plots sown in spring showed higher levels of establishment when compared to the ones sown in fall. Considering the spring sown plots, plant population m^{-2} was higher in undisturbed plots (19) and the seed yield m^{-2} was greater in well tilled seed bed (19.6g). Although mowing didn't significantly affect plant population m^{-2} (17), it substantially reduced the seed output m^{-2} (1.55g) and in most of the plots mowed plants didn't produce any mature seed before the second mowing. Herbicide (2, 4-D) application had an adverse effect on the survival of recruiting seedlings. However, later recruiting seedlings continued to grow and produced seeds, although low in average (3.12 gm^{-2}). Despite the lower plant population (3 plants m^{-2}), plots with sward scarring produced considerably greater seed yields m^{-2} (15.92g). This could be due to the favorable microsite and reduced competition for the recruiting seedlings. Higher levels of seedling mortality were observed in fall seeded treatmen ts since the seedlings didn't survive winter. However, among the fall seeded treatments, undisturbed plots recorded higher plant population m^{-2} (11) and sward scarred plots produced greater seed yields m^{-2} (13.88g). The degree of winter survival was correlated with the level of vegetation in each treatment. This information will be useful in population dynamic models to predict the population growth of feral alfalfa as affected by different stochastic processes. This information and this type of model will be helpful in the risk assessment of alfalfa containing novel traits.

TIMING OF SULFENTRAZONE PLUS PRODIAMINE FOR CRABGRASS CONTROL IN PERENNIAL RYEGRASS AND KENTUCKY BLUEGRASS. T.L. Mittlesteadt*, S.D. Askew; Virginia Tech, Blacksburg, VA

ABSTRACT

Crabgrass (*Digitaria* sp.) is one of the most troublesome summer annual weeds in the south. Crabgrass usually germinates in late April or early May and persists throughout the summer. Crabgrass can be found in most turfgrass species and can tolerate low mowing heights. Common crabgrass control strategies include using pre emergent herbicides in the spring and using post emergent selective herbicides to control any crabgrass that emerges. Prodiamine is among the most common preemergence herbicides used for crabgrass control. This common herbicide was recently combined with a new sedge and broadleaf herbicide, sulfentrazone, to produce a value-added preemergence herbicide called Echelon 4SC. Our objective is to evaluate the control of smooth crabgrass (*Digitaria ischaemum* L.) using Echelon 4SC (sulfentrazone+prodiamine) and Echelon on fertilizer (sulfentrazone+prodiamine 24-5-11) at three different application timings. Studies were conducted in Blacksburg, VA at the Glade Road Research Facility on Kentucky bluegrass (*Poa pratensis* L.) and at the Turfgrass Research Center on perennial ryegrass (*Lolium perenne* L.). A randomized complete block design was used at both locations. Treatments included Echelon 4SC (470 g ai/ha), Echelon on fertilizer (470 g ai/ha), and Dimension (dithiopyr) (157 g ai/ha) as a comparison. Treatments were applied on April 1 at the PRE stage, June 11 at the 1-4 leaf, and July 1 at the 1-2 tiller stage. Data collected included cover, control, and injury. Means were separated using Fisher's LSD. Applying treatments at the PRE timing controls smooth crabgrass > 40% better than other application timings. Smooth crabgrass control did not significantly differ between the 1-4 leaf and 1-2 tiller application timings. Furthermore, smooth crabgrass control did not significantly differ between the three herbicides tested in perennial ryegrass. However, in Kentucky bluegrass Echelon 4SC and Dimension controlled smooth crabgrass significantly better (>40%) than Echelon on fertilizer when applied at the PRE stage. Treatments did not injure Kentucky bluegrass or perennial ryegrass.

HERBICIDE OPTIONS FOR STAR-OF-BETHLEHEM (*ORNITHOGALUM UMBELLATUM*) CONTROL.

G.K. Breeden*, J.T. Brosnan; University of Tennessee, Knoxville, TN

ABSTRACT

Star-of-Bethlehem (*Ornithogalum umbellatum*) is a perennial ornamental plant that can be a troublesome weed in many turf areas, including golf courses, athletic fields, and residential landscapes. Few herbicides have activity against Star-of-Bethlehem, with non-selective herbicides like glyphosate often exhibiting inconsistent activity. Reports suggest that new protoporhyrinogen oxidase (PPO) inhibiting herbicides, such as carfentrazone and sulfentrazone, may offer improved activity against Star-of-Bethlehem; however, research data supporting these claims is limited. Field research was initiated in the spring of 2008 to evaluate the efficacy of various turf herbicides including carfentrazone and sulfentrazone for postemergence control of Star-of-Bethlehem. Research was conducted on a mature stand of tall fescue (*Festuca arundinacea*) maintained as a golf course rough at the Plant Science Unit of the East Tennessee Research and Education Center in Knoxville, TN. Plots (1.5 by 3 m) were arranged in a randomized complete block design with three replications. Herbicide treatments included bromoxynil (560 g ai/ha), sulfentrazone (280 g ai/ha and 420 g ai/ha), carfentrazone (35 g ai/ha), quinclorac + sulfentrazone + 2,4-D + dicamba (1730 g ai/ha), and sulfentrazone + 2,4-D+ MCPP+ dicamba (1220 g ai/ha). All treatments were applied on 7 April 2008 with a CO_2 powered boom sprayer calibrated to deliver 280.5 L/ha utilizing four, flat-fan, 8002 nozzles at 124 kPa, configured to provide a 1.5-m spray swath. Weed control and turf injury were evaluated visually utilizing a 0 (no weed control or turf injury) to 100 (complete weed control or turf injury) % scale, with greater than 70% control considered acceptable. Data was collected at 7, 14, and 28 days after application (DAA). At no time in this study was tall fescue injury observed. Carfentrazone at 35 g ai/ha and sulfentrazone at rates of 280 and 420 g ai/ha controlled Star-of-Bethlehem ≥82% at 7 DAA. All other treatments controlled Star-of-Bethlehem ≤ 48% at 7 DAA. Bromoxynil at 560 g ai/ha, carfentrazone at 35 g ai/ha, and sulfentrazone at rates of 280 and 420 g ai/ha controlled Star-of-Bethlehem ≥93% at 14 DAA. Quinclorac + sulfentrazone + 2,4-D + dicamba at 1730 g ai/ha and sulfentrazone + 2,4-D+ MCPP+ dicamba at 1220 g ai/ha controlled Star-of-Bethlehem 82 and 77%, respectively at 14 DAA. Control for all treatments decreased to ≤72% at 28 DAA, except for sulfentrazone at rates of 280 and 420 g ai/ha, which measured ≥95% at 28 DAA. These data suggest applications of sulfentrazone at rates of 280 and 420 g ai/ha can provide postemergence control of Star-of-Bethlehem in established tall fescue turf.

CONTROL OF SEDGES IN TURFGRASS WITH IMAZETHAPYR AND SULFENTRAZONE COMPARED TO INDUSTRY STANDARDS. J. Rose*, S. McElroy; Auburn Univ., Auburn, AL

ABSTRACT

Purple nutsedge (*Cyperus rotundus*) is a troublesome weed in warm-season turfgrasses. Sulfonylurea herbicides, such as trifloxysulfuron, are efficacious in controlling purple nutsedge; however, this herbicide can be injurious to centipedegrass (*Eremochloa ophiuroides*). Sulfentrazone (Protox inhibitor) + imazethapyr (ALS inhibitor) could potentially control purple nutsedge without the risk of turfgrass injury. The objective of this study was to evaluate sulfentrazone + imazethapyr for purple nutsedge control and injury to warm-season turfgrasses compared to standard treatments. Two studies were conducted comparing sulfentrazone + imazethapyr (4 lb/gal) to the standard treatments trifloxysulfuron (Monument®) and halosulfuron (Sedgehammer®). The sulfentrazone + imazethapyr combination is 3.33 lb/gal sulfentrazone plus 0.67 lb/gal imazethapyr. Study one was conducted on centipedegrass at Auburn University's Turfgrass Research Unit in Auburn, AL. Study two was conducted in newly seeded bermudagrass (*Cynodon dactylon*) at Auburn University's E. V. Smith Research Center in Shorter, AL. For studies one and two, sulfentrazone + imazethapyr was applied at 0.16 (0.13 lb sulfentrazone and 0.03 lb imazethapyr), 0.25 (0.21 lb sulfentrazone and 0.04 lb imazethapyr), 0.29 (0.24 lb sulfentrazone and 0.05 lb imazethapyr), 0.38 (0.32 lb sulfentrazone and 0.06 lb imazethapyr), and 0.45 (0.37 lb sulfentrazone and 0.08 lb imazethapyr) lb ai/a; trifloxysulfuron was applied at a rate of 0.03 lb ai/a and halosulfuron was applied at 0.06 lb ai/a. Trifloxysulfuron and halosulfuron were applied with non-ionic surfactant (NIS) at 0.25%v/v. Following herbicide applications, turfgrass injury was visually estimated 1, 2, 4, 6, and 8 weeks after application (WAA) on a 0 (no turfgrass injury) to 100 (complete turfgrass death) % scale relative to the non-treated check. Nutsedge control was visually rated on the same dates on a 0 (no nutsedge control) to 100 (complete nutsedge control) % scale relative to the non-treated check. Both studies were a randomized complete block design. Data was subjected to ANOVA (P = 0.05). Means were separated using Fisher's protected LSD (P = 0.05). Study one: In general, purple nutsedge was controlled faster using sulfentrazone + imazethapyr, however, 4 WAA control from sulfentrazone + imazethapyr was equal to trifloxysulfuron and halosulfuron. Purple nutsedge control was 67, 62, and 77%, respectively, 1 WAA when using sulfentrazone + imazethapyr at 0.29, 0.38 and 0.45 lb ai/a. Trifloxysulfuron and halosulfuron controlled purple nutsedge 8 and 12%, respectively, 1WAA. 8 WAA trifloxysulfuron, halosulfuron, and sulfentrazone + imazethapyr at the three highest rates had ≥ 85% control of purple nutsedge. Halosulfuron and sulfentrazone + imazethapyr injured centipedegrass ≤ 35% 1 WAA, but had completely recovered 4 WAA. Trifloxysulfuron injured centipedegrass 10% 1 WAA and injury continued to increase throughout the study with 77 and 90% injury 4 and 6 WAA, respectively. Study two: In general, purple nutsedge control peaked 4 WAA for all herbicides. Sulfentrazone + imazethapyr applied at 0.45 lb ai/a controlled purple nutsedge 58, 90, 87 and 53% 1, 2, 4 and 8 WAA, respectively. Lower rates of sulfentrazone + imazethapyr did not provide effective long-term purple nutsedge control. Trifloxysulfuron controlled purple nutsedge 18 and 80% 1 and 2 WAA, respectively. Halosulfuron controlled purple nutsedge 95 and 68% 4 and 8 WAA, respectively. Sulfentrazone + imazethapyr applied at 0.16 to 0.45 lb ai/a injured newly seeded bermudagrass 50 to 80% respectively, 2 WAA. In general, sulfentrazone + imazethapyr at higher rates and trifloxysulfuron were the most effective purple nutsedge control treatments; however, control did change over time. Further research will investigate separate treatments of sulfentrazone and imazethapyr compared to combination treatments of similar rates; as well as investigating repeat applications.

ANNUAL WEED CONTROL WITH AMICARBAZONE AND FLUCARBAZONE IN WARM-SEASON TURF. J. Belcher*, R. Walker; Auburn University, Auburn University, AL

ABSTRACT

Amicarbazone (triazolinone) and flucarbazone (triazolone) are currently being evaluated for use in turfgrass. Research was conducted to evaluate emerald zoysiagrass (Zoysia japonica x Z. tenuifolia) tolerance and winter broadleaf weed control with these compounds. Two experiments were initiated January 2008 and evaluated the same treatments at two different locations. Treatments evaluated were: amicarbazone at 0.26 and 0.52 kg ai/ha; flucarbazone at 0.03 kg ai/ha, metsulfuron at 0.14 kg ai/ha, and a non-treated control. Treatments also included combinations of amicarbazone and flucarbazone at the above listed rates. Treatments were replicated four times. A non-ionic surfactant was added to all treatments at 0.25% v/v. Applications were made with a backpack sprayer calibrated to deliver 280 L/ha. Experiment one evaluated percent control of henbit (Lamium amplexicaule), narrowleaf vetch (Vicia sativa), bristly mallow (Modiola caroliniana), and dichondra (Dichondra carolinensis). Percent control of henbit, Carolina geranium (Geranium carolinaianum), common chickweed (Stellaria media), and Florida betony (Stachys floridana) were recorded over time in experiment two. Henbit control in experiment one was excellent (>90%) 31 days after application (DAA) with all treatments containing amicarbazone. Metsulfuron provided 85% control of henbit. Flucarbazone applied alone failed to provide any control or suppression of this species. Amicarbazone at 0.52 kg/ha applied alone as well as both rates of amicarbazone in combination with flucarbazone provided >98% control of narrowleaf vetch. Control with metsulfuron, amicarbazone at 0.26 kg/ha, and flucarbazone alone had little effect on this species, providing only 34, 13, and 5% control, respectively. Control of bristly mallow and dichondra were taken 110 DAA. Bristly mallow was controlled best with metsulfuron and the tank mix of amicarbazone at 0.52 kg/ha + flucarbazone, providing 96 and 90 %, respectively. Amicarbazone at 0.52 kg/ha provided the highest control of dichondra, 88%. In the second experiment, control of henbit 32 DAA was similar to that seen in experiment one. However, at 56 DAA, control had fallen for all treatments except metsulfuron (99%). Control with amicarbazone alone was 78 and 81%, respectively, for the 0.26 and 0.52 kg/ha rates. Combinations of amicarbazone+flucarbazone failed to control henbit 56 DAA. Only metsulfuron provided acceptable levels of control of Carolina geranium, common chickweed, and Florida betony 56 DAA, with control being >98% for all. Control of Carolina geranium and Florida betony was <40% with all other treatments. Control of chickweed was marginal, ranging from 43-65% with remaining treatments. A study was initiated August 2008 to evaluate emerald zoysiagrass tolerance. Treatments were: amicarbazone at 0.26 and 0.52 kg/ha with both single and repeat applications; flucarbazone at 0.03 kg/ha; and amicarbazone 0.26+flucarbazone 0.03 kg/ha. Repeat applications were made three weeks after the initial application. Zoysia injury was recorded over time. Injury from initial applications from all treatments was 31-38%, 10 DAA (30% considered unacceptable). However, injury had fallen to acceptable levels one week later. Highest injury from repeat applications was observed for the high amicarbazone rate at 38%, with all others being within acceptable limits. Six weeks after initial application, highest injury was recorded for the high rate of amicarbazone at 27%.

ANNUAL BLUEGRASS CONTROL WITH AMICARBAZONE IN PERENNIAL RYEGRASS OVERSEED. R. H. WALKER*, J. L. BELCHER; AUBURN UNIVERSITY, Auburn university, AL

ABSTRACT

Annual bluegrass (POAAN) is one of the most widespread winter weeds in turf, especially when hybrid bermudagrass is overseeded in the fall with cool-season species such as perennial ryegrass (LOLPE). Research objectives were to determine potential for amicarbazone (triazolinone) and flucarbazone (triazolone) to control POAAN in overseeded LOLPE, and effects on spring transition of hybrid bermudagrass. 'Integra' LOLPE was overseeded mid-October 2007 on areas that historically have high POAAN density. Each area was maintained as a golf course fairway. Proper fertilization, mowing, irrigation and pest control produced a high quality LOLPE turf. Experiment 1. Herbicide treatments evaluated were: amicarbazone at 0.26 and 0.52 kg ai/ha; flucarbazone at 0.03 kg ai/ha; amicarbazone + flucarbazone tank mixes; and trifloxysulfuron 0.02 kg ai/ha. Treatments were applied 15 February, 2008 to POAAN that was in full flower. Herbicides were applied with a backpack sprayer calibrated to deliver 280 L/ha. Non-ionic surfactant was included at 0.25% v/v. Individual plot size was 1.2 by 3.6 m and there were four replications. Percent POAAN control, LOLPE injury, and bermudagrass transition date were collected over time. LOLPE tolerance o amicarbazone at 0.26 kg/ha was excellent. Doubling this rate produced injury (canopy browning) greater than 20% when evaluated 39 DA-A (days after application). Flucarbazone caused only slight injury to the LOLPE. However, tank mixtures of amicarbazone and flucarbazone produced unacceptable injury. As expected, trifloxysulfuron caused unacceptbale injury to the LOLPE. POAAN control reached a maximum of 80% 61 DA-A with the 0.26 kg/ha rate. Doubling this rate provided 96 and 99% control 39 and 61 DA-A, respectively. Flucarbazone alone was not effective for POAAN control. Tank mixtures of amicarbazone + flucarbazone appeared to be antagonistic compared to amicarbazone alone. Amicarbazone provided better POAAN control than trifloxysulfuron. Tifway bermudagrass transition was not adversely affected by amicarbazone or flucarbazone. Experiment 2. Treatments included single applications of amicarbazone at 0.13, 0.26 and 0.52 kg/ha and sequential applications of 0.13 + 0.13 and 0.26 + 0.26 kg /ha. First application was 25 March and the sequential was 17 April, 2008. Experiment particulars and herbicide application and data collections were the same as previously described. LOLPE was tolerant of all rates of amicarbazone including the 0.52 kg/ha rate which at times was unacceptable in Experiment 1. A single application of 0.13 kg/ha provided only 35% control. A sequential at the same rate increased control to 89%. Amicarbazone at 0.26 kg/ha provided 79% control which increased to 99% when a sequential at this rate followed. A single rate of 0.52 kg/ha provided 99% POAAN control. Amicarbazone applied to LOLPE sooner than 20 weeks after emergence may produce unacceptable injury (on going research).

TOLERANCE OF EVENING PRIMROSE (*OENOTHERA ELATA* KUNTH) TRANSPLANTS TO PREEMERGENCE HERBICIDES. G.M. Henry*, A.N. Bates, C.B. McKenney; Texas Tech University, Lubbock, TX

ABSTRACT

Field experiments were conducted at the Quaker Research Farm at Texas Tech University in Lubbock, TX in the summer of 2008 to quantify the tolerance of *Oenothera elata* Kunth to preemergence herbicides. *O. elata* was established from seed in the greenhouse and transplanted in the field on June 6, 2008. Plots measured 1.0 x 3.6 m and were arranged in a randomized complete block design with four replications of treatments. Each plot contained five *O. elata* plugs spaced 0.6 m apart. Preemergence herbicide treatments were applied two days prior to plug transplant and consisted of pendimethalin at 0.67 kg ai/ha, prodiamine at 1.68 kg ai/ha, dithiopyr at 0.56 kg ai/ha, and metolachlor at 2.13 kg ai/ha. An untreated check and a weed-free check were included for comparison. Treatments were applied using a CO_2 backpack sprayer equipped with XR8003VS nozzle tips and calibrated to deliver 304 L/ha at 276 kPa. *O. elata* phytotoxicity ratings and percent control of pigweed spp., silverleaf nightshade, and barnyardgrass were taken 1, 2, 4, and 8 weeks after transplant (WAT). Data were subjected to analysis of variance (ANOVA) and means were separated using Fisher's Protected LSD at the 0.05 significance level. Pendimethalin and prodiamine treatments exhibited minimal phytotoxicity (9%) followed by (fb) metolachlor (47%) and dithiopyr (58%) 2 weeks after transplant (WAT). Phytotoxicity declined to 0% for pendimethalin and prodiamine treatments and 17 and 35% for metolachlor and dithiopyr treatments 8 WAT, respectively. All treatments provided unacceptable to moderate control (38 to 70%) of silverleaf nightshade 8 WAT. Pigweed spp. control 8 WAT was highest with metolachlor (91%). All other treatments provided moderate control 56 to 69%. Barnyardgrass control 8 WAT was highest (98%) with prodiamine fb dithiopyr (94%) fb metolachlor (88%) fb pendimethalin (83%). This trial will be replicated over time.

HERBICIDAL ACTIVITY OF MRC-01 ON *POA ANNUA*. K. Hwang, S. Koo*; Moghu Research Center Ltd., Daejeon, Republic of Korea

ABSTRACT

Herbicidal activity of a new herbicidal compound MRC-01 (5-(2,6-difluorobenzyl) oxymethyl-5-methyl-3-(3-methylthiophen-2-yl)-1,2-isoxazoline) on *Poa annua* was investigated in greenhouse and field. In greenhouse, MRC-01 showed 100, 80, and 60% of growth inhibition at pre-emergence, 2-, and 4-leaf stage of *P. annua* at 500 g a.i. ha^{-1}, respectively, and controlled *P. annua* independently with soil texture (loamy sand, sandy loam, clay loam) at 125 g a.i. ha^{-1}. With different sowing- depth, MRC-01 completely controlled *P. annua* at 125 g a.i. ha^{-1} at 1 and 5 mm, but showed about 91% growth inhibition at dose of 500 g a.i. ha^{-1} at 10 mm. The values of ED_{50} and ED_{90} to MRC-01 for pre-emergence application were 20.3 and 43.7 g a.i. ha^{-1}, respectively. For field test, MRC-01 was applied on March 14, 2008 on bentgrass putting green with a high level of *P. annua* infestation. *P. annua* treated was completely controlled with no phytotoxicity of turfgrass at dose of 500 g a.i. ha^{-1}. These results demonstrate that MRC-01 has potent herbicidal activity against *P. annua* at pre- and post-emergence and can be used safely in bentgrass putting green.

EFFECT OF PREEMERGENCE HERBICIDES ON BERMUDAGRASS ROOT ARCHITECTURE. J. Nettles,[1] G. Munshaw,[1] S.M. Borst*,[2] R. Strahan,[2] J. Beasley[2]; [1]Mississippi State University, Starkville, MS, [2]LSU Ag Center, Baton Rouge, LA

ABSTRACT

Preemergence herbicides (PH) have been shown to reduce root dry weights of several turfgrass species. However, very little is known regarding the effect of PH on root architecture. This study examined the effect of several commonly applied PH on bermudagrass cv. Tifway [Cynodon dactylon (L.) Pers.] rooting for 12 weeks after treatment (WAT). Herbicides were applied as single applications of dithiopyr, oxidiazon, pendimethalin, or quinclorac at manufacturer's recommended label rates. At 2, 4, 8, 12 WAT, bermudagrass roots were harvested and analyzed for total root length (TRL), surface area (SA), and diameter using the WinRhizo System. Pendimethalin-treated bermudagrass exhibited the greatest reduction in rooting in excess of 55% of control (POC) for TRL and SA at 8 WAT. Oxidiazon and quinclorac-treated bermudagrass exhibited patterns of early reduction in rooting of 15 to 25 POC and 28 to 41 POC, respectively, through 8 WAT before rebounding to control levels; whereas, a steady decline in diothiopyr-treated bermudagrass rooting was evident throughout the 12 week trial. Decline in root architectural parameters from PH treatment indicate root soil exploitation and uptake functions may be temporarily compromised.

GROWTH REGULATION OF PATRIOT BERMUDAGRASS WITH T-NEX AND BREAK-THRU COMBINATIONS. J.L. Jester*, J.B. Willis, S.D. Askew; Virginia Tech, Blacksburg, VA

ABSTRACT

Trinexapac ethyl is the most common plant growth regulator in turfgrass management. T-Nex™ and Primo™ are two commercial formulations of trinexapac ethyl. Cost of plant growth regulator treatments on golf courses can exceed $6000 annually and efforts to reduce costs can significantly impact golf course budgets. Recent advancements in organosilicon surfactant technology has led to new products that can potentially increase foliar and root absorption of plant protection chemicals. Break-Thru™ is a trisilicon product under evaluation for use in turfgrass. The use of improved adjuvants could allow for lower use rates of PGRs or to better performing formulations of commercial PGR products. The objective of this trial is to 1) evaluate effects of two T-Nex rates and three Break -Thru formulations on bermudagrass (*Cynodon dactylon*) clipping dry biomass and 2) compare effects of T-Nex to Primo on bermudagrass clipping reduction. The trial was initiated on July 10, 2008 at Glade Road Research Facility in Blacksburg, VA. Treatments were arranged in a randomized complete block design with 13 treatments and 3 replications. 'Patriot' bermudagrass was maintained at 13 mm clipping height, fertilized monthly during summer, and irrigated as needed. Clippings were taken 7, 14, 21 and 28 days after each of three treatments. Three treatments were applied July 11, August 8, and September 5, 2008 respectively. Treatments included T-Nex 48 and 96 g ai/ha alone and with 3 formulations of Break-Thru S200, S233 and S278 at 187 g ai/ha. Primo was applied at 96 g ai/ha. For ratings taken following the third application, T-Nex at 96 g ai/ha alone or with any surfactant and T-Nex at 48 g ai/ha plus Break-Thru S278 significantly reduced clipping biomass compared to the nontreated check for 28 days. Lower rates of T-Nex that did not contain the S278 formulation of Break-Thru significantly reduced clipping biomass for 21 days. The three Break-Thru formulations alone did not significantly influence clipping biomass at any evaluation. Clipping biomass reduction from Primo was never different from the same rate of T-Nex regardless of surfactant use. Considerable variability between clipping weights between plots were too high to separate what appear to be numeric trends between rates and occasionally between adjuvants at other evaluation times.

POSTEMERGENCE CONTROL OF PUNCTUREVINE (*TRIBULUS CISTOIDES* L.) IN BERMUDAGRASS. G.M. Henry*, T. Williams; Texas Tech University, Lubbock, TX

ABSTRACT

Field experiments were conducted at Meadowbrook Country Club in Lubbock, TX in the summer of 2008 to quantify the efficacy of several herbicides for the postemergence control of puncturevine (*Tribulus cistoides* L.). Studies were located on established infestations of puncturevine present in a common bermudagrass rough cut to a height of 5.0 cm. Plots measured 1.5 x 1.5 m and were arranged in a randomized complete block design with four replications of treatments. Treatments were applied using a CO_2 backpack sprayer equipped with XR8003VS nozzle tips and calibrated to deliver 304 L/ha at 276 kPa. Treatments were initiated on July 3, 2008 and consisted of metsulfuron at 0.036 or 0.072 kg ai/ha, sulfentrazone at 0.21 or 0.28 kg ai/ha, carfentrazone at 0.017 or 0.034 kg ai/ha, sulfosulfuron at 0.066 or 0.105 kg ai/ha + NIS at 1.0% v/v, trifloxysulfuron at 0.033 or 0.050 kg ai/ha, and 2,4-D + MCPP + dicamba + carfentrazone at 0.22 or 0.44 kg ai/ha. Visual estimates of percent puncturevine control and bermudagrass phytotoxicity were recorded 1, 2, 4, and 6 weeks after initial treatment (WAIT). Data were subjected to analysis of variance (ANOVA) and means were separated using Fisher's Protected LSD at the 0.05 significance level. No bermudagrass phytotoxicity was recorded throughout the length of the study. Puncturevine control declined with herbicide rates; therefore, only treatments containing the highest rates will be discussed. 2,4-D + MCPP + dicamba + carfentrazone exhibited 99% control followed by sulfosulfuron (76%) 2 WAIT. All other treatments exhibited ≤ 50% control 2 WAIT. Puncturevine control with 2,4-D + MCPP + dicamba + carfentrazone remained high (98%), while control with metsulfuron increased to 99% 6 WAIT. Moderate control (79%) was observed with trifloxysulfuron treatments 6 WAIT. All other treatments exhibited ≤ 43% control 6 WAIT. This experiment will be replicated in time.

PERFORMANCE CONSISTENCY OF REDUCED ATRAZINE USE IN MORPHOLOGICALLY DIVERGENT SWEET CORN HYBRIDS. M.M. Williams*,[1] R.A. Boydston,[2] R.E. Peachey,[3] D.E. Robinson[4]; [1]USDA-ARS, Urbana, IL, [2]USDA-ARS, Prosser, WA, [3]Oregon State University, Corvallis, OR, [4]Univesity of Guelph, Ridgetown, ON, Canada

ABSTRACT

Sweet corn losses due to weed interference occur in a majority of growers' fields. Restriction of atrazine, the single most important herbicide used in North American sweet corn production, is on the rise due to environmental concerns. Experiments were conducted in the primary sweet corn production regions to determine the agronomic implications of further reductions in atrazine use. Because commercial hybrids differ in competitive ability, we also tested the hypothesis that maintaining weed control at reduced atrazine doses would depend in part on the level of competition exerted by the hybrid. Field locations included Illinois, Oregon, and Washington in 2007 and 2008, and Ontario, Canada in 2008. Using weed species common to each location, we examined weed control and crop yield responses to five doses of atrazine applied postemergence (0, 41, 123, 370, and 1,120 g/ha) with 31 g/ha of tembotrione to 5-collar sweet corn. Two homozygous sugary1 hybrids representing the range of sweet corn competitive ability were also included: 'Quickie', a weakly competitive hybrid, and 'Code128', a strongly competitive hybrid. Increasing atrazine doses up to 1,120 g/ha improved weed control at harvest in six of seven environments; the one exception being a location where the crop had a significant size advantage to late-emerging weeds. Hybrid 'Code128' provided greater at-harvest weed control than 'Quickie' in four of seven environments. Atrazine use was associated with higher yields in two environments, where at-harvest weed control was less than 64%; otherwise, tembotrione alone mitigated crop losses due to weeds. Effect of atrazine dose on potential links between weed control two weeks after treatment (2WAT), at-harvest weed control, maximum crop leaf area index (LAI), and crop yield were investigated by pooling data across environments and using path analysis. The standardized regression coefficient linking weed control at harvest to weed control at 2WAT declined from 0.919 to 0.381, suggesting that the effect of higher doses of atrazine carried through to harvest to a greater extent than lower doses. As atrazine dose was reduced from 1,120 to 0 g/ha, level of weed control at harvest became a better predictor of crop yield. This was because at-harvest weed control varied more at doses below 1,120 g/ha, resulting in a greater range of competitive effects from residual weeds. In the absence of atrazine, the contribution of crop competitive ability was revealed, as evidenced by the significant regression coefficient (0.218) linking at-harvest weed control to crop LAI. Without effective alternatives, additional reductions of atrazine use in sweet corn production will result in poorer weed control and even greater crop losses. Utilizing more competitive hybrids lowers the risk associated with atrazine use reduction; however, even the most competitive of commercial hybrids are not immune to losses due to weed interference.

ARE THERE AS MUCH WEEDS ON THE CORN ROW AS ON THE INTER-ROW? L. Longchamps*,[1] B. Panneton,[2] M. Brouillard,[2] M. Simard,[3] G.D. Leroux[1]; [1]Laval University, Quebec, QC, Canada, [2]Agriculture and Agrifood Canada, St-Jean-sur-Richelieu, QC, Canada, [3]Agriculture and Agrifood Canada, Quebec, QC, Canada

ABSTRACT

Weeds occur in patches in row crops. Locating patches and targeting them by herbicide spot spraying could generate economical and environmental benefits. Spot spraying can be achieved if the spatial distribution of weeds is known or if a real time weed sensor triggers the spraying in presence of weeds. The second option requires sensors that discriminate crop plants from weeds. However, crop plants and weeds can be very similar in color and shape. Using a vegetation sensor only in the inter-row where there are no crop plants would eliminate this problem. Before doing so, the following question has to be answered: Are there as much weeds on the row as on the inter-row? To verify this hypothesis, nine 1-hectare field plots located in different commercial corn fields of Quebec were exhaustively photographed (image size: 3 m x 2 m; precision: ca 1 pixel / mm2) at the 3-5 leaf stage of corn. A sample was extracted from 20 % of the pictures (about 220 samples per plot). These samples consisted of a narrow band (750 mm wide by 3 mm high) with its centre exactly on the row, covering three regions: inter-row, corn row and inter-row compacted by the tractor wheel at seeding. In each region the area covered by weeds was estimated. Differences in average number of weed pixels per field among these regions were evaluated using ANOVA. The comparison of these three regions showed that weed infestation in the non-compacted inter-row was 40 % lower when compared to the infestation on the row. Weed infestation in the inter-rows compacted by the tractor wheel at seeding did not differ from that on the corn row. A possible reason for this is the increased weed seed-soil contact on the corn row and the inter-row compacted by the press wheel or the tractor wheel at seeding. These results suggest that a vegetation sensor should be located in the inter-row compacted by the tractor wheel at seeding to detect weeds. Otherwise, sensors located in inter-rows would underestimate weed cover.

HERBICIDE RESISTANT WEED SEED CONTAMINATION IN GRAIN SOWN IN WESTERN AUSTRALIA.

P. Michael*,[1] M.K. Owen,[2] S.B. Powles[2]; [1]Curtin University of Technology, Perth, Australia, [2]University of Western Australia, Perth, Australia

ABSTRACT

Preventing the introduction of weeds into the farming system through sowing of clean seed is an essential component of integrated weed management. As well as adding to the weed burden already present, foreign seed contamination may also introduce unwanted species and herbicide resistant biotypes into farming systems with potentially devastating consequences. Herbicide resistant annual ryegrass (*Lolium rigidum* L.), wild oats (*Avena fatua* L.), and wild radish (*Raphanus raphanistrum* L.) populations are widespread throughout the Western Australian (WA) grain belt and several studies have also identified high levels of weed seed contamination in crop seed. In 2007/8 a study was conducted to determine the extent of weed seed contamination of grain seed used for sowing and the herbicide resistance status of the weed seeds. A total of 183 grain samples (~10kg), of which half were wheat and half an alternative crop (i.e. barley, lupins, pea, canola and oats), were provided by 78 farmers from across the WA grain-belt. Samples were then hand cleaned and the total weed seed contamination was determined. Weed seeds were then screened for herbicide resistance using the most common herbicides used for the control of the weed. The results showed that 74% of grain samples had some level of weed seed contamination even though 97% of farmers stated that they had cleaned their grain. Contamination levels were highly variable between samples with an average of 14.1 ± 0.3 weed seeds per kg of crop seed (w/kg). The main contaminant weed was annual ryegrass (av 8.9 w/kg), which occurred in over half of all samples, followed by wild radish (av 2.7 w/kg), brome grass (*Bromus* sp) (av 1.3 w/kg) and wild oats (av <1 w/kg), which were all found in approximately one third of samples. The majority of annual ryegrass seeds were resistant to diclofop-methyl (83%) and sulfometuron (78%). Some resistance to the herbicides diclofop-methyl and chlorsulfuron was displayed within wild radish and wild oat seeds respectively, however, no resistance was found in brome grass to any Group-A herbicide tested. This study reveals that many WA farmers may be unknowingly introducing resistant weed seeds into their paddocks through the seeding process.

PURPLE NUTSEDGE (*CYPERUS ROTUNDUS*) AND YELLOW NUTSEDGE (*C. ESCULENTUS*) MANAGEMENT IN IRRIGATED SYSTEMS INFESTED WITH SOUTHERN ROOT-KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*).

J. Schroeder*,[1] S.H. Thomas,[1] L.W. Murray,[2] C. Fiore,[1] J. Trojan,[1] J. Libbin[1]; [1]New Mexico State University, Las Cruces, NM, [2]Kansas State University, Manhattan, KS

ABSTRACT

One factor affecting the sustainability of agriculture in the arid southwest is the management of pest complexes that have developed over time and limit profitability. Such persistent interactions among weeds, nematodes, insects and diseases are particularly important to producers who must intensively manage limited irrigated acreage in an economically efficient manner and without the use of nonselective biocides. Lack of knowledge regarding pest interactions encourages growers to focus on individual pests rather than broader complexes. Previous research identified relationships between yellow nutsedge, purple nutsedge, and southern root-knot nematode occurring simultaneously in sandy soils used to produce chile pepper (*Capsicum annuum* L.). These pests do not disseminate readily and, unlike their damaging effects on chile and most other crops, are adapted to a mutually beneficial coexistence that sustains and enhances the pest complex. Specifically, both nutsedge species host the nematode with little to no effect on vegetative growth, and tuber production is often enhanced. Root-knot nematodes overwinter in nutsedge tubers and are protected from fumigant nematicides. The nematode has a broad host range including most competitive crops that might be grown to suppress nutsedge populations. Research was conducted to determine if rotation with nondormant nematode-resistant alfalfa 'Mecca II' effectively suppresses the pest complex. Alfalfa grown for three years suppressed the pest complex compared to cotton. Chile yields were two times greater after alfalfa; however, populations of all three pests resurged to economically damaging levels by the end of the season. Research continued to determine if a two-year rotation of alfalfa followed by a directed-postemergence halosulfuron treatment in the chile crop slowed resurgence of the pest complex in the chile and a subsequent cotton crop. Nutsedge populations began to resurge in March, immediately after planting chile and prior to herbicide application when chile plants were 20 cm tall. This early resurgance indicated that two seasons of alfalfa did not suppress the weed population as effectively as three seasons had in previous research. However, nutsedge populations were suppressed by the halosulfuron treatment in both the chile crop and the following cotton crop. In addition, the herbicide treatment appeared to slow development of the nematode populations in the subsequent cotton crop compared to no herbicide treatment, probably due to suppression of the nutsedge. However, overall nutsedge and nematode populations were higher in the cotton crop indicating that work needs to continue to identify strategies that will effectively suppress the pest complex over multiple seasons. Results suggest that herbicide treatment in the alfalfa or three seasons of a nutsedge/nematode suppressing crop are needed to obtain initial suppression of the pest complex and additional in-crop management is needed to sustain pest suppression in subsequent crops. Rotation schemes must be chosen based on economic return, efficient water use, and effective suppression of the weed-nematode complex.

EVOLUTION OF RESISTANT *ECHINOCHLOA* SPP. IN CALIFORNIA RICE. C.E. Marchesi*, C.A. Greer, J.E. Hill, M.A. Jasieniuk, M. Canevari, R.G. Mutters, R.E. Plant, J. Eckert, A.J. Fischer; University of California, Davis, Davis, CA

ABSTRACT

Late watergrass (*Echinochloa phyllopogon*, LWG), early watergrass (*E. oryzoides*, EWG) and barnyardgrass (*E. crus-galli*, BYG) are the most competitive and difficult weeds to control in rice. Herbicide resistance in these species was confirmed in California in 1998. Resistance is the result of an evolutionary process in which preexisting mutants are allowed to proliferate under recurrent selection by herbicide use. Selection pressure is determined by factors related to the herbicide, the weed and their management. It is crucial to understand how resistance evolves and spreads. Factors that shape the incidence, evolution and spread of herbicide resistance weeds can be associated with crop management and landscape properties. Cross-resistance of *Echinochloa* spp. (ECH) to herbicides with different modes of action in California involves enhanced metabolism, and has evolved and spread differently for each species. My objective was to develop an integrative study to establish how interactions between crop management practices, landscape variables and mechanisms of resistance dispersal contributed towards defining the current distribution of ECH resistance throughout the California rice area. The research involved a field survey and controlled environment studies. Seed samples of EWG, LWG and BYG populations were taken from rice fields (U-shaped transect and problematic patches) and geo-referenced. Seed from each population along with known R and S controls for each species were screened for resistance against thiobencarb, fenoxaprop-ethyl and bispyribac sodium. Detailed field histories (herbicide use, water management and other rice cultural practices) for each site were retrieved via questionnaires. Data were subjected to multivariate analysis (CART) to assess relationships between site variables and levels of thiobencarb resistance. Cross resistance among the three herbicides was also assayed for the entire ECH collection. Species and populations exhibited various levels of thiobencarb resistance. The CART analysis revealed that preserving geographic isolation and reducing selection pressure are keys to resistance management. No R population of any of the three ECH tested in this study was found in the southern region (San Joaquin Valley), while both R and S populations were present in the north (Sacramento Valley). Responses of LWG populations to thiobencarb were clearly bi-modal, either highly S or R. Earlier studies using AFLP markers had suggested R populations are dispersed descendants from a single founder introduction. Geographic location was the only site or weed management variable discriminating between R or S LWG populations. Therefore, results suggest that flow of resistance genes is a crucial issue to address for delaying resistance evolution in LWG in CA rice fields. Resistance to thiobencarb in EWG exhibited a gradual progression from highly S to highly R populations with considerable within-population variability. Recent studies with SSR markers demonstrate that R EWG populations do not originate from a common founder effect but result from independent mutations within different populations, and that inter-population movement of resistant individuals had also occurred. Situations that favor weed proliferation and strong herbicide selection pressure were associated with the presence of R EWG. Good and diversified weed control should be prioritized for managing EWG resistance in CA rice fields. Few cases of low-level resistance were observed in BYG. Herbicide selection pressure for resistance may not have been strongly exerted upon BYG, since this is not a prevailing weed in CA rice. Resistance may have been introduced to this species by hybridization with R EWG, as suggested by the presence of abundant interspecific hybrids in the field. The CART analysis suggested gene flow via contaminated crop seed and poor weed control were associated with the presence of R BYG. EWG populations exhibited diverse cross-resistance patterns when screened against thiobencarb, fenoxaprop-ethyl and bispyribac sodium, which is consistent with the concept of resistance having originated from diverse independent mutations. Similar results were obtained with BYG. All R LWG populations exhibited resistance to the three herbicides, but levels of resistance to thiobencarb and bispyribac-Na were highly correlated in LWG, while resistance to fenoxaprop-ethyl was poorly correlated with resistance to the other herbicides, suggesting the involvement of different mechanism of resistance. Strategies to delay the evolution of resistance in ECH can be prescribed based on information relating the presence of resistance to the genetic structure of resistant population, and to site and weed management variables.

INTERCEPTION AND IDENTIFICATION OF FEDERAL NOXIOUS WEEDS AT U.S. PORTS OF ENTRY, 2007-2008.
M.L. Smither-Kopperl*,[1] I. Singh[2]; [1]USDA-APHIS-PPQ, SeaTac, WA, [2]USDA-APHIS-PPQ, Riverdale, MD

ABSTRACT

Several species of wind dispersed seeds are classified as Federal Noxious Weeds (FNW), and prohibited from entry into the United States. Wind dispersed seeds present particular challenges for interception; they may be dispersed over long distances, the seeds are small and light and can adhere to a variety of surfaces including the exterior of shipping containers and wooden pallets. Agriculture Specialists of Customs and Border Protection inspect cargo for the presence of FNW. Interceptions are sent to USDA-APHIS for identification. This documents the risk pathway for entry of wind dispersed FNW on maritime cargo into the ports of Seattle and Tacoma, WA. The four most frequently intercepted FNW in 2007 and 2008 respectively were cogongrass (*Imperata cylindrica* (L) Beauv.) (40, 130), mission grass (*Pennisetum polystachion* (L.) Schult.) (10, 24), wild sugarcane (*Saccharum spontaneum* L.) (23, 37) and Tridax daisy, (*Tridax procumbens* L.) (4, 19). There were seasonal differences in interceptions for cogon grass, which peaked in June and July, while wild sugarcane interceptions were greatest during October and November. The major countries of origin for cogon grass were China, Japan, Malaysia, Vietnam and Italy, 50% of all interceptions were from China. The major countries of origin for mission grass were Vietnam, Malaysia, Thailand and Turkey; and, 64% of interceptions were from Vietnam. The major countries of origin for wild sugarcane were India, China, Guam, Japan, and the Philippines; 26% of interceptions were from India and 25% from China. The major countries of origin for Tridax daisy were Vietnam, China, and Australia, 27% of all interceptions were from Vietnam, and 22% from Australia. During 2008, 16% of interceptions of wind dispersed FNW were from container inspections, and 32% from wooden pallets.

WEEDS OF THE SOUTH - A NEW WEED IDENTIFICATION BOOK FOR THE SOUTHERN UNITED STATES. M.S. DeFelice*; Pioneer Hi-Bred, Johnston, IA

ABSTRACT

The University of Georgia Press will be publishing a high quality, perfect-bound edition of the Southern Weed Science Society's weed identification book this spring. The book is co-edited by Charles Bryson and Michael DeFelice using photographs taken by Arlyn Evans. Drawing on the expertise of more than forty weed scientists and botanists, the guide identifies each plant at various stages of its life and offers useful details about its origin, habitat, morphology, biology, distribution, and toxic properties. The book also includes illustrations of the most common characteristics of and terms used to describe plants, a key to plant families, a glossary of frequently used terms, a bibliography, and indexes of scientific and common plant names. Each species account includes up to four full-color photographs showing seed, seedling, plant, flower, and other unique plant features, distribution map covering the United States and Canada (excluding Hawaii), a line drawing of the collar for each grass species, scientific names, common names, and local synonyms of common names, vegetative characteristics for seedlings and leaves, special identifying characteristics, reproductive characteristics, and toxic properties. States covered (species distribution maps also show occurrences outside the South) include Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. An essential resource for Cooperative Extension Service agents, government quarantine workers, agriculture and biology students, farmers, gardeners, lawn care professionals, green industry professionals, nursery owners, agronomists, horticulturists, botanists, and land preservationists. Royalties will go to the SWSS to support its education and service activities. Price has not been established as of this writing.

INTEGRATED WEED MANAGEMENT: "FINE TUNING THE SYSTEM..." E.C. Taylor*, K.A. Renner, C.L. Sprague; Michigan State University, East Lansing, MI

ABSTRACT

Based on grower demand for information on integrated weed management, Michigan State University published a new 132-page, all color extension bulletin titled “Integrated Weed Management: Fine Tuning the System” (E-3065). This new publication compliments “Integrated Weed Management: One Year’s Seeding¼” (E-2931), released in February 2005. Similar to “One Year’s Seeding¼” this new guide does not provide detailed management plans. Each chapter looks at how different cultural and management practices affect weeds. Our goal was to go one step beyond compiling written information from researchers and extension personnel to also include input from experienced growers through featured crop rotations, profiles, and the on-farm trials. The chapters in “Fine Tuning” include: complex crop rotations, cover crop systems, manure and compost, flaming, grazing and other biological controls, weed thresholds, on-farm weed management trials, and 14 new weed profiles.

OBSERVATIONS ON UNDERGRADUATE WEED SCIENCE TERM PAPERS. B.J. Lowry*, R.E. Whitesides, S.A. Dewey, C.V. Ransom; Utah State University, Logan, UT

ABSTRACT

During fall semester 2007 undergraduate students at Utah State University registered for Plant Science 5550/6550 - "Weed Biology and Control" or Plant Science 4900 - "Weed Management". The term paper assignment for each class was identical. Students were required to prepare a term paper in the form of an educational fact sheet that would be used to create a new Extension Publication titled - "Common Weeds of Yard and Garden". Fifty weeds, common to the yards and gardens of Utah and the Great Basin of the United States had been previously selected by county agents and weed scientists at Utah State University. Each of the students in the classes selected one of the weeds to use as the basis for their term paper. Students were told that their papers would be used as a skeleton for the text of the new Extension publication and that the class would be given credit in a footnote for their contributions to the document. All papers were required to contain a bibliography/literature cited section. After the semester was complete, term papers were used by a graduate student to compare text and references for accuracy prior to completing the Extension publication. This activity was not intended to evaluate student performance on the term papers but was intended to verify references and statements to ensure a quality Extension document. In addition to the fact that most term papers did not include all of the specific information requested in the assignment, results of this comparison showed: 1) more than 40% of the papers gave too few citations or no citations at all; 2) over one-third of the students had discrepancies between their in-text citations and their bibliography, did not appropriately reference a quotation found in their paper, or did not provide sufficient information in their bibliography; 3) nearly one quarter of term papers contained some areas where the students had plagiarized a reference; 4) more than one-fifth of the students provided some suitable references, but used less authoritative sources as the basis for the majority of their paper; 5) almost all papers contained more than one of the preceding problems. The amount of time necessary to compare term papers and references caused the authors to conclude that although it may have been appropriately educational to utilize students in this project, it was not pragmatic to have students involved in producing the publication, and that it would have been much easier to have written all weed biology material for the new publication from scratch.

NORTHEASTERN WEED SCIENCE SOCIETY NOXIOUS AND INVASIVE VEGETATION SHORT COURSE, SEPTEMBER 15-18, 2008. M.A. Bravo*,[1] W.S. Curran[2]; [1]Penn State University/Penn Dept of Agriculture, Harrisburg, PA, [2]Penn State University, University Park, PA

ABSTRACT

The Northeastern Weed Science Society (NEWSS) Noxious and Invasive Vegetation Management Short Course (NIVM) was offered for the first time in the Northeast for public and private land managers; policy makers; township and municipality supervisors; and contractors who wanted to gain a better understanding of noxious and invasive vegetation management in terrestrial and aquatic environments such as forests, parks, preserves, conservancies, C.R.E.P (conservation reserve) lands, highway right-of-ways (R.O.W), and ponds, lakes and riparian areas. Weed management and invasive vegetation identification professionals affiliated with NEWSS from Maine to North Carolina to Tennessee conducted the training program that was designed to encourage interaction between instructors and participants. The three-day course was held in Lebanon County, Pennsylvania at a wooded retreat in Mount Gretna the week of September 15th, 2008. Participants had the option of registering for a 2 day terrestrial species course providing more than 15 hours of continuing education and a 1 day aquatic species course providing 8 hours of continuing education or a combination thereof. Sixty-one registrants from MD, DE, PA, Washington D.C, NJ, NY, OH, VA, TN and Ontario, Canada attended the course that was taught by 16 instructors, a course coordinator and one staff assistant. Through hands-on participation, registrants learned how to identify invasive terrestrial and aquatic vegetation problematic in the northeastern region of the United States, apply basal or cut stump treatments, operated and calibrated herbicide application equipment, and inventory for multiple species. Registrants also attended lectures on the ecology of plant invasion, early detection and rapid response, inventory and mapping techniques, the decision making process, herbicide dissipation, mechanical tools of weed control, basic math calculations and species specific weed management scenarios. Break out sessions demonstrating herbicide mode of action, herbicide absorption and translocation, herbicide formulations and adjuvants, sprayer application tools, aquatic herbicide application techniques, were also provided. Registrants received plant identification books, a course binder, course certificates from the society and pesticide recertification credits from participating states. The course will be offered again in 2009 and is open to all interested parties on a first come-first registered basis (50 people registrant cap) and has been supported by a grant from the US Forest Service.

INNOVATIVE CONCEPTS FOR THE CREATION OF AN INTERACTIVE INVASIVE WEED POCKET GUIDE. R.E. Koepke-Hill*,[1] G.R. Armel,[1] G.N. Rhodes,[1] R.J. Richardson[2]; [1]University of Tennessee, Knoxville, TN, [2]North Carolina State University, Raleigh, NC

ABSTRACT

Combining the infinite capacity of the internet with the transportability of a pocket guide is one way to convey large amounts of information to a diverse audience. An invasive weed pocket guide needs to be portable for rapid identification of species and must contain organized sections to allow users to record information regarding the location and scope of the invasive weed infestation. The invasive weed community needs quick access to this information in order to develop strategies for control of those weeds. A pocket guide that incorporates all of these concepts would include color photos, detailed descriptive characteristics of the weed, and control measures for eradication. It would also provide space for the user to record detailed information regarding the location and scope of the weed issue. An interactive website allowing the user to input those findings and communicate with others would allow the weed community to examine the full scope of the weed infestation and enable the user to take appropriate steps to control the infestation. This paper will describe the methods used to develop an invasive pocket guide and how this pocket guide will be linked to an interactive website for active transfer of information regarding invasive weed infestations. The pocket guide will be developed with the goal of getting information from the field to the guide and ultimately to the internet by including simple tables for organizing detailed notes about invasive weed infestations. The website will have an interface developed in Microsoft Visual Studio and backed by a dynamic SQL database that will be populated by the users and closely monitored by experts.

INTERNATIONAL SURVEY OF HERBICIDE-RESISTANT WEEDS. I. Heap*; WeedSmart, Corvallis, OR

ABSTRACT

In January 2009, the International Survey of Herbicide-Resistant Weeds recorded 323 herbicide-resistant weed biotypes globally. ALS and ACCase inhibitor-resistant weeds account for the greatest area and economic impact of herbicide-resistant weeds globally. ALS inhibitor resistant broadleaf weeds such as *Cyperus*, *Lindernia*, *Monochoria*, *Sagittaria* and *Scirpus* spp. with resistance to ALS inhibitor herbicides have been most problematic in rice production. ACCase inhibitor resistant grass weeds, such as *Avena*, *Phalaris* and *Lolium* spp. have been most problematic in cereal production. Whilst glyphosate-resistant weeds are not as widespread, or of enormous economic impact yet, they are certainly of greatest concern to scientists, industry and farmers. From 1996 to present fifteen cases of glyphosate resistant weeds have been identified. Increasing reports of glyphosate-resistant *Amaranthus palmeri* infestations in southern USA cotton fields now make this the worst case of a glyphosate-resistant weed globally. The criteria for documenting resistance has been established to assist scientists in distinguishing evolved low level herbicide resistance from natural pre-selection variation in susceptibility to herbicides. This is of particular importance when documenting new cases of glyphosate resistance, because the level of resistance to glyphosate in weeds is typically very low.

DOCUMENTATION OF ACCASE AND ALS RESISTANT ITALIAN RYEGRASS BIOTYPES IN NORTH CAROLINA. A. Chandi*, A.C. York, D.L. Jordan; NC State Unversity, Raleigh, NC

ABSTRACT

Italian ryegrass (*Lolium multiflorum)* is a major weed of wheat (*Triticum aestivum*) grown in the southern United States. Diclofop, an ACCase inhibitor, was used effectively and routinely to control this weed in wheat. However, long-term repeated use of this herbicide resulted in evolution of resistance. Farmers thereafter started using commercial premixture of chlorsulfuron plus metsulfuron (ALS inhibitors), which typically only suppressed ryegrass. Mesosulfuron, an ALS inhibitor, was registered in 2003 for use in wheat and has been widely used since then. It remained effective in controlling ryegrass until failures were recorded in some fields in Lincoln and Union counties of North Carolina in spring of 2007. These fields had history of continuous annual applications of mesosulfuron or chlorsulfuron plus metsulfuron. Seeds from Italian ryegrass suspected of being resistant to mesosulfuron were collected in spring 2007 from two farms in Lincoln County and five farms in Union County. Seeds were also collected from an area in Edgecombe County that had not got been exposed to wheat herbicides for at least twenty years. A greenhouse experiment was conducted in spring 2008 to examine the three ryegrass populations for their response to pinoxaden and diclofop (ACCase inhibitors) and the ALS inhibitors imazamox, mesosulfuron and pyroxulam. Each herbicide was applied at 1/20x, 1/10x, 1/4x, 1/2x, 1x, 3x, 6x, 12x, 24x, 48x and 96x rates where x was recommended field rate. Plants were approximately 4 inches in height and averaged two tillers when herbicides were applied. Plants were visually rated for percent weed control two and three weeks after application and shoot fresh weight was recorded three weeks after application. Treatments were replicated three times and the experiment was repeated. The two suspected resistant biotypes were much less susceptible to mesosulfuron compared to susceptible biotypes. There was 99% reduction in fresh weight of susceptible biotype following treatment with the 1x rate of mesosulfuron compared to only 5 to18% reduction for resistant biotypes. Diclofop reduced fresh weight of Union and Lincoln County biotypes by only 11 to18% (suspected resistance to ACCase inhibitors) compared with 81% reduction for the susceptible Edgecombe County biotype. Pinoxaden controlled the biotype from Edgecombe County completely at the recommended field rate but did not control the biotypes suspected to be resistant to ACCase herbicides. The ALS inhibitor imazamox reduced fresh weight of suspected resistant biotypes from 17 to 29% but did controlling susceptible biotype at 1x rate of application completely. Pyroxulam reduced fresh weight of biotype from Edgecombe County at 1x rate 92% while a 12x rate of this herbicide was needed to reduce fresh weight 90%. Fresh weight reduction in biotypes from Union County was not complete even when a 96x rate of pyroxulam was applied. These data confirm multiple and cross resistance in biotypes from three counties in North Carolina.

CONFIRMATION AND MANAGEMENT OF CLOMAZONE-RESISTANT BARNYARDGRASS IN RICE.

J.K. Norsworthy*, R. Scott, K. Smith, J. Still, L. Estorninos, Jr., S. Bangarwa; University of Arkansas, Fayetteville, AR

ABSTRACT

Barnyardgrass is the most troublesome weed of rice in Arkansas. A barnyardgrass biotype from Delaplaine, AR, was not controlled with a labeled use rate of clomazone in a resistance screening program in fall 2007. The sample was collected from a field of continuous rice that had been treated solely with clomazone for at least 6 years. A field trial was conducted at Lonoke, AR, in 2008 to determine the effectiveness of preemergence-applied clomazone with and without other residual rice herbicides for control clomazone-resistant and -susceptible banyardgrass. CL-161 rice was drill seeded in 10 by 40 ft plots on May 21, 2008. Each barnyardgrass biotype was sown in a single row perpendicular to the drilled rows immediately after rice planting. Herbicide treatments evaluated included clomazone at 0.3 and 0.45 lb ai/A, quinclorac at 0.375 lb ai/A, imazethapyr at 0.06 lb ai/A, halosulfuron at 0.06 lb ai/A, clomazone at 0.3 and 0.45 lb/A plus quinclorac at 0.375 lb/A, clomazone at 0.3 and 0.45 lb/A plus imazethapyr at 0.06 lb/A, clomazone at 0.3 lb/A plus halosulfuron at 0.06 lb/A, halosulfuron at 0.06 lb/A plus quinclorac at 0.375 lb/A, and halosulfuron at 0.06 lb/A plus quinclorac at 0.375 lb/A. Approximately 2 inches of rainfall occurred at the test site within 2 days of application, resulting in excellent activation of all herbicides. Barnyardgrass control and rice injury were evaluated at 2, 4, 6, and 7 weeks after treatment. Injury to rice from clomazone at 2 WAT ranged from 10 to 44% and injury persisted through 7 WAT, averaging 6% in several treatments containing clomazone at 0.45 lb/A. Rice injury from all other herbicides applied alone was <10% on all rating dates. Both susceptible barnyardgrass biotypes were completely controlled (100%) through 7 WAT, regardless of clomazone rate. However, control of the resistant biotype with clomazone at 0.3 lb/A ranged from 65 to 71% at 2 to 7 WAT. The higher rate did completely control the resistant biotype; however, the injury associated with the highest rate of clomazone would not be deemed acceptable by growers. Quinclorac, halosulfuron, and imazethapyr alone provided at least 95% control of all biotypes, evidence that alternative preemergence herbicides are available for control of the resistant biotype. Efforts are underway to evaluate the effectiveness of postemergence-applied herbicides alone and the success of season-long programs for control of the resistant biotype. Additionally, laboratory experiments have been initiated to determine the resistance mechanism.

QUINCLORAC RESISTANCE IN CALIFORNIA'S LATE WATERGRASS (*ECHINOCHLOA PHYLLOPOGON* (STAPF) KOSS.). M. Milan*,[1] H. Yasuor,[2] J.W. Eckert,[2] A.J. Fischer[2]; [1]University Of Turin, Grugliasco, Italy, [2]University of California, Davis, CA

ABSTRACT

Quinclorac (3,7-dichloro-quinoline-carboxylic acid) is a pre and post emergence herbicide widely used to control grass weeds (*Echinochloa* spp., *Digitaria* spp., *Setaria* spp.) and some broadleaf species in rice and turf. Late watergrass (*Echinochloa phyllopogon* (Stapf) Koss.) is one of the most noxious weeds in California rice fields. It has evolved resistance (R) to multiple herbicides with different modes of action. A late watergrass biotype resistant to quinclorac has been found in a rice field of the Sacramento valley where quinclorac has never been applied. We characterized quinclorac resistance in this biotype and investigated the mechanism. Ratios (R/S) of the GR_{50} values ranged from 6 to 18 when quinclorac was applied as a foliar spray or hydroponically, respectively. Quinclorac stimulated rapid (6 HAT) ethylene formation and S plants produced 3.1 times more ethylene than R plants. Pre-treatment with malathion (a cytochrome P450 monooxygenases inhibitor) prior to quinclorac application, increased ethylene formation in S plants by 7.6 fold compared to R plants, while no such increase in ethylene formation was observed in R plants pretreated with malathion. Despite this lack of ethylene stimulation in malathion pre-treated R plants, malathion enhanced quinclorac reduction of chlorophyll fluorescence (Fv/Fm) and total biomass in both biotypes; thus in presence of the inhibitor, R plants became as susceptible to quinclorac as S plants. Quinclorac-induced reduction of late watergrass biomass was accompanied by a similar damage to photosynthetic integrity (reduction in Fv/Fm) in leaves, perhaps related to HCN release during ethylene biosynthesis in quinclorac-treated plants. However, since malathion synergism of quinclorac toxicity (enhanced fresh weight and Fv/Fm reduction) was not observed with respect to ethylene production, it is possible that quinclorac toxicity may also involve an additional mechanism causing photosynthetic damage, besides one hypothetically related to ethylene and HCN. These data suggest that resistance to quinclorac in the R late watergrass biotype involved two mechanisms: a) enhanced P450 detoxification of either quinclorac or a quinclorac-induced toxicants; b) Insensitivity along the response pathway whereby quinclorac induces ethylene production ("target site resistance"). This adds new mechanisms of resistance to those already reported for this multiple-herbicide-resistant biotype that has already spread throughout most of the CA rice fields. Pre-existing resistance to quinclorac further complicates management of herbicide-resistant *E. phyllopogon* in rice.

GLYPHOSATE-RESISTANT HORSEWEED (*CONYZA CANADENSIS*) CONTROL WITH PREPLANT APPLICATIONS OF BAS800H. V.M. Davis*,[1] G.R. Kruger,[1] B.G. Young,[2] S.Z. Knezevic,[3] W.G. Johnson[1]; [1]Purdue University, West Lafayette, IN, [2]Southern Illinois University, Carbondale, IL, [3]University of Nebraska, Nebraska, NE

ABSTRACT

Horseweed (*Conyza canadensis*), also known as marestail, has become a problematic weed in no-till crop production systems. Frequent occurrence of glyphosate-resistant and acetolactate synthase inhibitor-resistant biotypes, especially in no-till soybean producing regions, are particularly problematic. Horseweed can also be challenging because it can complete its lifecycle as a winter or summer annual weed. BAS800H is an experimental herbicide (common name saflufenacil), and is also trademarked by BASF as Kixor™. Saflufenacil is a protoporphyriogen-IX-oxidase (PPO) inhibitor with postemergence and soil residual activity on a wide range of broadleaf weed species. The use of preplant herbicides with residual horseweed activity is the best management recommendation for horseweed control in soybean. Currently, there are no documented PPO-resistant horseweed biotypes, and saflufenacil could be a new tool for producers with glyphosate-resistant horseweed infestations. The objective of this experiment was to evaluate the efficacy and persistence of saflufenacil in comparison with other preplant corn and soybean herbicides when applied in the fall and spring. No-till fallow field studies were conducted in southeastern Indiana and southern Illinois from fall 2006 to summer 2007 and repeated in 2007 to 2008. Experiments were a two-way factorial with four application timings and six herbicide treatments each replicated four times. The four application timings were early fall (Oct. 15th - 30th), late fall (Nov. 15th - 30th), early spring (Mar. 15th - 30th) and late spring (Apr. 15th - 30th). Herbicide treatments were saflufenacil at 50 and 100 g ai/ha, chlorimuron + tribenuron at 35 + 11 g ai/ha, respectively, flumioxazin at 72 g ai/ha, simazine at 1120 g ai/ha, and 2,4-D at 560 g ai/ha. Glyphosate at 840 g ae/ha + 257 g/L AMS was added to all treatments. Horseweed plants were counted every two weeks following the first spring application until the first week of July each year. Horseweed primarily emerged in the spring at both experiment locations. Spring applications reduced horseweed densities more than fall applications. Horseweed densities in July were reduced 78 and 87% versus the untreated check for the low and high rate of early-spring applied saflufenacil, respectively. Horseweed densities in July were reduced 96 and 98% versus the untreated check for the low and high rate of late-spring applied saflufenacil, respectively. Overall, saflufenacil provided effective preemergence activity for the control of spring emerging horseweed when applied in the spring prior to the typical timing of crop establishment.

PHENOTYPIC EXPRESSION OF SELECTED PALMER AMARANTH BIOTYPES RESISTANT TO GLYPHOSATE. A. Chandi*, D.L. Jordan, J. Burton, A. York, S. Clewis; NC State Unversity, Raleigh, NC

ABSTRACT

Research was conducted in the greenhouse to compare relative growth rates and variations in phenotypic expression of selected Palmer amaranth (*Amaranthus palmeri*) biotypes from North Carolina and Georgia expressing resistance and susceptibility to glyphosate. The North Carolina biotypes used for study were defined as NCSU Resistant and NCSU Susceptible. Seeds for glyphosate resistant biotypes from Georgia were collected from Sumter (S2), Macon, and Emanuel counties (E2) while those for susceptible ones were obtained from Sumter (S1), Emanuel (E1) and Crisp counties. Eight biotypes of Palmer amaranth each in ten replications were planted in the greenhouse. Plants were thinned to five per pot and allowed to grow for 20 days after which half of the resistant biotypes were treated with glyphosate at field recommended rate. Later in experiment, plants were thinned to one per plot to allow sufficient room and resources and avoid interplant interference. Plants were harvested 40 days after planting. Data for plant height (in inches at interval of four days), number of nodes/plant at harvest, leaf area (cm^2), fresh weight of leaves and stems (g/plant) and dry weight of leaves and stems (g/plant) were recorded. Field experiments were also conducted with soybean (*Glycine max*) near Kinston during summer 2008 using same biotypes of Palmer amaranth except susceptible biotype from Sumter County. Approximately ten seeds of each biotype were planted in each plot at one inch spacing with gentle watering after planting. Susceptible biotypes were thinned to one plant per plot (one per row with border rows between experimental units). After thinning susceptible plots, cups were placed over each biotype and glyphosate at 1.1 kg ai/ha was applied over the entire test area. Resistant biotypes were also thinned to one per plot. Height of Palmer amaranth, soybean at distance of 1, 2, 3, 4 and 5 feet on either side of Palmer were recorded bi-weekly through anthesis. Each Palmer amaranth and soybean plant was harvested at a density that reduced yield by 50% based on computations from HADSS (Herbicide Application Decision Support System). Preliminary results from the greenhouse indicated that differences in relative growth rates among biotypes. Glyphosate resistant biotype from NCSU recorded the maximum plant height of 63 inches as compared to the biotype from Macon County (40 inches) and was the shortest among all the biotypes. Heights of the remaining biotypes were intermediate between these extremes. Leaf fresh weight was similar for biotypes NCSU Resistant, NCSU Susceptible and Sumptor County biotypes. Lower leaf fresh weight was observed for biotypes from Emanuel and Crisp counties as compared to other biotypes. No differences were noted among the biotypes at harvest for stem fresh weight, leaf dry weight, stem dry weight, and leaf area. However, plant height was reduced when glyphosate was applied to resistant biotypes compared to non-treated plants. The number of nodes was higher for the biotype Emanuel E1 compared to other biotypes except NCSU susceptible. Preliminary data in the field experiment indicated that several Palmer amaranth biotypes grew more quickly and competed more effectively with soybean compared with other biotypes. Although differences in height of both crops as result of interference were not observed, there were significant differences in soybean yield. The lowest soybean yield of 1330 kg/ha was observed as a result of interference by NCSU resistant biotype which was similar to that obtained with resistant biotypes from Macon and Emanuel counties.Season long interference by all other biotypes did not reduce soybean yield.

HERBICIDE ASSOCIATIONS FOR MANAGEMENT OF GLYPHOSATE RESISTANT AND TOLERANT WEEDS. R.A. Vidal*,[1] H.P. Rainero[2]; [1]UFRGS, Porto Alegre, Brazil, [2]INTA, Manfredi, Argentina

ABSTRACT

The intense use of glyphosate increased the amount of weeds with herbicide tolerance that in Argentina, including the species Amaranthus hybridus (smooth pigweed) and Ipomoea nil (ivy morningglory). In Brazil, the number of glyphosate resistant biotypes are increasing also, mainly in the species Euphorbia heterophylla (wild poinsettia) and Lolium multiflorum (ryegrass). The objective of this research was to assess antagonism or synergy of all the possible combinations between two of the following herbicides: glyphosate, imazethapyr, lactofen, and clomazone in the control of the mentioned weeds, prior the onset of resistance. Seedlings of glyphosate susceptible plants were sprayed at the following growth stages: pigweed at 2 cm; morningglory at 7 cm; and the other two species at 10 cm high. The herbicide treatments consisted of: glyphosate at 108 g/ha; imazethapyr at 10 g/ha; clomazone 160 g/ha; and lactofen 30 g/ha, used alone or in all the six possible combination of each two of them. An untreated control was used for comparisons. A non-ionic adjuvant at 0.2% (v/v) was added to all treatments but that with glyphosate alone and the untreated. The effect of the combination of herbicides depended on the species and also of herbicides used. For pigweed and morningglory, antagonism was observed in four of the twelve combinations tested. Neutral effect was found in seven, whereas synergy was observed in only one herbicide mix. For poinsettia and ryegrass, antagonism was observed in five of the twelve combinations tested. Neutral effect was found in seven of the twelve mixtures evaluated. All combinations with neutral or synergistic effect are considered potentially useful to prevent the increase of glyphosate tolerant and resistant weeds.

RESEARCH AND DEVELOPMENT IN MONSANTO GLOBAL BIOEVALUATIONS. D. Sanyal*, B. Krebel, S. Prosch, M. Bugg, F. Kohn, D. Sammons, S. Schrader, D. Edgecomb, M. South, B. Bussler; Monsanto Company, St. Louis, MO.

ABSTRACT

Monsanto Company is a leader in developing pest control solutions, enhanced plant traits, and superior germplasm for agricultural markets worldwide. The Global Bioevaluations (GBE) research team is part of the Chemistry Technology organization within Monsanto Company. GBE provides biological expertise in plant physiology, weed control strategies, insect and plant pest control, crop productivity, and practical agronomic practices. GBE supports the development of glyphosate based technologies, including maximizing the productivity of Roundup Ready® cropping systems. Understanding glyphosate resistance mechanisms and developing methods to control glyphosate resistant weeds are major research focus areas for the team. GBE also contributes significantly towards the development and commercialization of a broad range of technologies including Monsanto's new Acceleron™ seed treatment brand. Plant health technologies and the integration of new plant traits into comprehensive crop production programs are additional areas of emphasis. GBE has extensive cross-functional collaborations with Monsanto's Biotechnology, Breeding, Regulatory Science and Commercial organizations. GBE's unique role and contributions provide substantial value to the company through creation of competitive new products for a changing marketplace.

RESPONSE OF VIRGINIA COLLECTIONS OF COMMON CHICKWEED (*STELLARIA MEDIA*) TO SULFONYLUREA HERBICIDES. E.S. Hagood*,[1] D.D. Ganske,[2] G.A. Hite[3]; [1]Virginia Tech, Blacksburg, VA, [2]DuPont Agricultural Enterprise, Winchester, VA, [3]Virginia Tech, Halifax, VA

ABSTRACT

Postemergence control of common chickweed with sulfonylurea herbicides in Virginia small grains has generally been very effective. The standard treatment for the control of common chickweed and other winter annuals has been the commercially formulated combination of thifensulfuron-methyl plus tribenuron-methyl. In the 2007-08 growing season, insufficient control of common chickweed was observed in response to this treatment in two Virginia counties: New Kent (NK) and King William (KW). Two collections of mature common chickweed plants were made at each of these locations, and designated NK1, NK2, KW1, and KW2. Susceptibility of F1 progeny derived from these collections was evaluated relative to the susceptibility of wild type (WT) F1 progeny derived from common chickweed collected in Montgomery County, Virginia. Thifensulfuron-methyl was applied to 3-4 cm common chickweed seedlings at 0, 0.25, 0.5, 1, 2, 4, 8, 16, and 32 times the labeled use rate of 0.026 kg ai/ha. At 28 days after treatment (DAT), vigor reductions in WT common chickweed ranged from 91 to 99% in response to thifensulfuron-methyl rates from 0.5 to 32X. In NK and KW common chickweed, no vigor reduction was observed in response to thifensulfuron-methyl rates up to 4X, and vigor reductions of 0 to 11% were observed in response to rates ranging from 8 to 32X. Fresh weight of WT common chickweed at 28 DAT in response to 0.5 to 32X thifensulfuron-methyl rates was reduced by 98% or greater. Fresh weight reductions in response to this range of thifensulfuron-methyl rates were 11 to 26%, 13 to 30%, 11 to 40%, and 20 to 55% for NK1, NK2, KW1, and KW2 collections, respectively. In subsequent experiments, common chickweed seedlings were treated with 1 or 4X rates of other ALS-inhibiting herbicides including metsulfuron-methyl, prosulfuron, imazethapyr, imazapyr, and bispyribac-sodium. Significant differences in susceptibility were observed on the basis of herbicide, rate, and collection at 28 DAT. In response to 4X rates of metsulfuron-methyl and prosulfuron, WT common chickweed vigor reductions in excess of 98% were observed, while vigor reductions of 8 to 33% were observed across NK and KW collections. Imazethapyr and imazapyr at 4X rates caused 100 and 99% vigor reductions in WT common chickweed, respectively, and elicited vigor reductions ranging from 78 to 95% in NK2, KW1, and KW2 collections. In the NK1 collection, however, 4X rates of imazethapyr and imazapyr caused only 6 and 0% vigor reductions, respectively. Bispyribac-sodium at the 4X rate caused 96% vigor reduction in WT common chickweed, and vigor reductions of 3 and 89% in NK1 and NK2 collections, respectively. The responses of KW1 and KW2 collections were 25 and 61%, respectively. Field experiments were also initiated in 2008 at the NK location to evaluate alternative control strategies for common chickweed. Preemergence (PRE) applications of flumioxazin at 0.036, 0.072, and 0.144 kg ai/ha provided 81, 90, and 100% common chickweed control at 38 DAT with no phytotoxicity to wheat. PRE application of diuron at 0.90 kg ai/ha provided 83% common chickweed control with no injury to the crop. Delayed preemergence (DP) treatments including diuron at 0.90 kg ai/ha, flufenacet plus metribuzin at 0.23 plus 0.06 kg ai/ha, fluroxypyr at 0.08 kg ai/ha, metribuzin at 0.05 or 0.11 kg ai/ha, and pendimethalin at 1.06 kg ai/ha were made to 1-2 leaf wheat and prior to common chickweed emergence. All treatments provided 91% or greater common chickweed control at 26 DAT except pendimethalin, which provided 83% control. Slight to moderate reductions in wheat vigor were observed in response to DP applications of diuron, flufenacet plus metribuzin, and metribuzin at the 0.11 kg ai/ha rate. Evaluations of herbicide susceptibility of F2 common chickweed from each collection, and of the effects of postemergence alternatives for common chickweed control, are ongoing.

RESISTANT WEED MANAGEMENT USING DICAMBA TOLERANT SOYBEAN. S.K. Carter*,[1] C.H. Slack,[1] G.P. Murphy[2]; [1]University of Kentucky, Lexington, KY, [2]The Monsanto Company, St. Louis, MO

ABSTRACT

In 2007 and 2008, the University of Kentucky conducted research evaluating weed control measures and overall crop tolerance of soybean with traits exhibiting tolerance of dicamba and glyphosate applications. The trials took place at the Spindletop Research Facility in Lexington, KY. The study site was conventionally prepared on Maury Silt Loam soil. The 2007 study was planted on May 18 using a John Deere MaxEmerge planter at a depth of 2.54 centimeters and 76.2cm row spacing. Preemergent applications of dicamba (280.46 g ae ha^{-1}) were made the day of planting. Subsequent applications of dicamba (140.23 and 280.46 g ae ha^{-1}) were made when weed growth reached 7.62 and 15.24 cm and again when weed re-growth reached 15.24 cm. Each application of dicamba was tank mixed with glyphosate (841.38 g ae ha^{-1}) and liquid ammonium sulfate (3.7% v/v). Visual ratings were taken 7 days after each application. The 2008 study was conducted on the same site, under the same field conditions as the 2007 study. Planting occurred on June 2 with preemergent applications of dicamba (280.46 g ae ha^{-1}). Postemergent treatments were applied at 7.62 and 15.24 cm and again when weed re-growth reached 15.24 cm. Dicamba rates evaluated were 140.23 and 280.46 g ae ha^{-1} applied with glyphosate (841.38 g ae ha^{-1}) and ammonium sulfate (3.7% v/v). Visual evaluations were taken 7 days after each application. Evaluations in 2007 showed excellent tolerance of the soybean variety to applications of dicamba regardless of when it was applied throughout the growing season. Weed control using the combination of glyphosate and dicamba resulted in at least 96% control of all weeds evaluated following the final application at 15.24 cm weed re-growth. Evaluations made in 2008 showed similar results to that of the previous year. Crop tolerance was excellent and weed control reached at least 93% following the final applications.

CONTROL OF FAILED CORN STANDS IN MISSISSIPPI. C.L. Smith*, J.T. Irby, D.B. Reynolds; Mississippi State University, Mississippi State, MS

ABSTRACT

Recent trait developments in transgenic corn production such as glyphosate and glufosinate resistant corn have increased the available weed control options. Additional herbicide resistant traits are currently under development that will include resistance to acetolactate synthase (ALS)-inhibiting herbicides, and will likely be in conjunction with existing herbicide resistant traits. With the advent of these additional herbicide systems for corn, previously unaddressed weed control scenarios can occur. Situations including volunteer populations from the prior year, as well as controlling existing populations when a field needs to be replanted are likely to pose unique challenges. Control options for herbicide-resistant corn populations are needed for both replant and rotational cropping systems. In 2008, experiments were conducted in both field and greenhouse environments. The field trial consisted of 2 row plots that were 12 meters long planted at a seeding rate of 79,000 seeds/hectare. The greenhouse trials were planted with 1 corn plant per pot. Visual ratings for plant mortality were recorded 7, 14, 21, and 28 days after application (DAA). Paraquat and glufosinate were applied both individually as well as with various tank-mix partners. These tank-mix partners included atrazine, diuron, metribuzin, linuron, simazine, and a rimsulfuron with chlorpyrifos combination. An application of paraquat applied at 700 grams active ingredient per hectare (g ai/ha) provided 45% (field trial) and 68% (greenhouse trial) mortality 28 DAA. Glufosinate applied at 590 g/ha showed 70% (field trial) and 96% (greenhouse trial) mortality 28 DAA. In the field trial, adding metribuzin (140 g ai/ha) or linuron (560 g ai/ha) as a tank-mix partner provided better than 93% mortality with paraquat and better than 85% mortality with glufosinate 28 DAA. The rimsulfuron (2.18 g ai/acre) with chlorpyrifos (560 g ai/ha) combination resulted in 88% mortality when applied with paraquat and 81% mortality when tank-mixed with glufosinate at 28 DAA. Similar results were found for the greenhouse trial. Applying either metribuzin or linuron as a tank-mixture with paraquat or glufosinate provided 99% mortality in the greenhouse trials 28 DAA. One exception in the greenhouse experiment was that the tank-mixture of paraquat with rimsulfuron and chlorpyrifos only provided 60% mortality 28 DAA. In summary, controlling a failed corn stand in a glyphosate-resistant cropping system could be obtained by applying paraquat or glufosinate in combination with metribuzin or linuron. In a glufosinate-resistant or glyphosate/glufosinate-resistant stack system, the use of paraquat with one of these tank-mix partners could provide control of a failed stand of corn. Further research is needed to better understand the impact of environment and stage of growth on control of undesirable corn populations.

TOLERANCE OF ADVANCED COWPEA (*VIGNA UNGUICALATA*) LINES AND CULTIVARS TO SULFENTRAZONE HERBICIDE. T. Tseng*, N. Burgos, E. Alcober, V. Shivrain, D. Motes, T. Morelock; University of Arkansas, Fayetteville, AR

ABSTRACT

It is important to evaluate crop safety when a new herbicide is introduced for use in commercial production. There is little information on the differential sensitivity of cowpea cultivars to sulfentrazone. Tolerance of twelve cultivars and advanced breeding lines of cowpea to the preemergence (PRE) application of sulfentrazone at 0, 0.1875 and 0.375 lb ai/A was evaluated at Kibler, Arkansas in 2007 and 2008. Experiments were laid out in a split-split plot design with year as main factor, cowpea cultivar as sub factor and herbicide rate as sub-sub factor, replicated three times. Stand count, crop injury, flowering, pod maturation, and yield were recorded. Stand reduction was high at the high rate of sulfentrazone. Cultivars showing the least stand reduction at 0.375 lb ai/A were Coronet (5 %), CT Pinkeye (13 %) and AR blackeye (14 %); and those with high stand reduction were Early Acre (68 %) and Erect Set (57 %). Cowpea injury was higher in 2007 than in 2008. At 14 days after application (DAA), the cultivars showing the least injury at 0.1875 lb ai/A were CT Pinkeye (5 %), AR blackeye (5 %), 92-551 (5 %) and 00-178 (3 %). The injured plants remained smaller than the nontreated check at 42 DAA in both years, but tolerant cultivars or advanced lines showed recovery from initial injury at the low rate. In 2007, at 0.375 lb ai/A sulfentrazone, delayed flowering was observed in Erect Set (1%), CT Pinkeye (2 %), 92-551 (0%), 01-243 (3 %) and 01-874 (0%). The flowering of AR blackeye was not affected by the herbicide treatments. Pod load data were collected only for 2007. Sulfentrazone caused 90-95 % decrease in pod load of Erect Set, 01-1746 and 01-874 at 42 DAA. CT Pinkeye showed no reduction in pod load with increase in herbicide rate. The overall yield reduction in 2008 was less than that in 2007. In 2007, at 0.1875 lb ai/A, cultivars showing the least yield reduction were Coronet (3 %), CT Pinkeye (2 %), 00-855 (2%) and 01-874 (4%); while cultivars showing the highest yield reduction were Early Acre (53 %), 01-243 (56 %) and 00-178 (51 %). Similar observations of yield reduction were observed in 2008. Thus, among the 12 cultivars and advanced lines tested, 00-855, 01-874, CT Pinkeye and AR blackeye showed the highest tolerance to sulfentrazone; whereas, Early Acre, Erect Set, 95-551, 01-243 and 01-874 showed the most susceptibility to sulfentrazone.

BIOLOGICAL INFORMATICS FOR EARLY DETECTION AND RAPID RESPONSE: EXAMPLES FROM THE NBII (National Biological Information Infrastructure). E. Sellers*, A. Simpson; United States Geological Survey (USGS), Reston, VA

ABSTRACT

Effective early detection, rapid assessment, and rapid response (EDRR) is critical in halting the establishment and spread of invasive species. However, successful EDRR is dependent on the existence, availability, and accessibility of information for decision making, research, and evaluation. This need is being addressed through practical application of biological informatics concepts and technologies to real-world invasive species EDRR and research. The field of biological informatics sits at the intersection of biological sciences, information science, and computer technology. It concerns the assembly, organization, integration, and dissemination of biological information. The United States National Biological Information Infrastructure (NBII) is a broad, collaborative program to provide increased access to data and information on the nation's biological resources. A program of the Biological Informatics Office of the United States Geological Survey (USGS), the NBII works with partners to link diverse, high-quality biological databases, information products, and analytical tools; and on developing new standards, tools, and technologies that make it easier to find, integrate, and apply biological resources information. To better understand and coordinate EDRR efforts within the U.S., the NBII, USGS, Departments of Interior, Agriculture, Commerce, and Defense, and the National Invasive Species Council, collaborated on the development of a seven-component National Framework for EDRR. The NBII also supports other projects that provide practical, working examples of biological informatics at work in EDRR - some of which are now recognized as models that other EDRR projects follow.

INVASIVE SPECIES MONITORING AND DATABASES: THE IMPORTANCE OF MEASURING OUTCOMES AND IMPACT. M.A. Bowers*; CSREES, Washington, DC

ABSTRACT

For the past sixteen years, the US government has increasingly been practicing performance based budgeting. Under this emphasis, programs must prove their relevance, effectiveness and efficiency in carrying out their missions in annual portfolio reviews conducted by the Office of Management and Budget (OMD). It is Darwinian selection at the program level with those achieving their goals being rewarded and those falling short having their budget reduced. For extramural programs, goals are achieved through the work of the awardees. For continued federal funding of projects that use citizen volunteers in early detection-rapid response programs an increased emphasis on outcomes and inputs is critical. OMB encourages a logic model approach to project management that distinguishes between outputs (e.g., number of volunteers enlisted), and outcomes (e.g., number of invasions prevented, number of populations eliminated). My challenge to the group is to not stop with documenting outputs but to consider various ways that that the impact of the effort can be measured and the expenditure of increasingly limited federal funds justified. I will provide some examples of possible outcomes.

CONNECTING CITIZENS TO SCIENCE TO CREATE A REGIONAL EARLY DETECTION NETWORK FOR NEW ENGLAND. L.J. Mehrhoff*; University of Connecticut, Storrs, CT

ABSTRACT

A number of strategies for dealing with problems caused by non-native invasive plants currently exist. Most conservationists agree that the early detection of an invasive plant incursion, followed by a strategic and rapid response, is cost-effective, potentially less disruptive to the environment, and more likely to succeed. The overarching goal of the Invasive Plant Atlas of New England (IPANE) is to develop tools for early detection and establish a network of stakeholders to use them. In New England, there are too many invasive or potentially invasive plant species and too much land for the existing professional botanists, weed scientists, and conservationists to adequately monitor even in a region where five out of six states are small when compared against other states in the nation. IPANE trains concerned citizens to recognize and report incursions of invasive plants and to gather some basic ecological information about each occurrence. These trained volunteers comprise the IPANE early detection network. Data gathered, in part, by these program-trained volunteers are used to generate maps and databases and are used to construct ecological models of predicted ranges within the region. These models can be used to focus volunteer field work and for setting training priorities. Conversely, the volunteer network can be used to "ground truth" the predictive models. A big part of the IPANE initiative is to increase public awareness of invasive plants and the efficacy of early detection as a strategy for invasive plant control by making data, including those gathered by the volunteers available on the IPANE interactive website (http://ipane.org) . This presentation discusses IPANE's early detection efforts, the tools available on the IPANE website, IPANE's "Localized Early Detection Site" network, how the program's extensive volunteer network works across New England, and IPANE's involvement in building a national and international early detection network.

THE INVASIVE PLANT ATLAS OF THE MIDSOUTH. J.D. Madsen*, G.N. Ervin; Mississippi State University, Mississippi State, MS

ABSTRACT

Invasive weedy plants are a widespread problem throughout the United States. Their growth is often widely dispersed, with little scientific ability to predict why they occur in a given location. In addition, historical human activities such as urbanization, agriculture, and forestry have a marked effect on the distribution and spread of invasives. This project will quantify relationships of weed distribution and spread with land use, then use that information directly in educating agriculture stakeholders, natural resources managers, and other interested parties on potential human-induced opportunities for invasive species spread. The Invasive Plant Atlas of the Mid-South (IPAMS) is an integrated research and extension project to develop an invasive plant program for the Mid-South states of Alabama, Arkansas, Louisiana, Mississippi, and Tennessee. Research activities include conducting systematic regional vegetation surveys to assess the distribution of key invasive plants, developing models for predicting the occurrence of target species based on land use and cover, and evaluating the relative effectiveness of professional versus volunteer surveys. For the research component of this project, we have surveyed almost 400 points throughout the state of Mississippi, providing data on more than 650 plant species, including 74 not native to the region. Initial analyses of these data have demonstrated a strong correlation of land use/cover with the presence of exotic plant species, especially key invaders such as the grass *Imperata cylindrica* (cogongrass). Outreach and extension activities include developing training programs for volunteers to identify and report invasive species using IPAMS, developing an efficient Early Detection and Rapid Response (EDRR) system for invasive plants, developing best management information, and developing an online mapping system. To date, we have trained numerous individuals in identification of our target forty species. We are in the process of developing management information for these species. Our webpage (www.gri.msstate.edu/ipams) is largely operational, with over 4995 records of 134 species from 29 states, entered and many more observations completed but not entered into the database.

HOW TO COLLABORATE AND SHARE INVASIVE SPECIES INFORMATION VIA WEB SERVICES AND THE GLOBAL INVASIVE SPECIES INFORMATION NETWORK. A. Simpson*, E. Sellers; United States Geological Survey (USGS), Reston, VA

ABSTRACT

The sharing of invasive species information is vital to improving our knowledge about biological invasions and enabling our coordination of effective control efforts. The Global Invasive Species Information Network (GISIN) is a network of invasive species researchers, experts, information managers, and computer scientists sharing knowledge and experience, adopting standards and protocols for information exchange, and increasing availability of invasive species information at local, national, regional, and global levels. The GISIN has been funded by the Group on Earth Observations (GEO), the National Biological Information Infrastructure (NBII), and the National Aeronautics and Space Administration (NASA), and is seeking additional partnerships among the weed science community. To date, three kinds of information are being shared in the GISIN system: Occurrences, Species Status, and Species Resource URLs. If you have an online database with invasive species information, moderate programming expertise, and a desire to share your information with others, you too can become a GISIN data provider. And if you are seeking an online repository for your invasive species project information, the National Institute of Invasive Species Science (NIISS) accepts data of all formats, allowing you to map your fields for batch uploads. If you have weed occurrence spreadsheet data with location coordinates, Discover Life will accept the data, format it, map it on their online Global Mapper, and submit the data to the Global Biodiversity Information Facility (http://www.gbif.org). The GISIN system currently has 12 data providers, and we are seeking additional early adopters of the GISIN system. Find out more about us at these Web addresses:

- Non-technical online interface, email listserv, and information repository: http://www.gisinetwork.org
- Technical documents repository and GISIN information system: http://www.niiss.org/gisin
- National Institute for Invasive Species Science: http://www.niiss.org
- Discover Life: http://www.discoverlife.org
- Wiki for invasive species standards development: http://wiki.tdwg.org/twiki/bin/view/InvasiveSpecies/WebHome
- Technical email listserv for GISIN data providers: http://www.hear.org/hearlists/gisintech.htm

DEVELOPMENT OF WEB BASED DATABASES AND OTHER RESOURCES FOR SUPPORTING LOCAL EDRR INITIATIVES. R.G. Westbrooks*; U.S. Geological Survey, Whiteville, NC

ABSTRACT

Over the past decade, there has been a concerted effort to develop new capacity for preventing the establishment and spread of new weeds in the U.S. through the creation of a National Early Detection and Rapid Response System for Invasive Plants. Conceptually, the system is a coordinated framework of interagency partner groups at the local, state, national, and international levels, that is focused on early detection and reporting of suspected invaders (by trained volunteers and agency field professionals), identification and vouchering of plant specimens (by cooperating botanists), archiving of new plants records in regional databases (e.g., the Invasive Plant Atlas of New England), rapid assessment of new species (by state and federal scientists), and rapid response to confirmed new invaders (by single agencies, or through interagency task forces). Over the years, a number of guidance documents have been developed for assisting partner groups in developing the state and local elements of the National EDRR System. In an effort to make this ever expanding library of documents more readily available to partners across the country and elsewhere, the U.S. Geological Survey, Biological Resources Discipline (USGS BRD), and the USGS National Biological Information Infrastructure (NBII), are collaborating with the Invasive Plant Atlas of New England (UCONN), the Invasive Plant Atlas of the MidSouth (MS State University), and the Center for Earth Science Information (Columbia University), to develop an online EDRR Tool Box. Ultimately, the EDRR Tool Box will include basic support documents such as an EDRR Partnership Directory, a generic State EDRR Committee Work Plan, Guidelines for Volunteer Recruitment and Training, Guidelines for Rapid Assessment and Rapid Response, Weed Alerts, EDRR System Fact Sheets, and other resources. The goal is to create 'one-stop-shopping' for information on invasive plant prevention strategies, methods, and procedures. The USDA/Carolinas Witchweed Eradication Program, the Carolinas Beach Vitex Task Force, the North Carolina Giant Salvinia Task Force, the Caddo Lake (TX) Giant Salvinia Task Force, and the numerous state and provincial invasive species councils that have been established in recent years across the U.S. and Canada, are examples of programs and partner groups that would benefit from easy access to the type of information that will be made available through in the online EDRR Tool Box.

EFFECTIVENESS OF LATE-SEASON HERBICIDE APPLICATIONS ON SEED SUPPRESSION OF GLYPHOSATE-RESISTANT PALMER AMARANTH. L.E. Estorninos*, J.K. Norsworthy, M.J. Wilson; Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR

ABSTRACT

An experiment was conducted at the University of Arkansas in Fayetteville in 2008 to evaluate the effectiveness of late-season herbicide applications for control and seed prevention of glyphosate-resistant Palmer amaranth. Two glyphosate-resistant biotypes were evaluated. One was from Mississippi County (MC) and the other from Lincoln County (LC). Fifteen 21-day-old seedlings of both biotypes per plot were transplanted in the field and later sprayed (25-inch-tall MC and 37-inch-tall LC) with recommended rate of glyphosate (Roundup WeatherMax), dicamba (Clarity), 2,4-D amine (Weedar 64), glufosinate (Ignite), and pyrithiobac (Staple LX) when the inflorescence became visible. The experiment was established as a factorial arrangement of treatments (biotype by herbicide) and was replicated four times. Control of both biotypes was visually evaluated at 7, 14, 21, and 28 d after treatment (DAT), individual plant survival was recorded at 28 DAT, and seed production, germination, and viability were evaluated from one female plant from each plot. Control of the MC biotype was generally greater than the LC biotype probably because plants were smaller at application. Visual control or damage to both biotypes by glyphosate was less than 25% at 28 DAT. 2,4-D was the most effective herbicide, resulting in 49 to 85% control at 28 DAT. Control of both biotypes with dicamba was <50%, and glufosinate controlled the MC biotype 69% but LC biotype only 13%. Neither biotype responded to pyrithiobac. Glufosinate and 2,4-D caused 60% and 67% mortality of MC, respectively, compared to <20% mortality of the LC biotype. Most surviving plants in all treatments matured, and female plants produced seed. The LC biotype produced larger and more seeds than the MC biotype, although the reduction of seed production did not differ among herbicides. Seed reduction ranged from 61% to 84%, although there was still a large number of seeds, especially with the high seed-producing LC biotype. The MC biotype produced fewer viable seeds when sprayed with glufosinate and pyrithiobac, and the LC biotype produced fewer viable seeds by any of the herbicides applied, when compared to the untreated check. Emergence of progenies from the LC-treated biotype was earlier than the MC biotype by 7 to 14 d. However, there were no differences in the reduction of aboveground biomass of plants due to previous herbicide treatments. These results show that late-season applications of these herbicides will not effectively control glyphosate-resistant Palmer amaranth nor eliminate seed production.

MOVEMENT OF GLYPHOSATE-RESISTANT PALMER AMARANTH (*AMARANTHUS PALMERI*) POLLEN IN-FIELD. L.M. Sosnoskie*,[1] T.M. Webster,[2] A. MacRae,[3] T.L. Grey,[1] A.S. Culpepper[1]; [1]Crop and Soil Sciences, University of Georgia, Tifton, GA, [2]USDA-ARS, Tifton, GA, [3]Horticulture, University of Florida, Wimauma, FL

ABSTRACT

Palmer amaranth is one of the most troublesome weeds of cotton and other Southern row crops. In addition to being a strong competitor, Palmer amaranth has developed resistance to several important agricultural herbicides, including glyphosate. The objective of this study was to determine if the glyphosate resistance trait can be transferred via pollen movement from a glyphosate-resistant (GR) Palmer amaranth population to a glyphosate-susceptible (GS) population. In 2006, a GR Palmer amaranth pollen source population was planted in the center of a 30 Ha field. Nine GS plants were planted in plots located at distances of 1, 5, 10, 25, 50, 75, 100, 150, and 200 m from the edge of the source in each of eight directions (N, NE, E, SE, S, SW, W, and NW). In 2007, 15 GS plants were planted in plots at distances of 5, 50, 250, 200, 250, and 300 m from the GR source in the same eight directions. Except for the GR source population, the interior of the field and surrounding acreage (300 m from the field edge) were kept free of Palmer amaranth by chemical and physical means. Seed was harvested from 249 and 301 mature females in October 2006 and 2007, respectively. Offspring from each GS mother plant were treated with 0.5 kg ae/Ha glyphosate when the plants were 5-7 cm tall and evaluated 7 and 14 DAT. At 14 DT, the GR and GS standards were controlled by glyphosate 4% and 100%, respectively. Resistant offspring were observed at each distance from the GR source in each direction, although the percentage of resistant individuals decreased with increased distance from the pollen source. Approximately 50-60% of the offspring at the 1 m and 5 m distance were resistant to glyphosate; approximately 20-40% of the offspring were resistant at 250 m and 300 m. An integrated approach to herbicide resistance management should require that suspected resistant individuals are controlled prior to reaching reproductive maturity to prevent both seed and pollen from dispersing the resistance trait.

SPREAD OF HERBICIDE RESISTANCE ALLELES IN *LOLIUM RIGIDUM* ON FARMS. J. Malone*,[1] J. Baker,[2] P. Boutsalis,[1] C. Preston[1]; [1]School of Agriculture, Food & Wine, University of Adelaide, Glen Osmond, SA, Australia, [2]Bureau of Rural Sciences, Canberra, ACT, Australia

ABSTRACT

Herbicide-resistant weed species have become an increasing problem in many farming areas across Australia. *Lolium rigidum* Gaud. (rigid ryegrass), the most significant weed of southern Australian cropping systems, has been found to have alarming levels of herbicide resistance. Rigid ryegrass is an obligate outcrossing species meaning resistance could spread between fields through pollen as well as seed. Random surveys of farm populations have shown that almost half of tested sites contain ryegrass resistant to ACCase-inhibiting herbicides. Sequencing of individuals from the random survey identified 8 mutations in ACCase resistant individuals, with the most common mutation present in 25% of the individuals. A detailed survey of 3 fields at Roseworthy in South Australia identified rigid ryegrass resistant to ACCase-inhibiting herbicides in two fields. When sequenced, 4 different mutations were found in these fields and several individuals contained two or more mutations. Some mutations tended to be clustered and some were more widespread. Pollen competition experiments, where a single resistant individual was surrounded by increasing number of susceptible individuals, demonstrate that resistant pollen from outside a patch has only a small chance of resulting in a pollination event once there are more than five susceptible plants in the patch. These studies suggest that resistance to ACCase-inhibiting herbicides is widespread across South Australia. Most resistant population contain one or more mutations within the target site. Pollen flow between fields probably contributes little to resistance evolution, but pollen flow within a field and continued use of ACCase-inhibiting herbicides result in multiple mutations in individuals.

GENETIC DIVERSITY IN RED RICE FROM THE SOUTHERN U.S.A. V.K. Shivrain*,[1] N.R. Burgos,[1] D.R. Gealy,[2] K.A. Moldenhauer,[1] V.A. Boyett,[1] E.L. Alcober,[1] H.A. Agrama[1]; [1]Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]USDA-ARS, Dale Bumpers National Rice Research Center, Stuttgart, AR

ABSTRACT

Red rice *(Oryza sativa* L.*)* is a problematic weed in Arkansas rice production, and infestations have increased in the last three decades. We hypothesize that the morphologically diverse Arkansas red rice populations also have high genetic diversity and that this diversity emanates from genetic introgression between red rice and cultivated rice in more than a century of coexistence. We tested 137 red rice accessions from four different ecological zones in Arkansas and 36 rice cultivars that have been grown in Arkansas in the past century with 27 rice microsatellite markers distributed across 12 chromosomes. Results suggest that awnless strawhull red rice populations are genetically distant from blackhull (GD = 0.55) and brownhull (GD = 0.60) red rice types. Blackhull and brownhull types are most genetically distant (GD = 0.96) compared with strawhull. Within each red rice type, blackhull (GD = 0.76) and strawhull (GD = 0.68) are genetically less diverse than brownhull (GD = 0.80). The blackhull and strawhull diversity is affected by their zone of origin. Rice cultivars grown in Arkansas during the last 100 yr have a narrow genetic background. Twenty-five percent of the red rice accessions tested showed some genetic introgression from cultivated rice in the last century. Despite originating from a few introduced biotypes in the late 1600s, a diverse complex of weedy populations had evolved in a region devoid of other weedy and wild *Oryza* species.

SORGHUM AND SHATTERCANE HYBRIDIZATION: IMPLICATIONS FOR TRANSGENIC SORGHUM. J.J. Schmidt*,[1] L. Sahoo,[1] J.L. Lindquist,[1] D.J. Lee,[1] J.F. Pederson[2]; [1]Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE, [2]USDA-ARS, Lincoln, NE

ABSTRACT

Grain sorghum (*Sorghum bicolor ssp. bicolor*) can interbreed with its closest weedy relative, shattercane (*Sorghum bicolor L. Moench ssp. drummondii*).This hybridization can contribute to changes in fitness and the potential invasiveness of shattercane. Traits contributing to shattercane fitness include seed dormancy and germinability, vegetative growth and competitive ability, and fecundity. Understanding the fitness of shattercane x sorghum hybrids is particularly important because if alleles from the crop can become introgressed into the weed population, then a transgene and its associated trait introduced in a crop also may become introgressed into the weed population. The object of this research was to assess the fitness of shattercane x sorghum hybrids relative to their parents. Four genetic lines were evaluated in this research. The commercial inbred sorghum line RTx430 was used as the male parent (SO) and an inbred shattercane line with A3 male sterility was used as the female parent (SHA3). Their progeny were the F1 hybrid (F1). The inbred wild-type shattercane (SH) used to produce the A3 male sterile shattercane was included as the fertile shattercane parent. Several fitness characteristics were measured including: germination, early emergence and seedling survival, phenological development, plant height, tiller number and height, leaf area, above ground biomass and seed production. Shattercane seeds in a natural state are potentially dormant. Our first experiment was conducted to compare the dormancy and germinability of the four lines at various temperatures in germination chambers. Temperature treatments included four constant temperatures (20, 25, 30, and 35 C) and three variable temperatures: standard germination test for sorghum (varying from 20-30 C over the course of a day, used as control), cold germination (prechill at 10 C for 5 d followed by standard germination), and accelerated aging germination (accelerated aging at 43 C for 3 d at high humidity followed by standard germination). A second experiment was conducted at Lincoln and Mead, Nebraska to compare fitness characteristics of the four lines in two field environments. Fifty seeds of each line were sown in a uniform spacing by hand to a depth of 2 cm in a single 3 m long row. Four adjacent rows, one for each line, were spaced 0.76 m apart to make up a complete block. There were four replicate blocks at each location. Emergence and mortality were measured every other day or as required for the first twenty days. Five plants were randomly selected and permanently marked within the first week of emergence and plant height, growth stage, tiller height and number of tillers was measured on a weekly basis throughout the growing season. Total plant biomass and leaf area were measured by clipping five plants per experimental unit at the soil surface at panicle emergence. Panicles of five plants were bagged after pollination and tied to a stake to ensure no loss of seed and panicles were harvested when seeds were fully mature. Seeds of each panicle were threshed by hand and seed number and 100 seed weight and were determined. Results were analyzed using ANOVA and nonlinear regression analysis. Where possible, results from the shattercane lines were pooled. The germination chamber experiments showed that shattercane and the F1 hybrids were partially dormant 20 C and some sorghum seeds died. Both sorghum and the F1 hybrids were more sensitive to the high temperatures of the accelerated aging treatment than shattercane. However, the accelerated aging treatment increased the rate of shattercane and the F1 hybrid germination (to 1.9 d) more than sorghum (2.4 d) indicating that the germination patterns of F1 hybrids were more like shattercane, but the sensitivity to environmental conditions were more like sorghum. In the field experiments, the F1 hybrids were taller and produced more total aboveground biomass compared to either parent, but the F1 leaf area index (LAI) was intermediate between sorghum and shattercane. The greater height and LAI of the F1 hybrids compared to the shattercane imply that the hybrid may be more competitive than shattercane. The weight of 100 seeds was greatest for sorghum, intermediate for the F1 hybrid and smallest for shattercane. Seed production per panicle was similar for the F1 hybrid and shattercane and smaller for sorghum. These combined results indicate that the fitness of F1 hybrids would be relatively greater than its wild shattercane parent. Therefore, traits introduced into a crop are likely to be successfully introgressed into the shattercane population unless they have a specific deleterious effect on the fitness of the shattercane plant.

MOLECULAR TARGETS FOR GLYPHOSATE RESISTANCE IN HORSEWEED AND PHYLOGEOGRAPHY OF SPREAD. C.N. Stewart*,[1] Y. Peng,[1] X. Wang,[2] L.G. Abercrombie,[1] M.D. Halfhill,[1] M.R. Rao,[1] D.H. Johnson,[2] P.A. Wadl,[2] D.R. Panthee,[1] B.E. Scheffler,[3] T.A. Rinehart,[4] N.R. Stewart,[1] J.S. Yuan,[5] J. Hu,[1] R.N. Trigiano,[2] P.J. Tranel,[6] R.D. Sammons,[7] Y. Cao,[7] T.J. Larosa,[7] G.R. Heck[7]; [1]Department of Plant Sciences, University of Tennessee, Knoxville, TN, [2]Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, TN, [3]Genomics Laboratory, USDA-ARS, Stoneville, MS, [4]Southern Horticutural Laboratory, USDA-ARS, Poplarville, MS, [5]Department of Plant Pathology, Texas A&M University, College Station, TX, [6]Department of Crop Science, University of Illinois, Champaign-Urbana, IL, [7]Monsanto Corporation, St. Louis, MO

ABSTRACT

It is unknown how non-target-site glyphosate resistance has spread in *Conyza canadensis* (horseweed) in addition to the molecular mechanism that confers resistance. To begin to address these, various genomics methods were utilized. To produce a hypothesis about the spread of resistance, simple sequence repeat (SSR) loci were identified and a phylogeographic analysis was performed among 22 accessions containing susceptible and resistant lines. Our results indicate that resistance has probably arisen independently multiple times. To address genomic mechanisms of resistance, three separate strategies have been undertaken: 1. A heterologous microarray experiment was performed among resistant individuals against an Arabidopsis array; 2. An open transcriptional platform was used to analyze numerous horseweed plants, and candidate genes were obtained and screened against several thousand cDNAs. 3. To substantially increase horseweed gene sequence for analysis, Roche GS FLX (454) sequencing was performed of pooled normalized cDNAs. For this experiment cDNA samples from glyphosate-resistant and sensitive samples were pooled and 411,962 sequences were obtained. The average length of each read was 233 bp, and the total data size is 95.8 megabases. These sequences were subsequently trimmed and assembled to generate unique transcripts. To annotate these transcripts, all 16,102 contigs and15,681 singletons were used as queries to search database of all green plant proteins (from GenBank) using BLASTX. Candidate resistance genes, several of which now corresponding to full-length cDNAs have been identified and are being functionally analyzed.

SURVEY OF WEED DIVERSITY IN RELATION TO VARIOUS AGRICULTURAL PRACTICES AS PERFORMED BY FARMERS IN THAILAND 2009. R. Nam-Matra*, S.L. Jury, R.J. Froud-Williams; Plant Science, School of Biological Sciences, Reading, United Kingdom

ABSTRACT

Changes in agricultural practice based on farmer's needs may have a direct effect on weed shift infestations in weed diversity or even the loss of some species of weeds. The aims of the study are to define which weed species are associated with which individual crops and production systems in Thai agriculture, to evaluate the importance of the conservation of the weed flora and define which species are endangered, the factors that contribute to their decline, such as cultivation frequency, crop density and season of planting and weed management practices. The method is to collect statistical data about weed incidence, crops grown, and herbicide application in Thai agriculture. In addition, to compare the number of weed species present in various regions at different times, both before and after herbicide application. Weed management might cause unforeseen problems or have unintended destructive environmental and economic effects, such as herbicides usage. Although, humans often depend on single solution for weed management, single weed control strategies cause weed adaptation to management. An ecologically based approach to weed management may lead to a more balanced and diverse weed community. To achieve these aims, a survey of weed diversity should be performed. The surveys were conducted to reflect different weed management practices and in particular cropping practices and soil properties in Thailand. The survey has been carried out in three regions, the Central, North and Northeast regions in 2007. The questionnaire used in this research was divided into 3 sections such as Farm structure and related information, observations about weed flora, and further information. The 445 questionnaires were delivered to farmers and weed scientists throughout the three main areas and 368 were returned.

LONG-TERM IMPACTS OF WEED MANAGEMENT, NITROGEN SUPPLY, AND IRRIGATION ON WEED POPULATIONS IN WHEAT/FALLOW SYSTEMS; UPDATE AND REANALYSIS. R.F. Norris*; Plant Science, University of California, Davis, CA

ABSTRACT

The Long Term Research in Agricultural Systems project was initiated in the fall of 1993 at the University of California, Davis, research farm. Systems evaluated included no additional nitrogen, synthetic fertilizer nitrogen, or winter legume cover-crop, and were either rain-fed or with supplemental irrigation as required. A two-year wheat/fallow rotation was employed. Both entry points into the two-year rotations were maintained separately. Weeds in fallow systems were controlled with glyphosate. Weeds in the wheat were initially controlled with a mixture of 2,4-D and bromoxynil. All treatments were replicated three times, and each individual plot was 65 m by 65 m. Winter annual weeds were evaluated by annual counts in five quadrats per plot; quadrat size varied with weed density. The total number of weeds showed no consistent change over the 14 years. Species composition of the weed flora has, however, changed in relation to nitrogen, irrigation, and weed management. Shepherd's-purse (*Capsella bursa-pastoris* (L.) Medic.) was the dominant weed at the initiation of the experiment, but has now been reduced to a minor species in all systems. All other weed species constituted less than 1% of the population at initiation in 1994. Systems using a winter legume cover-crop to provide nitrogen have had higher, but variable, overall weed populations, which are now dominated by common chickweed (*Stellaria media* (L.) Vill.), miner's lettuce (*Claytonia perfoliata* Willd.), and annual bluegrass (*Poa annua* L.). Miner's lettuce did not increase in cover-crop systems with the fallow entry point until recent years. During the eight years following initiation littleseed canarygrass (*Phalaris minor* Retz.) populations increased in all systems with wheat as the crop at entry; inclusion of the grass-killing herbicide fenoxaprop-p-ethyl in 2002 has resulted in a subsequent decline in the grass population. However, in the last six years canarygrass has increased in systems that were fallowed at initiation. Annual bluegrass has increased in all systems with supplemental irrigation in contrast with rain-fed systems. Yellow sweetclover (*Melilotus officinalis* (L.) Lam.) became a significant component of the weed population in systems that do not receive additional nitrogen. Henbit (*Lamium amplexicaule* L.) has unexpectedly become a significant component of the weed flora in the fallow entry point of the systems not utilizing winter legume cover-crops; no increase occurred in systems that started at the wheat rotation at initiation. Species such as little mallow (*Malva parviflora* L.), coast fiddleneck (*Amsinkia intermedia* Fisch. & Mey.), wild mustard (*Sinapis arvensis* L.), common sowthistle (*Sonchus oleraceus* L.), and tooth-pick ammi (*Ammi visnaga* (L.) Lam.) are present in several systems, but populations have remained low levels. The two entry points into the rotations have resulted in different weed populations. The experiment has clearly demonstrated that management practices result in alteration of weed species composition in agricultural ecosystems, and that some changes could be expected based on ecology of weeds.

THE ASSOCIATION BETWEEN THE EARTHWORM LUMBRICUS TERRESTRIS AND GIANT RAGWEED (*AMBROSIA TRIFIDA*) IN AGRICULTURAL FIELDS ACROSS THE EASTERN U.S. CORN BELT.

B. Schutte*,[1] J. Liu,[2] A. Davis,[1] K. Harrison,[3] E. Regnier[3]; [1]United States Department of Agriculture - Agricultural Research Service, Urbana, IL, [2]University of Illinois, Urbana, IL, [3]Department of Horticulture and Crop Science, The Ohio State University, Columbus, OH

ABSTRACT

Previous research indicated that secondary seed dispersal by the earthworm *L. terrestris* can improve giant ragweed seed survival and influence seedling spatial structure at the quadrat (m^2) scale. Here, we examine the association between *L. terrestris* and giant ragweed at seedling neighborhood (within 15 cm of seedling), transect (23 m) and regional (eastern U.S. Corn Belt) scales. Our specific objectives were: 1) compare nearest neighbor distances and neighborhood densities between midden (MS) and nonmidden (NMS) seedlings, 2) determine the *L. terrestris*-ragweed association strength (AS) at the quadrat and transect scales in agricultural fields across the eastern U.S. Corn Belt, and 3) conduct exploratory analyses to identify potential causes of differential AS among fields. We studied the *L. terrestris*-ragweed association in no-till soybean fields across Illinois, Indiana, and Ohio in the springs of 2007 and 2008. At each site, seedling neighborhoods were quantified using spatial coordinates of giant ragweed seedlings and *L. terrestris* middens obtained from digital images of 1-m^2 quadrats. First and third nearest neighbor distances and neighborhood densities at 5, 10, and 15 cm were determined for MS and NMS. For quadrat and transect analyses, the presence or absence of middens and seedlings in 0.04-m^2 quadrats was recorded at 0.9-m intervals along 23-m transects. In quadrats where middens and seedlings co-occurred, we determined the percent of seedlings emerging from middens and the percent of ground covered by middens. Quadrat AS equaled percent midden emergence divided by percent midden coverage; values greater than one indicated a *L. terrestris*-ragweed association. Transect AS was the percent of seedling quadrats in which middens and seedlings co-occurred; values ranged from 0 (no association) to 100 (complete association). First nearest neighbor distances were similar between seedling types, but third nearest neighbors for MS were closer than those for NMS. Also, MS neighborhoods at 5 and 10 cm were denser than NMS neighborhoods. These results indicate that MS and NMS experience different competitive environments, which may impact subsequent plant growth and development. Quadrat AS values ranged from 0 to 25 and varied among site-years. Site-years with high quadrat AS values (> 5) received over 135 mm of precipitation the previous autumn (September to October), whereas site-years with low quadrat AS values (< 1.6) received less than 135 mm of autumn precipitation. Transect AS values ranged from 27 to 100, varied among site-years, and correlated with the proportion of quadrats containing middens. The proportion of quadrats containing middens was greatest for site-years that received over 252 mm of precipitation the previous October to December and had at least ten December days with minimum air temperatures greater than 0 C. A strong *L. terrestris*-ragweed association may reduce seed predation due to protection of seeds cached in middens. Climatic and other factors that affect the association at the regional scale may indicate where seed predation-based integrated weed management tactics will be most effective.

WORLD'S WORST WEEDS: A NEW PARADIGM. L. Ziska*; Crop Systems and Gobal Change Laboratory, USDA-ARS, Beltsville, MD

ABSTRACT

As students and even today as weed science professionals, all of us have encountered the concept of worst weeds. For many, Holm's seminal work on "World's Worst Weeds" was required reading, and the paradigm that influenced, specifically that the worst weeds are "c4", that purple nutsedge was the worst weed, etc. are still part of our teaching or research paradigm. Yet, it is also clear that the concept of "worst" is subjective and dynamic. In this presentation I hope to illustrate the history of such designations as "worst", to discuss the criteria used to establish the designation and to illustrate examples of how the concept of worst weed is subject to both human practice and environmental variables.

THE EFFECT OF MAGNETIC POLARITY FIELDS ON INVASIVE AND NON-INVASIVE PLANT SPECIES. S.M. Talley*, C.L. Ramsey; CPHST Lab - Fort Collins CO, USDA-APHIS, Fort Collins, CO

ABSTRACT

Plant species have the ability, with varying degrees, to change in response to environmental stimuli or stressors. The strength and/or rapidity of stimuli/stressor responses among species may be valuable parameters in modeling the invasive potential for unknown species. The ability to change could result from any combination of genetic or phenotypic plasticity mechanisms. In order to accurately and efficiently quantify the strength and rapidity of a plant's response to electromagnetic stimuli a greenhouse study was conducted in Fort Collins, CO. The study objective was to determine seedling growth responses of four plant species when the seeds were exposed to static magnets and then the germinated seedlings watered with south pole magnetized water over two months. Taxonomically paired plant species were classified as two invasive species and two non-invasive species. The invasive species were *Lythrum salicaria* and *Chrysanthemum vulgare*, and the two paired, non-invasive species were *Lythrum virgatum*, and *Erigeron speciosus*. Each seed source was from a single accession, thus genotypic variation was not a factor in this study. Static neodymium magnets were used as electromagnetic stimulators by using south pole fields to accelerate seedling growth. Surface field strength of the magnets ranged from 500 to 580 mT. Seeds were sterilized and either germinated with out any magnetic field, or placed on top the south pole magnet until germination. The control seedling trays were watered with tap water while the south pole seedling trays were watered from containers that sat on top of south pole magnets for 24 hours. Leaf area, plant height and root/shoot biomass were recorded for each plant. The invasive species leaf area for *L. salicaria* and *C. vulgare* was 33.5 and 38.1 cm^2, respectively, for the south pole magnetic treatments. The non-invasive species leaf area for *L. virgatum* and *E. speciosus* was 25.5 and 12.2 cm^2, respectively, for the south pole magnetic treatments. The relative change in leaf area due to magnetic polarity was used to determine the overall strength or intensity of response by each species. The ANOVA tests show that L. salicaria (leaf area increase = 309%) had a three fold response when exposed to south pole fields when compared to *L. virgatum* (leaf area increase = 125%). Similarly, the relative response in average leaf width to south pole fields for *C. vulgare* (ave. width leaf increase = 62%) was higher than its native counterpart *E. speciosus* (ave. width leaf increase = 27%). However, the relative change in leaf area response to south pole fields reversed between the invasive classes showing that *E. speciosus* (leaf area increase = 121%) had a stronger response than *C. vulgare* (leaf area increase = 80%). These results indicate that multiple plant traits or parameters are needed to fully circumscribe and model a species relative responses to stimuli/stressors.

WHY IS EARLY-SEASON WEED CONTROL IMPORTANT IN MAIZE [*ZEA MAYS* (L.)]? E. Page*, E.A. Lee, M.T. Tollenaar, L.L. Lukens, C.J. Swanton; Plant Agriculture, University of Guelph, Guelph, ON, Canada

ABSTRACT

Weed competition in crops is a major challenge to crop production in North America. This competition has been regarded traditionally as a struggle for resources that limit plant growth and development. However, it has also been hypothesized that early detection of weeds through reflected light quality (i.e. the ratio of red to far-red light or R:FR) occurs prior to onset of resource competition and thus, may determine the onset and outcome of crop-weed competition. Our preliminary research on weed competition in maize (Zea mays L.) indicated that the rate of seedling biomass accumulation decreased as the time spent in a low R:FR environment increased. Moreover, transfer to low R:FR following a period of high R:FR (i.e., weed-addition) had little impact on biomass or leaf area accumulation. The objective of our current research was to quantify the impact of early weed competition on season-long biomass accumulation and crop yield. A maize hybrid was grown in a field hydroponics system under ambient and reduced R:FR conditions, simulating weed-free and weedy conditions, respectively. These light quality treatments were established by planting maize seeds in buckets surrounded by turface (a baked clay medium with ambient R:FR) or commercial sod (low R:FR), such that there was no below ground competition. When the treatments were removed at the 10 leaf-tip stage biomass accumulation in the low R:FR treatment had been reduced by 10 % and this difference was maintained through to silking. At maturity, kernel number in the low R:FR treatment was reduced by 9%, however this effect was offset by a 6% increase in thousand kernel weight, such that yield was only reduced by 5%. These results suggest that early shade avoidance in maize may come at a cost to kernel number per plant and thus, crop yield potential.

WEED CONTROL IN FURROW-IRRIGATED CLEARFIELD RICE. G.M. Griffith*,[1] J.K. Norsworthy,[1] J. Still,[1] S. Bangarwa,[1] R.C. Scott[2]; [1]Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Fayetteville, AR

ABSTRACT

Research was conducted at the Pine Tree Branch Experiment Station in Colt, AR, in 2008, to evaluate weed control options in a Clearfield® rice production system. Beds (76-cm spacing) were formed on a Calloway silt loam (fine-silty, mixed active, thermic Glossaquic Fragiudalf) soil. Imidazolinone-tolerant hybrid rice 'CL 730' was drill-seeded at 29 seeds/m of row on raised beds on May 13, 2008. The experimental design was a randomized complete block with a 2 by 5 factorial treatment arrangement with four replications. Five herbicide programs applied up to the 4- to 6-leaf stage of rice were evaluated with and without additional 'as needed' herbicide at later stages. Treatments included imazethapyr applied preemergence (PRE) followed by (fb) imazethapyr at 4- to 6-leaf rice, imazethapyr at 2- to 3-leaf rice followed by imazethapyr at 4- to 6-leaf rice, imazethapyr plus quinclorac at 560 g ai/ha PRE fb imazethapyr at 4- to 6-leaf rice, imazethapyr PRE fb imazethapyr plus quinclorac at 560 g/ha applied at 4- to 6-leaf rice, and clomazone PRE at 336 g ai/ha fb propanil at 4480 g ai/ha at 4- to 6-leaf rice. All imazethapyr was applied at 70 g ai/ha, with 1% v/v nonionic surfactant when applied postemergence (POST). All 'as needed' treatments received propanil at 4480 g/ha plus acifluorfen at 280 g ai/ha fb 2,4-D at 1,600 g ai/ha plus 1% v/v nonionic surfactant, except for clomazone fb propanil, which received only 2,4-D. Data collected included visual injury, weed control, and rice yield. Weeds evaluated included Palmer amaranth, pitted morningglory, hophornbeam copperleaf, prickly sida, and broadleaf signalgrass. Additional herbicides were needed throughout the season following the 4- to 6-leaf stage of rice for control of Palmer amaranth. Most of the Palmer amaranth at this site appeared to be non-responsive to imazethapyr. Due to moist soil conditions from frequent furrow irrigation, most weeds emerged throughout the crop season, resulting in failure of herbicide applications terminated at the 4- to 6-leaf stage of rice to provide season-long weed control. Lack of season-long weed control did not result in significant yield loss, although yield of all 'as needed' treatments was numerically greater than their corresponding treatment terminated at the 4- to 6-leaf stage of rice. This research indicates that additional herbicides will be needed beyond the 4- to 6-leaf stage of furrow-irrigated rice, meaning that weed management will be costly and quite challenging in this system.

IMPACT OF ISOXAFLUTOLE ON KOCHIA (*KOCHIA SCOPARIA*) GERMINATION. G.M. Sbatella*, R.G. Wilson; University of Nebraska, Scottsbluff, NE

ABSTRACT

Kochia (Bassia scoparia) control in continuous corn became increasingly difficult in experimental plots where isoxaflutole was used as a preemergence herbicide for 8 years. A series of studies were conducted to determine if poor kochia control could be explained by: a) An escape mechanism based on different germination rates or b) Differences in tolerance to isoxaflutole among populations. Weed seed from plants present in the experimental plot were harvest in 2006 and 2007. At the same time seeds from plants growing in rangeland and an adjacent production corn field where isoxaflutole had not been utilized for weed control were collected. A germination study was conducted to determine the dormancy levels and possible differences among populations. All populations were incubated at constant temperatures of 5, 10, 15, 20, 25, 30, 35 and 40 C and treated with a solution of KNO3 as a treatment to release dormancy. Seeds collected from the isoxaflutole treated area did not exceed 20 % germination at temperatures below 25 C. A second study was conducted to determine the optimal alternating temperatures to release dormancy. Seeds were grown at alternating night-day temperatures of 5-15, 15-25, 20-30 and 25-35 C. The greatest germination of seeds from the isoxaflutole treated area was obtained with alternating temperatures of 25-35 C. Results suggest that seeds from the isoxaflutole treated area have higher dormancy levels and require higher temperatures to germinate when compare to other populations never exposed to isoxaflutole or cropping situations. In a third study kochia plants were grown in hydroponic solutions different levels of isoxaflutole added to the nutrient solution, and chlorophyll content were measured to determine the population tolerance to isoxaflutole.

INFLUENCE OF TEMPERATURE AND LIGHT ON WILD RADISH (*RAPHANUS RAPHANISTRUM*) GERMINATION OVER A 12-MONTH PERIOD. M.S. Malik*,[1] J.K. Norsworthy,[2] M.B. Riley,[1] P. Jha[2]; [1]Entomology, Soils, and Plant Sciences, Clemson University, Clemson, SC, [2]Crop, Soils, and Environmental Sciences, University of Arkansas, Fayetteville, AR

ABSTRACT

Wild radish is facultative winter annual that emerges throughout the year. It is a troublesome weed in small grain crops in the southeastern United States. The siliques containing seeds shatter following maturation. Decay of siliques during the after-ripening process allows seed germination to occur under favorable environmental conditions. Experiments were conducted during 2005/2006 and 2007/2008 on seeds collected from natural populations of wild radish to evaluate its germination requirements over a 12-month period beginning in July. Wild radish siliques containing seeds were placed in nylon mesh bags and then into 50-cm diameter open ended pipes inserted in soil at a 15-cm depth. The bags were placed on the soil surface and at a 10-cm depth in those pipes. Siliques on the soil surface and buried were retrieved at 0 (freshly harvested), 3, 6, 9, and 12 months after placement in the field. A portion of the siliques were cleaned and dried at room temperature and the seeds were removed from the remaining siliques. Germination tests were performed by placing 50 seeds between filter paper moistened with 10 ml of distilled water in 9-cm-diameter petri dishes. The petri dishes were placed in incubators maintained at constant temperatures of 0, 5, 10, 15, 20, 25, and 30 C and 12 h fluctuating temperatures (±7.5 C) of 10, 15, 20, 25, and 30 C. In the light experiments, seeds were exposed to red, far-red, red followed by far-red, and far-red followed by red lights for a duration of 15 min each. The experimental design was a split-split plot design with three replications. Germination data were subjected to ANOVA, and means were separated using Fisher's protected LSD at 5% level of significance. Germination of wild radish was influenced by time of year, amplitude, and burial. Freshly harvested seeds of wild radish (July) had germination ranging from 3 to 18%. Conversely, seeds retrieved after 3 and 6 months following maturation had 3 to 40% over the various temperature regimes. Germination of wild radish retrieved from the soil surface was 1.2 to 1.5 times greater at fluctuating temperatures compared to constant temperatures at 0, 3, and 6 months after maturation. Seeds buried at a 10-cm depth had greater germination at 3 months after maturity, whereas germination of seed from the soil surface at later retrieval dates was greater compared with seeds that were buried. The light requirement for germination varied by time of year, with no differences in germination between light and dark conditions for freshly harvested seeds. Far-red light inhibited wild radish germination following 6 months of burial in soil. No differences were found in germination of seeds enclosed in siliques and those having the silique removed.

SEED SIZE AND GERMINATION CHARACTERISTICS OF SPRING VERSUS FALL COHORTS OF *ANTHEMIS ARVENSIS*. D.C. Brainard*,[1] R.R. Bellinder,[2] V. Kumar,[3] C. Benedict[2]; [1]Horticulture, Michigan State University, East Lansing, MI, [2]Horticulture, Cornell University, Ithaca, NY, [3]International Rice Research Institute - India, New Delhi, India

ABSTRACT

Corn chamomile (*Anthemis arvensis*) is an important weed contaminant in peas, producing flower buds which cannot be easily separated from peas during processing. Corn chamomile can behave as either a winter or a summer annual, and both overwintering and spring-germinating individuals can be found in pea fields. Field and greenhouse experiments were conducted to (i) evaluate the relative importance of overwintering versus spring-germinating cohorts as contaminants in pea production, and (ii) assess fecundity and seed characteristics of these cohorts. Fall-germinating cohorts escaping field preparation in the spring were found to be the most difficult to control in peas and the most likely source of contamination. Fall cohorts flowered and produced seeds two to three weeks earlier in the summer than spring cohorts. Compared to spring cohorts, fall cohorts produced 1) more seeds, 2) a greater proportion of large seeds, and 3) more dormant seeds for a given seed size class. Differences in seed size were largely due to seed coat thickness, not embryo size. Larger seeds had thicker seed coats and greater dormancy than small seeds. Mean fecundity for spring cohorts ranged from approximately 300-1,000 seeds/plant compared to 2,000-23,000 seeds/plant for over-wintering cohorts. Our results suggest that the most efficient strategy for managing corn chamomile is prevention of establishment and seed production of over-wintering cohorts. Aggressive fall management in rotational crops like winter wheat is especially important for avoiding long-term problems from this persistent weed.

PALMER AMARANTH PERSISTENCE IN THE SOIL SEEDBANK OVER FOUR YEARS. P. Jha*, J.K. Norsworthy; Department of Crop. Soil, and Environmental Science, University of Arkansas, Fayetteville, AR

ABSTRACT

Experiments were conducted at the Simpson Research Station near Pendleton, SC, to evaluate the persistence of Palmer amaranth seeds in the soil over 4 years (2004 to 2008). Seeds were collected in the fall of 2004 from a site in Pendleton with a natural infestation of Palmer amaranth. Cylindrical pipes of 30 cm height and 50 cm diameter with openings at both ends were placed in the soil with the upper 2.5 cm of pipe above the soil surface. The upper 10 cm of soil from each buried pipe was removed and placed in a bucket. Approximately 4000 germinable Palmer amaranth were thoroughly mixed with the soil and the soil/seed mixture was returned to the pipe. Tilled and no-till plots were randomly assigned in the first year of the experiment and were permanent throughout the period of the study. Soil disturbance in the tillage plots was through hand-hoeing to a depth of 10 cm once annually. The experiment was conducted as a completely randomized design with eight replications. Seedling emergence was determined twice monthly. All the emerged seedlings were counted and removed subsequently by hand. Each November, soil samples from depths of 0 to 5 cm and 5 to 10 cm were taken from 16 plots [2 treatments (tillage and no-tillage) by 8 replications]. Samples were bagged and stored at 10 C. Soil samples were placed in trays in the greenhouse at 30/24 C and 16 h light to determine the number of germinable seeds. Palmer amaranth emergence was not affected by tillage, except in 2006. In 2006, emergence was 0.28% of the original Palmer amaranth seedbank in tilled plots compared with 0.07% of the original seedbank in no-till plots. Averaged across tillage treatments, 0.47 and 0.0047% of the seedbank emerged in 2005 and 2007, respectively, while no emergence occurred in 2008. The effects of tillage, depth, and the interaction of depth by tillage each year on the percentage of germinable seeds remaining in the soil seedbank relative to the initial seedbank were not significant. The germinable fraction of the original seedbank ranged from 0.65 to 1.35% in 2005, 0.05 to 0.10% in 2006, and 0.0068 to 0.033% in 2007. These results suggest that in South Carolina Palmer amaranth is not highly persistent in the soil seedbank. After accounting for the in-field emergence and the germinable fraction of the soil seedbank, approximately 99% of the Palmer amaranth seeds are lost during the first 12 months following introduction into the soil seedbank.

THE DEMOGRAPHY OF FERAL ALFALFA (*MEDICAGO SATIVA* L.) POPULATIONS OCCURRING IN SOUTHERN MANITOBA, CANADA. M.V. Bagavathiannan*,[1] R.H. Gulden,[1] G.S. Begg,[2] R.C. Van Acker[3]; [1]Plant Science, University of Manitoba, Winnipeg, MB, Canada, [2]Environment Plant Interactions, Scottish Crop Research Institute, Dundee, United Kingdom, [3]Plant Agriculture, University of Guelph, Guelph, ON, Canada

ABSTRACT

Medicago sativa (alfalfa) is an important forage crop in North America. Apart from cultivated fields, alfalfa is also found along road sides and other natural and semi-natural habitats. However, limited information is available on the establishment capabilities of alfalfa in non-cultivated areas and the potential of these founding populations to become feral. This information will help us to understand whether feral alfalfa populations will become a barrier for the co-existence of cultivated alfalfa containing novel traits with conventional alfalfa. The objective of this study was to investigate the demography and dynamics of alfalfa populations occurring in natural and semi-natural environments. Research sites were identified in three rural municipalities in Southern Manitoba (Western Canada) in 2006. Within each municipality, four sites each about 150-200m long and 10-15m wide were marked using global positioning system (GPS) way points. Within each site, 30 alfalfa plants of different age and size were randomly selected and tagged. A total of 360 plants were studied. The dynamics of different life stages including soil seedbank, seedling recruitment, vegetative growth and reproductive output were investigated. Road verge management such as mowing and herbicide spray affected the dynamics of feral populations. Mowing was usually done by the rural municipality two times per season (late June, late August). In general, almost 93% of the non-mowed alfalfa plants and about 29% of the mowed plants were reproductively successful and this may be sufficient for replenishing a seed bank. On average, mowed plants produced 70 seeds plant^{-1} and non-mowed plants produced 1340 seeds plant^{-1}. We found a viable and active seed bank at the roadside sites. Viable seed content levels were higher next to non-mowed plants but were low on average (94 seeds m^{-2}) suggesting that the seedbank may be relatively ephemeral. Mowing affected the seedbank dynamics through its effects on seed production. Seedling recruitment varied greatly among the sites and on average, 1.2 seedlings successfully recruited around each mother plant studied. Herbicide spray in the road verges (often 2,4-D) killed the above ground life stages but its effect on below ground stages is not clear. This data was used to develop a matrix population model for feral alfalfa population establishment and growth. This dynamic predictive model will be useful for the biosafety assessment of alfalfa in relation to the production of novel traits in this species.

THE EFFECT OF GENOTYPE AND GENERATION ON COMPETITION AND FECUNDITY OF VOLUNTEER *BRASSICA NAPUS*. N. Seerey*, S.J. Shirtliffe; Plant Sciences, University of Saskatchewan, Saskatoon, SK, Canada

ABSTRACT

Due to the large acreage of canola (*Brassica napus* L.) grown in western Canada, and inherent harvest losses, volunteer canola has become a common weed in producer fields. Commonly grown canola varieties are developed by hybrid genetics which segregate in subsequent generations. The segregation of traits creates volunteers with unknown fecundity and competition capabilities. The objective of this study was to evaluate the effect of volunteer canola genotype and generation on seed fecundity and competition with hard red spring wheat (*Triticum aestivum*L.). Two hybrid and one open pollinated canola varieties with three consecutive generations were grown at varying densities in a competitive wheat stand, for five site years. Data from two site years shows a maximum yield loss at densities of 20 canola plants m^{-2}, and varied from 35 to 65% depending upon environment. Generation or genotype did not significantly affect competitive ability. Fecundity was affected by generation in which the F1 generation produced more seed than the F2 and F3 generations, across four site years. Volunteer canola genetics did not affect competition, but generational differences did allow for differences in fecundity.

GROWTH, FECUNDITY AND COMPETITIVENESS OF HERBICIDE-RESISTANT AND -SUSCEPTIBLE *ECHINOCHLOA PHYLLOPOGON* IN A RICE ENVIRONMENT. L.G. Boddy*,[1] E.A. Laca,[1] M. Moechnig,[2] A.J. Fischer[1]; [1]Department of Plant Sciences, UC Davis, Davis, CA, [2]Plant Science Department, South Dakota State University, Brookings, SD

ABSTRACT

Echinochloa phyllopogon (ECHPH) is one of the most important weeds of rice in California, Japan and other temperate regions, and has evolved resistance in California to most available herbicides, thus severely limiting control options. Resistance to a wide variety of herbicide modes of action presents a need for non-chemical control measures. A series of experiments were conducted to explore possible differences in ECHPH growth, fecundity and competitive ability with rice. Growing at five densities within a rice stand, resistant (R) ECHPH biotypes had lower biomass, relative leaf area (RLA) and fecundity when compared to susceptible (S) biotypes. When considered together, rice biomass, grain weight, height and RLA, were affected differently by R and S biotypes. In particular, rice RLA was lower in competition with S biotypes. However, this effect did not translate into greater rice growth or grain weight reduction by S vs. R biotypes. Thus R plants' ability to interfere with rice was not disadvantaged by their inferior ability for light capture and biomass accumulation, suggesting other factors besides competition for light may be at play. These results also suggest the lower fecundity of the R biotypes could result in lower ecological fitness in the absence of herbicide selection pressure.

EFFECTS OF VARYING SOIL NITROGEN FERTILITY LEVELS AND COMPETITIVE ENVIRONMENT ON WEED VIGOR AND GROWTH. S.E. Whitehouse*, A. DiTommaso, C.L. Mohler; Crop & Soil Science, Cornell University, Ithaca, NY

ABSTRACT

Reducing weed competition and maintaining soil fertility are essential to proper crop growth. Understanding the effects of nutrients on crop and weed growth can allow growers to adopt soil fertility strategies that suppress weeds while benefiting the crop. Macronutrients such as nitrogen may be drivers of weed competition, and large supplies of nitrogen that are available earlier in the growing season can increase the competitive ability of a weed. Much is known about the effects of soil nitrogen availability on crop growth and yields; however, the effects of varying nitrogen availability as a means of managing weeds are yet unclear. The objective of this 2-year field study was to investigate the effects of different nitrogen application rates and competitive environments on the growth of three major annual weeds in corn, including velvetleaf (*Abutilon theophrasti*), common lambsquarters (*Chenopodium album*), and giant foxtail (*Setaria faberi*). We hypothesized that the greatest growth for all three weed species would be realized for plants grown in pure stands and receiving the highest nitrogen applications. The field study was established near Ithaca, NY, USA in 2007 and 2008, and was a randomized complete block factorial with four replications. Corn was seeded at 74,129 seeds ha^{-1} in late May during both years. Three competitive environments (corn-only, weed-only, mixed stands), measuring 4.56m (6-corn rows) by 3m, were established by either removing corn or hand-seeding each weed species along three diagonal lines between the three innermost corn rows. Three nitrogen fertilization levels (164, 209, and 234 kg ha^{-1}) were applied to plots after planting by top-dressing ammonium nitrate (NH_4NO_3). Weeds were then hand-thinned to 20 plants m^{-2}, and several data parameters were collected bi-weekly from June to November during the two years, including height, leaf number, tiller number, stem diameter, and capsule or panicle number. Aboveground plant tissue was harvested in early November of both years and dry biomass determined. In both 2007 and 2008 the aboveground biomass of all three weed species was affected by competitive environment ($P<0.05$). In both years velvetleaf biomass did not differ between the competitive environments or nitrogen levels. Giant foxtail and common lambsquarters biomass decreased when grown in mixed stands with corn as compared to pure stands in 2007 (35% and 40% respectively) and in 2008 (69% and 70% respectively). In both 2007 and 2008 nitrogen application had no effect on the biomass of the three weed species, and no interaction was found between the main factors. ese results support our hypothesis that growth of our weed species would be greatest when grown in pure stand than in mixture with corn. However, the nitrogen fertility component of our hypothesis was not supported for all species. Although varying the timing and amounts of nitrogen applied could have changed the results, findings from our study suggest that weed management tactics should not focus on soil nitrogen applications. Rather, factors of inter-specific competition between the crop and weed, such as cropping density and establishment of a dense crop canopy to shade out weed seedlings, should be the focus of weed management strategies.

CORN (*ZEA MAYS*) AND VELVETLEAF (*ABUTILON THEOPHRASTI*) WATER USE EFFICIENCY. L.G. Vaughn*, J.L. Lindquist, M.L. Bernards, T.J. Arkebauer; University of Nebraska-Lincoln, Lincoln, NE

ABSTRACT

Rainfall and soil water availability during the corn growing season is highly variable throughout Nebraska and the north central USA, which greatly impacts all aspects of agroecosystems and their management, including the presence and abundance of weedy species. The supply of soil resources is critical for the establishment and long-term competitive success of a plant species. While there is considerable research on the effects of water supply on crop growth and productivity, there is little published research on the response of weedy and invasive plants to limiting soil water supply relative to that of the crop. The objective of this greenhouse study was to determine the water use efficiency (WUE) of corn 'DKC60-19' and velvetleaf as the plants were subjected to varying levels of constant water supply. Prior to the start of the experiment, 0.90 mil black plastic bags were placed inside pots (25 cm diam by 23 cm deep). Corn and velvetleaf plants were seeded in the pots filled with a constant 13.5 kg dry weight of a 8:1:1 mixture of soil:sand:perlite. Plants were thinned to one plant per pot with bags sealed around the base of the plant stem so the only water loss was that due to transpiration. Sealed access tubes were inserted through the bags to allow daily water replacement with minimal disturbance of plants. Daily transpiration was measured by weighing the pots at the same time each day. Two trials of the experiment were conducted, one in the fall with three water treatments where pots were maintained at 14.58, 14.985 and 15.5 kg, respectively, and the second in the spring where the three treatments were 14.7, 15.5 and 16.5 kg . Four replicate plants of each species were harvested periodically at differing stages of plant development to determine leaf area and biomass accumulation. The relationship between cumulative above ground biomass and water use was described using a linear function where the slope defines the WUE. Corn WUE was greater than that of velvetleaf in all treatments in both trials. In the first trial, WUE of both corn and velvetleaf differed among all water treatments. For example, corn WUE was 13.46, 8.82, and 7.27 g/kg in the 14.58, 14.985, and 15.5 kg water treatments. The ratio of the WUE for corn and velvetleaf was about 1.3 in the first trial. In the second trial, WUE of both species was lower overall and did not differ among the two greater water treatments. For example, corn WUE was 5.0 g/kg in the 15.5 and 16.5 kg treatments but 10.55 g/kg in the 14.7 kg water treatment. The corn:velvetleaf WUE ratio was 1.4 in the 14.7 kg water treatment and 1.6 in the 15.5 and 16.5 kg water treatments. Results from this study support previous research that suggests corn has the ability to increase physiological water use efficiency as water supply is reduced which resulted in a greater WUE at the lowest water treatments. However in the highest water treatments, corn had the greatest slope ratio between the two species suggesting that corn will best utilize available water relative to velvetleaf at higher water levels.

VARIATIONS IN SEED DORMANCY OF WEEDY RICE DIRECTLY HARVESTED FROM RICE FIELDS IN ARKANSAS. T. TSENG*, N. Burgos, V. Shivrain, E. Alcober; Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR

ABSTRACT

Weedy red rice is a serious threat to the Arkansas rice industry and has the potential to affect rice yield and quality. This weed is widespread in the southern U.S. rice producing states and continues to be a major constraint to production wherever it occurs. Weedy red rice is a member of the cultivated rice species (Oryza sativa), but is highly competitive with the crop. Competition results in significant yield losses and reduction of rice grain quality. Understanding about the physiological characteristics of weedy rice seed is essential to manage it sustainably. Among its weedy traits, seed dormancy is of major importance to its persistence. In this study, the seeds from red rice accessions collected in late summer, 2008 were exposed to four temperatures, 1C, 15C, 25C and 35C. We evaluated the germination traits of 59 red rice populations collected from 18 counties. At 35C the germination capacity ranged from 76 to 100%. Ten out of 59 populations tested showed the least germination and also took the longest time to reach maximum germination. Overall, 97% of the populations showed more than 90% germination. At 15C, the germination capacity ranged from 7 to 100% with nine populations showing the lowest germination rate ranging from 7 to 40%. Only 41% of the populations attained >90% germination capacity at this temperature. None of the populations germinated at 1C within 12 d of incubation, but rapidly attained germination capacities of 90% or higher when transferred to 30C. Variations in dormancy between plants within a field were observed. The effects of hull type, location, and temperature on germination characteristics will be discussed. Temperature and plant type showed significant effects on the dormancy of new seed and in turn will impact the size of the seed bank and the level of infestation that growers will contend with in the succeeding crop cycle. Future studies will include characterization of the highly dormant accessions.

PALE SWALLOW-WORT ESTABLISHMENT AND SURVIVAL IN FOUR DISTURBANCE REGIMENS IN CENTRAL NEW YORK STATE. K.M. Averill*,[1] A. DiTommaso,[1] C.L. Mohler,[1] L.R. Milbrath[2]; [1]Cornell University, Ithaca, NY, [2]USDA ARS, Ithaca, NY

ABSTRACT

Pale swallow-wort (*Vincetoxicum rossicum*) is a nonnative, perennial, herbaceous vine in the Apocynaceae that is invading natural areas in the northeastern United States and southeastern Canada. The species forms dense stands across a wide range of moisture regimes in full sun or forest understories. The dense colonies outcompete resident vegetation and reduce vertebrate and invertebrate biodiversity. A classical biological control program was initiated by the USDA-ARS in 2004 with the goal of providing sustainable and economical long-term suppression of this aggressive species. The success of this biological control effort depends on the availability of plant demographic data that can be modeled to determine which swallow-wort life stage(s) may be most susceptible to control efforts. Since little is known about the establishment phase of swallow-wort's life cycle, we conducted a field experiment in central New York State to determine establishment and survival during the first two years after sowing. In November 2006, we planted pale swallow-wort seeds in two old fields subjected to four disturbance regimens. The treatments were established in a randomized complete block design with eight replications at each site: (1) one application of isopropylamine salt of glyphosate (3.0 kg ae ha^{-1}) plus diglycolamine salt of dicamba (1.9 kg ae ha^{-1}), followed by rotary tillage to 15 cm depth in 2006, (2) one application of glyphosate plus dicamba in 2006, (3) mowing to approximately 20 cm once per year, and (4) an undisturbed control. We hypothesized that establishment and survival would be greater in treatments with greater disturbance. At the Mt. Pleasant site, which is better drained than the Hanshaw site, overall swallow-wort establishment (seedling emergence as of August 2007) was 15 ± 1% and did not differ between treatments. At the Hanshaw site, establishment varied by treatment; mowed and control plots had greater swallow-wort establishment (10 ± 2%) than herbicide + tillage and herbicide plots (1.6 ± 0.5%). Of those seedlings that emerged in 2007, survival to August 2008 (84 ± 4%) was not affected by treatment at Mt. Pleasant. At Hanshaw, survival was greater in mowed, control, and herbicide plots (73 ± 6%) than in herbicide + tillage plots (17 ± 17%). At both sites, swallow-wort total (above- and below-ground) biomass was greater in herbicide + tillage (0.31 ± 0.1 g) and herbicide (0.28 ± 0.09 g) plots than in mowed (0.036 ± 0.005 g) and control (0.034 ± 0.006 g) plots. Only at the Mt. Pleasant site in the herbicide + tillage (3 ± 3%) and herbicide plots (4 ± 3%) did swallow-wort plants produce mature follicles in 2008. These results indicate that pale swallow-wort establishment and survival is successful across a range of disturbance regimens and that growth is greater in more disturbed regimens.

GERMINATION CHARACTERISTICS OF THE DIMORPHIC SEEDS OF SPREADING ATRIPLEX (*ATRIPLEX PATULA*). R.E. Nurse*,[1] W.D. Reynolds,[1] C. Doucet,[2] S.E. Weaver[1]; [1]Greenhouse and Processing Crops Research Centre, Agriculture and Agri-Food Canada, Harrow, ON, Canada, [2]Pest Management Regulatory Agency, Health Canada, Ottawa, ON, Canada

ABSTRACT

Spreading atriplex is an annual weed that colonizes roadsides, field edges, and increasingly no-till agricultural fields. It produces dimorphic seeds with different levels of physiological dormancy, but little is known about the germination ecology of the two seed types. Field and controlled environment studies were conducted to determine seed responses to light and stratification, the pattern of seedling emergence in the field, and the effect of soil water content on the length of cold stratification required to break dormancy for each seed type. The large brown seeds have three times the mass of the smaller black seeds, due primarily to a larger embryo, but have a thinner seed coat. Germination of brown and black seeds in Petri dishes was 98% and 90%, respectively, after stratification for 3 mo at 5 C, whereas germination of unstratified seeds was 19% and 12%, respectively. Light stimulated germination of both stratified and unstratified black seeds, but did not increase germination in stratified brown seeds. Up to 40% of brown seeds germinated *in situ* during stratification, compared to only 2% for black seeds. Germination in Petri dishes and emergence in the field were more rapid for brown seeds than for black seeds. Maximum germination of black seeds occurred after stratification for 2 or 3 mo at 5 C on soil that was waterlogged (pore water matric potential, ψ = 0 kPa), wet (ψ = -0.38 kPa), or at field capacity (ψ = -10 kPa). For shorter periods of stratification, total germination and germination rate of black seeds declined as soil water content decreased from waterlogged to dry (ψ = -500 kPa). Seed dimorphism in spreading orach may provide a mechanism to enhance survival in uncertain or variable habitats such as disturbed agricultural fields.

CONGENERIC AND BIOGEOGRAPHICAL APPROACHES TO ALLELOPATHY TO BETTER UNDERSTAND INVASION SUCCESS. I. Singh*; University of Delhi, Delhi, India

ABSTRACT

The congeneric approach involves comparative studies of exotic species with natives in the same genus and helps to understand mechanisms driving exotic plant invasions. The biogeographical approach compares the allelopathic effects of exotic invasives on native residents from their native and invaded communities that yield stronger evidence than the traditional approach to allelopathy. Togather congenric and biogeograpgical approach to allelopathy helps to understand the role of chemicals in the invasion success of exotic species in the invaded range. The importance of congeneric and biogeographical approach to allelopathy in determining its role in invasion success will be discussed by taking examples of *Lantana camara, Prosopis juliflora* and *Centaurea maculosa*.

TOLERANCE OF EXTREME SOIL MOISTURE STRESS BY THE BIOFUEL SWITCHGRASS MAY INCREASE INVASIVE POTENTIAL. J. Barney*, J. DiTomaso; Plant Sciences, University of California, Davis, CA

ABSTRACT

In an effort to reduce greenhouse gas emissions, expand domestic energy production, and maintain economic growth, public and private investments are being used to pursue dedicated feedstock crops for biofuel production. The leading candidate for lignocellulosic-based ethanol in the US is switchgrass (*Panicum virgatum*), a perennial rhizomatous grass native to most of North America east of the Rocky Mountains. Switchgrass possesses great genetic variation, harbors few resident pests, and is highly productive in marginal environments - all traits conducive for biofuel production. However, the same traits that are agronomically favorable also create the potential for switchgrass to escape the cultivated environment and become an invasive species. Commercial switchgrass production is being proposed in the non-native region of the Pacific Northwest and California, which are environmentally dissimilar to most regions of its native range. California's Mediterranean climate receives much lower precipitation amounts and in different seasons compared to the native range of switchgrass. Additionally, California has thousands of miles of irrigation canals and many thousand acres under paddy rice production, both of which possess anoxic soils. Switchgrass has both upland and lowland ecotypes, which are adapted to mesic and hydric soils respectively, and may differ in their ability to survive in California. To assess the ability of switchgrass to survive outside cultivation in the unique California environment where it is non-native, we conducted a soil moisture stress experiment with four cultivars, two from both the upland and lowland switchgrass ecotypes. This experiment maintained switchgrass individuals under no stress, chronic drought stress, and chronic anoxic soil stress via flooding. All cultivars survived ten weeks under both drought (~5% soil moisture) and flooded (~60% soil moisture) conditions. Lowland forms were equally productive (i.e., tiller production) under flooded and control conditions, while across ecotypes, control plants produced greater the two-fold more tillers and were 20% taller than drought individuals. Sexual reproduction was unaffected by soil moisture treatments. However, across all treatments, upland individuals were twice as likely to flower compared to lowland individuals. Switchgrass appears to be highly tolerant of extremely low soil moisture and flooding conditions, suggesting that both arid and hydric sites will support a switchgrass population without human cultivation. Programs aimed at enhancing the already tolerant switchgrass cultivars to xeric soils will further increase the ability of switchgrass to become an invasive pest.

***IN PLANTA* MECHANISM OF ACTION OF SORGOLEONE.** F.E. Dayan*,[1] J.D. Weidenhamer[2]; [1]NPURU, USDA-ARS, University, MS, [2]Department of Chemistry, Ashland University, Ashland, OH

ABSTRACT

Injury to crops grown in rotation with sorghum (*Sorghum bicolor* L.) suggested that this species was allelopathic. This phytotoxicity is associated with a group of lipid benzoquinones called sorgoleone that exude from the root hairs of sorghum. The amount produced does not differ during the early stages of development, but varies with temperature and responds to the presence of other plants. Sorgoleone is released directly in the soil and acts as a pre-plant incorporated herbicide. One factor expanding the apparent persistence of sorgoleone in soil is the fact that it is continually released from the root hairs of sorghum, which sustains its concentration in soil over a long period of time. GC-MS analysis of root exudates shows that it is composed of a roughly 1:1 mixture of sorgoleone and a related dimethylated resorcinol. The function of the resorcinol derivative is unclear. Sorgoleone inhibits photosynthetic and mitochondrial electron transports and the activity enzyme *p*-hydroxyphenylpyruvate dioxygenase in *in vitro* assays. However, the *in vivo* mode(s) of action of sorgoleone is unclear and it is not clear whether this lipid benzoquinone can be taken up by roots of the receiving plants and translocated to their foliage where it must enter the chloroplast and inhibit PSII in the thylakoid membrane. Root or foliar exposure to sorgoleone has no effect on photosynthesis of 7 days-old velvetleaf. Radiolabeled sorgoleone is not translocated beyond the point of application. However, sorgoleone disrupts photosynthesis in young cotyledonary tissues; therefore, this allelochemical may still act as a PSII inhibitor in emerging seedlings. The growth of wild-type and atrazine-resistant *Amaranthus retroflexus* seedlings was reduced in the presence of sorghum plants. Dose-response curves obtained with sorgoleone and atrazine against oxygen evolution from chloroplasts isolated from these biotypes show that atrazine resistance (Ser264 mutation) does not provide cross-tolerance to sorgoleone, which belongs to the His215 group). Therefore, the allelopathic effect of sorgoleone is strong on young developing plants, which may take up sufficient amount of sorgoleone through their cotyledonary tissues to exert a phytotoxic response by light-independent disruption of membrane integrity, direct inhibition of photosynthesis, or a combination of these mechanisms of action with yet unknown ones.

SAFLUFENACIL: MODE OF ACTION OF A NEW HERBICIDE FOR BROAD SPECTRUM CONTROL OF DICOT WEEDS. K. Grossmann*,[1] R. Niggeweg,[1] T. Ehrhardt,[1] N. Christiansen,[2] R. Looser[2]; [1]BASF SE, Limburgerhof, Germany, [2]metanomics, Berlin, Germany

ABSTRACT

Saflufenacil (BAS 800H) is a new herbicide of pyrimidinedione structure being developed by BASF for preplant burndown and selective preemergence dicot weed control in multiple crops including corn. The herbicidal mode of action of saflufenacil was investigated in a series of experiments. After foliar and root application to young plants of black nightshade (*Solanum nigrum*) for 48 hours, saflufenacil elicited the same type of phytotoxic symptoms as peroxidizing herbicides, with light-dependent, rapid pigment bleaching, desiccation and necrosis of the green tissue. For further mode of action characterization, an array of biotests was used in a physionomics approach for comprehensive physiological profiling of saflufenacil effects. Using treated duckweed (*Lemna paucicostata*) plants, metabolite profiling was performed based on quantification of metabolite changes, relative to untreated controls. Physiological and metabolite profiling suggested a mode of action similar to inhibitors of protoporphyrinogen IX oxidase (PPO) in the tetrapyrrole biosynthetic pathway. Accordingly, saflufenacil inhibited PPO enzyme activity *in vitro* with IC_{50} values in the nM range. As subsequent effects of PPO inhibition by saflufenacil, accumulations of protoporphyrin IX and reactive oxygen species, such as hydrogen peroxide, were observed in the green tissues of black nightshade and velvetleaf. In corn, only slight increases in protoporphyrin IX and hydrogen peroxide were found, which reflects *in planta* tolerance of this crop. The results show that saflufenacil is a new PPO-inhibiting, peroxidizing herbicide. Moreover, studies with radiolabeled saflufenacil revealed that, due to its weak acid character, saflufenacil is distributed within the plant *via* xylem and phloem to the plant growing points. This property provides contact and additional systemic action of saflufenacil for more effective control of dicot weeds.

CLONING, CHARACTERIZATION, REGULATION, AND POTENTIAL FUNCTION OF DORMANCY-ASSOCIATED MADS-BOX GENES FROM LEAFY SPURGE. D. Horvath*, W. Chao; Plant Science, USDA-ARS, Fargo, ND

ABSTRACT

DORMANCY-ASSOCIATED MADS-BOX (*DAM*) genes are transcription factors that have been linked to endodormancy induction. The evergrowing mutation in peach, which renders it incapable of entering endodormancy, resulted from a deletion in a series of *DAM* genes (Bielenberg et al. 2008). Likewise, *DAM* genes were shown to be differentially regulated in several plant systems in response to stimuli known to impact endodormancy induction. *DAM* genes are very similar to *SHORT VEGETATIVE PHASE* (*SVP*), a negative regulator of flowering in *Arabidopsis thaliana*. We have cloned several cDNA and genomic clones of *DAM* genes from the model perennial rangeland weed leafy spurge (*Euphorbia esula*). Comparisons of the cDNAs reveal the possibility of a multi-gene family and differential splicing of *DAM* genes in leafy spurge. Analysis of the promoter of one *DAM* gene revealed several potential transcription factor binding sites including a CCGAC sequence that regulates cold responsive genes in plants. Cold is the primary environmental signal responsible for inducing endodormancy in leafy spurge. Cold does not play a significant role in poplar endodormancy induction and the promoters of poplar *DAM* genes lack the CCGAC sequences. However, several other potential transcription factor binding sites are conserved between leafy spurge and poplar, including the circadian-regulating *EVENING* element. We developed gene specific probes for three different *DAM* genes from leafy spurge and used them to show that two of the *DAM* genes were expressed only in meristem tissues and were induced by cold treatments. *DAM* genes were also preferentially expressed following specific treatments that induced endodormancy in leafy spurge. Böhlenius et al. 2006, showed that over-expression of *FLOWERING LOCUS T* (*FT*) in poplar inhibited growth cessation prior to endodormancy induction. Lee et al. 2007, demonstrated that SVP regulates flowering by inhibiting expression of *FT* in Arabidopsis. *DAM* expression in leafy spurge is inversely correlated with *FT* expression. Over-expression of *DAM* in Arabidopsis resulted in plants that flowered slightly later than wild type. We hypothesize that *DAM* genes are induced by cold temperatures in leafy spurge and act to induce dormancy by negatively-regulating *FT* (or similar genes) which then regulate growth cessation and endodormancy induction.

RED RICE TOLERANCE TO N DEFICIENCY DUE TO AN EARLY STRESS GENE SIGNALLING AND RESPONSE MECHANISM. M.A. Sales*,[1] V.K. Shivrain,[1] L. Beers,[2] K. Yun,[2] N.R. Burgos,[1] B.G. de los Reyes[2]; [1]Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]University of Maine, Orono, ME

ABSTRACT

To examine the molecular basis of N uptake variation between red rice and cultivated rice, a comparative analysis of gene expression was done by semi-quantitative RT-PCR, using shoot tissues subjected to different N conditions (Full N, 0 N, and 24-h or 48-h N readdition after N starvation). Analysis of relative gene expression revealed that transcript levels of genes involved in carbohydrate and N metabolism, protein fate processes, and signaling and response regulation as well as transcription were differentially accumulated, suggesting an earlier recovery from N starvation in red rice relative to 'Wells'. This rapid stress response may be manifested as a greater tolerance of red rice to N starvation relative to cultivated rice. Identifying gene networks coordinating these complex stress responses to N starvation will be the next step in elucidating the N stress response pathway.

RESPONSE TO LIGHT QUALITY AS A COMPETITIVE MECHANISM? BIOMASS PARTITIONING ASSOCIATED WITH SHADE AVOIDANCE CHARACTERISTICS IN *GLYCINE MAX* L. MERR. (SOYBEAN). E. Green-Tracewicz*, E.A. Lee, L. Lukens, M. Tollenaar, C.J. Swanton; Plant Agriculture, University of Guelph, Guelph, ON, Canada

ABSTRACT

It has recently been proposed that plants can detect surrounding plants by perceiving differences in light quality or red: far-red (R: FR ratio). Research has yet to link the reduced light quality of weedy environments to the shade avoidance response as a mechanism of competition in crops. Shade avoidance responses, such as stem elongation, altered flowering time, and increased apical dominance allow for successful reproduction in natural systems. In agricultural systems, these mechanisms are proposed to give crops a competitive advantage over weeds. Whether this competitive response affects reproductive fitness (yield), or above and below ground resource partitioning, remains unknown. We hypothesize that soybean plants will initiate shade avoidance as a competitive response due to changes in light quality when weeds are present. As a result, biomass allocation may be altered, at a potential cost to reproductive fitness. To address these hypotheses, field experiments were conducted in 2007 and 2008 at the Arkell Research Station, where soybean plants were grown using a fertigation system, in two light quality environments: (1) High R: FR and (2) Low R: FR representing weed-free and weedy conditions respectively. Soybean plants grown in weedy conditions were planted with turfgrass (a weed simulator). To prevent direct competition for light water and nutrients, soybean plants were not shaded, and root systems of soybean plants and turfgrass were self-contained. Within this design, the effects of light as an indirect competitive variable were isolated, and the impact of high and low R: FR ratios were examined on: (1) total height, internode elongation and stage of development, and (2) biomass partitioning measured through a sequential harvest. At early developmental stages, in the presence of weedy competitors, soybean plants had greater total height, hypocotyl and epicotyl elongation, leaf area and stem biomass compared to soybean plants grown in weed-free conditions. At later developmental stages, soybean plants grown in the presence of weeds were developmentally delayed by 0.5-2 trifoliate stages, while soybean plants grown in weed-free conditions had greater total height, leaf area, and stem biomass. Root biomass of soybean plants grown in weed-free conditions were consistently greater than those grown in weedy conditions throughout the duration of the life cycle. These results provide insight to the mechanisms of weed induced yield losses and shade avoidance as a competitive response in agricultural systems.

SPRAY SOLUTION PH AND GLYPHOSATE ACTIVITY. D. Penner*, J. Michael; Crop and Soil Sciences, Michigan State University, East Lansing, MI

ABSTRACT

In the 1890's Overton proposed that substances that dissolve in lipids, non-polar, pass more easily into cells than those that dissolve in water. Consistent with this concept, herbicides such as glyphosate, that are weak acids, should be more readily absorbed at lower spray pH solution values as this would favor non-disassociation of the acid groups on the molecule. This raises the question, should pH acidifiers be used with glyphosate application since leaf surfaces tend to be non-polar. A 2008 paper in the Proc. of the National Academy of Science disputes Overton's Rule. Thus, a greenhouse study was initiated to determine whether lowering the pH of the water containing isopropylamine salt of glyphosate would increase glyphosate activity on giant foxtail, common lambquarters, and velvetleaf. The spray solution pH was adjusted with HCI to pH values between 1.5 and 6. The results clearly indicated that for the weed species used in this study, pH had no effect on glyphosate activity. Subsequent studies were done with water conditioners in the spray solution.

MULTIPLE RESISTANCE IN ISOPROTURON RESISTANT BIOTYPES OF *PHALARIS MINOR* IN INDIA. S. Singh*, S.S. Punia, R.K. Malik; Agronomy Department, Haryana Agricultural University, Hisar, India

ABSTRACT

Phalaris minor biotypes in rice-wheat cropping system evolved resistance after 8-10 years of continuous application of isoproturon in wheat crop in India during 1991-92 resulting in significant yield loss. The new ACCase and ALS inhibitors (sulfosulfuron, fenoxaprop-P-ethyl and clodinafop-propargyl) recommended in 1998 to manage isoproturon resistant *P. minor* biotypes are showing the same symptoms of reduced efficacy at farmers' field causing concern about weed management strategies in wheat. Field and pot (screen house) studies were carried out during 2006-07 and 2007-08 using several herbicides to evaluate weed control efficacy with R and S biotypes of *P. minor*. Field studies carried out in the rice-wheat cropping system at farmers' fields revealed that isoproturon resistant biotypes of *P. minor* defied clodinafop and fenoxaprop at 60 (recommended) and 90 g ai/ha and 120 (recommended) and 150 g ai/ha rates, respectively. However, sulfosulfuron and pinoxaden effectively controlled the resistant biotypes. Under pot studies, several biotypes collected from farmer's fields where poor control were recorded in the preceding years, exhibited reduced efficacy with clodinafop, fenoxaprop and premix of mesosulfuron+iodosulfuron, but not to sulfosulfuron and pinoxaden. Delayed application from 4-leaf to 2-tillers stage to 4- to 6-tillers stage reduced the efficacy of all herbicides except of pinoxaden. Tank mix application of pinoxaden plus carfentrazone was more effective than pinoxaden alone. These studies indicate that isoproturon resistant biotypes have evolved multiple resistance to herbicides of several modes of action. Resistance in *P. minor* to isoproturon was characterized by enhanced metabolism, but some biotypes of *P. minor* from adjoining states were confirmed in other studies to possess target site resistance to ACCase herbicide, clodinafop. Resistance mechanisms to ACCase and ALS inhibitors need further confirmation.

CROSS-RESISTANCE TO CLOMAZONE AND PENOXSULAM IN LATE WATERGRASS (*ECHINOCHLOA PHYLLOPOGON*): ROLE OF CYTOCHROME P-450-MEDIATED HERBICIDE METABOLISM.

H. Yasuor*,[1] M.D. Osuna,[2] A. Ortiz,[3] N.E. Saldaín,[4] A.J. Fischer[1]; [1]Plant Science, University of California, Davis, CA, [2]Departamento de Hortofruticultura, Centro de Investigación "Finca La Orden", Guadajira, Badajoz, Spain, [3]Universidad Central de Venezuela, Maracay, Venezuela, [4]Instituto Nacional de Investigación Agropecuaria, Treinta y Tres, Uruguay

ABSTRACT

Echinochloa phyllopogon is a major weed of California rice that has evolved resistance to multiple herbicides. Cross-resistance to penoxsulam and clomazone was evaluated in a resistant (R) accession collected in a rice field of the northern Sacramento Valley. Ratios (R/S) of the GR_{50} values ranged from 5 to 9 for penoxsulam and were ~ 2 for clomazone. The ALS enzyme was similarly sensitive to penoxsulam in R and S plants but specific ALS activity was higher in the former. Addition of malathion (P450 inhibitor) enhanced penoxsulam phytotoxicity. Penoxsulam metabolism was the same in R plants pre-treated with malathion as in S plants treated with penoxsulam alone. Faster rates of ^{14}C-penoxsualm biotransformation to 5-OH penoxsulam and to BSTCA-methyl were observed in R *vs*. S plants. Similarly, R plants metabolized clomazone more than S plants by causing hydroxylation and di-hydroxylation at different positions on the clomazone molecule, which were detected using LC-MS analysis. These results suggest *E. phyllopogon* resistance to penoxsulam and clomazone is mostly due to P450-mediated enhanced metabolism. Although monoxygenation is the main biotransformation found in R plants, these plants have shown versatile herbicide detoxification capabilities in earlier work. In addition, higher specific ALS activity may contribute to reduce penoxsulam toxicity in these plants. Multi-herbicide resistance resulting from enhanced P450-mediated metabolism, wide P450 substrate specificity, and the high ALS activity observed in these biotypes will complicate future management of herbicide-resistant *E. phyllopogon* in rice fields.

ACCASE MUTATION PROFILE OF HERBICIDE-RESISTANT RYEGRASS IN ARKANSAS. N.R. Burgos*,[1] T. Stark,[2] V.K. Shivrain,[1] M.A. Sales,[1] E.A. Alcober,[1] R.C. Scott[3]; [1]Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]Biological Sciences, University of Arkansas, Fayetteville, AR, [3]Crop, Soil, and Environmental Sciences, University of Arkansas Cooperative Extension Service, Lonoke, AR

ABSTRACT

Diclofop-resistant Italian ryegrass (*Lolium perenne* var. *multiflorum*) is widespread in Arkansas. This is a major production constraint in wheat. Relatively new herbicides have been labeled for use in wheat production for ryegrass management. Ryegrass populations show different cross-resistance patterns to other herbicides of the same mode of action as diclofop. This experiment was initiated to determine the mutation patterns in the herbicide binding regions of acetyl coenzyme-A carboxylase (ACCase). Two universal primer pairs designed to amplify two regions of the carboxytransferase (CT) subunit of chloroplastic ACCase were used to amplify the corresponding regions of the gene in Italian ryegrass. Primer pair 1 (ACcp1, ACcp1R) produced a 515-bp fragment and primer pair 2 (ACcp4, ACcp2R) produced a 402-bp fragment. The first batch of test materials comprised 10 populations with four plants per population. The sequences were aligned with that of blackgrass (*Alopecurus myosuroides*) ACCase, which was used as the basis for numbering the nucleotide and amino acid positions, starting from the start codon of the open reading frame. Among the populations, region 1 showed six amino acid mutations namely: $M_{1719}L$ (in one resistant plant), $M_{1719}V$ (in one resistant plant), $R_{1728}C$ (in two resistant plants), $L_{1802}I$ (in two resistant plants), and $R_{1830}W$ (in three resistant plants). In region 2, four mutations were found. The first mutation, $V_{1980}D$, was found in only one resistant plant. The second mutation, $L_{2000}M$, was found in four plants, but not all were resistant. At position 2029, two mutations were observed: $I_{2029}N$, which was found in four populations and $I_{2029}V$, which was found in three populations. All these populations were resistant to diclofop. The last mutation observed in region 2 was $T_{2042}I$, which was observed in two resistant plants from two different populations. Comparison of whole-plant response and mutation patterns will allow indirect association of cross resistance patterns with target site mutations. Examining more populations and individuals will provide a robust database for predicting herbicide efficacy in certain populations.

MECHANISM OF TRIAZINE-RESISTANCE IN *AMARANTHUS PALMERI* AND *A. RUDIS*. W. K. Vencill*,[1] E. Prostko,[2] P. J. Tranel,[3] J. Kichler[4]; [1]Crop & Soil Sciences, University of Georgia, Athens, GA, [2]Crop & Soil Sciences, University of Georgia, Tifton, GA, [3]Department of Crop Science, University of Illinois, Urbana, IL, [4]University of Georgia, Oglethorpe, GA

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) seed were collected from twenty corn fields in Macon County, GA to be screened for atrazine resistance near an area where atrazine control problems had been reported in 2007. Collected seed were germinated and grown in a controlled greenhouse (16 h photoperiod, 28 C) and treated POST with 100, 1100, 5500, and 11000 g ai/ha dose of atrazine plus COC at the three to four leaf stage of growth. Injury was noted at 3 DAT with a PS1-Meter apparatus and at 7 DAT via visual rating. The PS1-Meter measures damage of the photosynthetic apparatus and has a scale of 0 to 100 where larger values indicate more damage. Data were analyzed via logistic regression analysis to produce an ED_{50} value. Of the twenty fields tested, four were highly resistant (no injury at 11000 g/ha), six were of intermediate resistance (ED_{50} of 200 to 1500 g/ha), and ten were determined to be susceptible (ED_{50} < 100 g/ha). Sequencing of a fragment of the psbA gene from one site of highly resistant *A. palmeri* indicated that an amino acid substitution normally associated with target site resistance had not occurred. Resistant plants were treated with ^{14}C-atrazine and plant extracts were separated by thin-layer chromatography to determine if enhanced metabolism was the cause of resistance. A polar metabolite was found in the resistant plants not seen in thesusceptible biotypes. The resistant *A. palmeri* were also susceptible to ametryn indicating that the mechanism of resistance may be an enhanced gluthatione conjugation of atrazine. Future studies will be conducted to determine the utility of using the handheld PS1 meter to determine atrazine resistance *in situ*.

INTERACTIONS BETWEEN MESOTRIONE AND ATRAZINE IN A VELVETLEAF (*ABUTILON THEOPHRASTI*) BIOTYPE WITH METABOLISM-BASED ATRAZINE RESISTANCE. A.J. Woodyard*, J.A. Hugie, D.E. Riechers; University of Illinois, Urbana, IL

ABSTRACT

The joint activity of mesotrione and atrazine can display synergistic effects on the control of both triazine-sensitive (TS) and site of action-based triazine-resistant (TR) broadleaf weeds in a tank mix. The first objective of this study was to evaluate a preemergence application of atrazine followed by a postemergence application of mesotrione for potential interactions in both site of action-based TR redroot pigweed and metabolism-based atrazine-resistant (AR) velvetleaf. Results from these sequential experiments demonstrated that synergism was detected in reducing biomass of the TR redroot pigweed but was not observed in the AR velvetleaf with metabolism-based resistance. The second objective was to evaluate the joint activity of mesotrione and atrazine in a tank mix on the AR velvetleaf biotype. Greenhouse studies and whole-plant chlorophyll fluorescence imaging were used to determine if synergism is achievable in the metabolism-based AR biotype. Greenhouse studies on the AR biotype indicated that synergism resulted from a tank mix with a constant mesotrione rate of 3.2 g ai/ha in mixture with atrazine ranging from 126 to 13,440 g ai/ha. Chlorophyll fluorescence imaging also revealed a synergistic interaction on the AR biotype when 3.2 g ai/ha of mesotrione was paired with 126 g ai/ha of atrazine beginning 36 h after treatment and persisting through 72 h.

MECHANISM OF RESISTANCE TO 2,4-D IN PRICKLY LETTUCE. D.S. Riar*, J. Yenish, I.C. Burke; Crop and Soil Sciences, Washington State University, Pullman, WA

ABSTRACT

Prickly lettuce (*Lactuca serriola*) is a problematic and well-adapted weed throughout the inland Pacific Northwest (PNW) production region. Recently, prickly lettuce has developed resistance to the synthetic auxin herbicide 2,4-D. To determine the mechanism of resistance, two studies were conducted to compare absorption and translocation of 2,4-D between 2,4-D-resistant and -susceptible biotypes. The first study compared across harvest intervals up to 96 hours and the second study compared across harvest intervals up to 21 days. Both studies utilized radiolabel techniques using ^{14}C-2,4-D. Absorption increased over time and the rate of absorption was similar for both biotypes at each successive harvest interval for both studies, indicating that absorption was not the mechanism of resistance. Out of the total ^{14}C-2,4-D applied, maximum absorption was observed at 96 hours after treatment (HAT; 33.8 % and 42.7% by resistant and susceptible biotype, respectively) in the short duration study and at 21 days after treatment (DAT; 60.4% and 60.8% by resistant and susceptible biotype, respectively) in the long duration study. In the short duration experiment, the total amount of radioactivity translocated from the treated leaf to different plant parts at 96 HAT was similar in both biotypes (25.5 and 29.9% for resistant and susceptible biotypes, respectively). However, less 2,4-D was translocated to the crown of the resistant biotype compared to the susceptible biotype at 24 and 96 HAT. In the long duration experiment, the total amount of radioactivity translocated out of the treated leaf to other plant parts was similar. Within the leaf, more radioactivity accumulated in the base of the treated leaf for plants of the resistant biotype at each harvest intervals. Plants of the resistant biotype continued to translocate radioactivity to the upper leaves at nearly the same rate at all harvest intervals whereas susceptible biotypes decreased translocation to upper leaves and crown after the 7 DAT harvest. The difference in cumulative translocation 7 DAT and later between biotypes is probably due to a disruption in source-sink relationships preceding plant death in the susceptible biotype. Regrowth of resistant prickly lettuce biotypes commonly occurs from apical or lateral meristems located in the crown. Reduced herbicide translocation to the crown in resistant biotypes could be, in part, a mechanism for 2,4-D resistance in prickly lettuce.

MECHANISMS OF GLYPHOSATE RESISTANCE IN *ECHINOCHLOA COLONA* FROM AUSTRALIA. F. Dolman*,[1] J. Malone,[1] P. Boutsalis,[1] A. Storrie,[2] C. Preston[1]; [1]School of Agriculture, Food & Wine, University of Adelaide, Glen Osmond, SA, Australia, [2]NSW Department of Primary Industries, Tamworth, NSW, Australia

ABSTRACT

Junglerice is one of two *Echinochloa* species that are common weeds of summer cropping systems in Australia. One of the most important herbicides for weed control in Australia is glyphosate. Glyphosate resistance has evolved in three populations of Australian junglerice. Dose response studies demonstrated the suspect populations were resistant to glyphosate when compared with the response of a local susceptible population of the same species. Five times more glyphosate was required to control the resistant populations compared with the susceptible population. These glyphosate-resistant populations occurred in fields with a long history of winter cropping and summer fallow control entirely with glyphosate. Several more populations are suspected to be glyphosate resistant but yet to be confirmed. Experiments to examine the mechanism of glyphosate resistance in junglerice showed only slight variations in glyphosate absorption between the resistant and susceptible plants. Glyphosate was taken up very slowly by all plants with less than 60% of the applied glyphosate absorbed over 48 h. Up to 50% of the absorbed glyphosate was translocated out of the treated leaf, accumulating in the roots and the rest of the shoot, in both resistant and susceptible plants. However, a small difference in the glyphosate translocation pattern was apparent, with less glyphosate leaving the treated leaf of resistant plants compared with susceptible plants. Glyphosate competitively inhibits EPSP synthase by occupying the binding site of phosphoenolpyruvate, effectively blocking the shikimic acid pathway. This causes shikimic acid to accumulate in the plant. Experiments to assess shikimate accumulation following glyphosate application in junglerice revealed that accumulation was greater in susceptible plants than in resistant plants. This indicates that absorbed glyphosate does not inhibit EPSP synthase as readily in the resistant plants. To investigate this further, a conserved region of the EPSP synthase gene in both resistant and susceptible plants was sequenced to detect possible amino acid substitutions in the protein, which may be responsible for resistance to glyphosate. To date, our studies have identified a substitution of proline $_{106}$ to a leucine in glyphosate-resistant junglerice but further work is required to confirm this finding.

INTRACELLULAR TRANSLOCATION OF GLYPHOSATE IN GLYPHOSATE-RESISTANT AND SUSCEPTIBLE PALMER AMARANTH (*AMARANTHUS PALMERI*). N. Mantripragada*,[1] W.K. Vencill,[1] T.L. Grey,[2] A.S Culpepper[2]; [1]Crop and Soil Science, University of Georgia, Athens, GA, [2]Crop and Soil Science, University of Georgia, Tifton, GA

ABSTRACT

Glyphosate resistant Palmer amaranth (*Amaranthus palmeri*) has infested over twenty counties in Georgia since 2005. Research was conducted to examine the possibility of reduced intracellular translocation of 14C - glyphosate into chloroplasts of glyphosate resistant (GR) Palmer amaranth leaves and apical meristem tissue compared to identical organs from glyphosate susceptible (GS) plants. Selected lower leaves on month old GR and GS plants raised in a growth chamber were treated by spot placement of 14C - glyphosate after both biotypes were sprayed with a 250 g/ha of formulated potassium salt of glyphosate to saturate the plant with the herbicide in order to prevent uneven spread of the labeled product thus enabling better 14C - glyphosate tracking. Trimmed and ground leaf and meristem sample extracts were subject to a Percoll gradient assisted centrifugation to isolate intact chloroplasts discarding other plant parts. Radiolabeled glyphosate in isolated chloroplasts was measured. The amount of chloroplast recovered from treatments was much better at 3 and 6 hours than at 24 hours after treatment (HAT). Less translocation was noticed in the GS leaves at 3 HAT than the leaves of GR plants but was similar at 6 and 24 HAT. Conversely, less labeled 14C - glyphosate was found in the GR meristem at 3 HAT and was still 25% less than GS meristem tissue at 6 HAT. These results are comparable to data obtained in similar experiments by other researchers with GR rigid ryegrass (*Lolium rigidum*). The mechanism of glyphosate resistance in this weed seems to exclude reduced whole plant uptake, translocation, metabolism of glyphosate and an altered EPSPS gene as possible causes. Instead a combination of factors including gene amplification and enhanced transcription aided by yet other unknown factors like plastid import could be a cause for resistance.

GLYPHOSATE-RESISTANCE IN HAIRY FLEABANE (*CONYZA BONARIENSIS*) IS TEMPERATURE AND AGE DEPENDENT. G. Ben-Ami, B. Rubin*; R H Smith Inst. Plant Sci. & Genetics in Agric., R H Smith Faculty of Agriculture, Food & Environment, Rehovot, Israel

ABSTRACT

In recent years both hairy fleabane and horseweed (*C. canadensis)* became problematic weeds in roadsides and agricultural fields, mainly when minimum tillage is practiced. A survey was conducted in which about 100 populations of hairy fleabane and horseweed from all over the country were collected and their response to glyphosate tested. Two populations of *C. bonariensis* were found resistant to glyphosate (GR) with a resistance index (RI) values of between 3.6 and 5.7. Studies have shown that plants become more resistant to glyphosate with increasing the temperature from 16°C to 34°C and with plant age from 15 to 100 days after planting (DAP). Shading of plants for 3 d before glyphosate application significantly increased their sensitivity to the herbicide. No differences between GR and glyphosate-sensitive (GS) were detected in shikimate accumulation in leaf discs exposed to glyphosate for 18 h in light. However, when GR and GS plants were treated post emergence with glyphosate (0.18 kg ae/ha), the GS plants accumulated within 24 h 1.6 to 3.7 folds more shikimate then the GR plants. These results indicate that the GR and GS biotypes differ in glyphosate translocation from site of uptake to the site of action in the chloroplasts. Using ^{14}C-glyphosate we found that GS and GR plants absorbed similar amounts of ^{14}C in source leaves, but GS plants translocated 1.5 folds more glyphosate to untreated leaves, apex and roots as compared to GR plants. These results support our hypothesis that glyphosate may be sequestered in the apoplast and vacuole of the GR plants as compared to the GS plants resulting with the observed resistance.

PHYSIOLOGICAL INVESTIGATION INTO GLYPHOSATE AND GLUFOSINATE ANTAGONISM. W.J. Everman*, C.F. Glaspie, D. Penner; Crop and Soil Science, Michigan State University, East Lansing, MI

ABSTRACT

The commercialization of stacked glyphosate- and glufosinate-resistant crops in presence of an increasing number of glyphosate-resistant weeds creates the potential for applications of glyphosate and glufosinate to be made in combination. Studies were conducted in 2008 to investigate antagonism when these two products are applied in combination. Seeds of common lambsquarters (*Chenopodium album*), giant foxtail (*Setaria faberi*), and velvetleaf (*Abutilon theophrasti*) were planted in 0.9 L pots. All species were treated at the 4-leaf stage. Glyphosate at 336 g ae/ha alone or glyphosate at 336 g/ha plus glufosinate at 33.6 g ae/ha was applied to common lambsquarters, and glyphosate at 224 g ae/ha or glyphosate at 224 g/ha plus glufosinate at 33.6 g/ha was applied to giant foxtail and velvetleaf. Treated leaves were covered, plants were sprayed, and five 1-µl drops containing ^{14}C-glyphosate were applied. Plants were harvested at 4, 12, 24, 48, and 72 HAT. Absorption was determined by rinsing the treated leaf portion. All plants were divided into four regions: 1) treated leaf, 2) above treated leaf, 3) below treated leaf, and 4) roots. The treated leaf was removed at the point of attachment to the stem. The study was arranged as a two level factorial with 3 species and 5 harvest timings in a randomized completed block with three replications of treatments and repeated in time. Data were subjected to analysis of variance and treatments separated by Fisher's Protected LSD test at P = 0.05. ^{14}C-glyphosate absorption was affected by species and herbicide application main effects. Common lambsquarters absorbed 30% of ^{14}C-glyphosate, when averaged across herbicides and harvest timings, compared to 21 and 20% for velvetleaf and giant foxtail, respectively. The treatment of glyphosate plus glufosinate resulted in 27% of ^{14}C-glyphosate absorption while plants treated with glyphosate alone absorbed only 20% of ^{14}C-glyphosate, averaged over species and harvest timings. A species by herbicide interaction was also observed, indicating the greatest differences in ^{14}C-glyphosate absorption were in giant foxtail, where 29 and 11% were absorbed when glyphosate plus glufosinate and glyphosate alone were applied, respectively. For all species absorption of ^{14}C-glyphosate was complete within 12 HAT. Herbicide combinations and harvest timings did not affect ^{14}C-glyphosate translocation in common lambsquarters or velvetleaf; however translocation of ^{14}C-glyphosate was affected by herbicide and harvest timing in giant foxtail. Translocation out of the treated leaf in giant foxtail following treatment with glyphosate alone was 58% 72 HAT compared to 26% following the glyphosate plus glufosinate treatment. The results of this study show antagonism of glyphosate by glufosinate when applied in combination to giant foxtail. Greater absorption occurs, resulting in more ^{14}C-glyphosate in the plant; however once inside the plant, translocation of ^{14}C-glyphosate is reduced.

EFFECTIVENESS OF GLYPHOSATE AND 2,4-D TANK-MIXES ON HORSEWEED (*CONYZA CANADENSIS*) PLANTS AT VARIOUS GROWTH STAGES. G.R. Kruger*, V.M. Davis, S.C. Weller, W.G. Johnson; Purdue University, West Lafayette, IN

ABSTRACT

Horseweed is a problematic weed in no-till soybean in Indiana. Glyphosate-resistant horseweed was first documented in Indiana in 2002, and is commonly found in no-till soybean fields throughout southeastern Indiana. The objective of this study was to determine the effectiveness of glyphosate and 2,4-D tank mixes on horseweed at various growth stages from a predominantly glyphosate-resistant field population. A randomized complete block experiment with a factorial arrangement of treatments was conducted at the Southeast Purdue Agricultural Center in Bulterville, IN in 2008. Factors included six different rates of glyphosate (0, 140, 280, 560, 1120, and 2240 g ae/ha) and six different rates 2,4-D amine (0, 70, 140, 280, 560, and 1120 g ae/ha). A natural emerging population of horseweed was used and up to four individual plants from each of four different size groups (0-7 cm tall, 7-15 cm tall, 15-30 cm tall, and greater than 30 cm tall) were flagged in each plot prior to herbicide applications. At 28 DAT, all surviving plants were rated, measured for height, and harvested to determine dry weight biomass accumulation. Data from treatments that included only glyphosate or only 2,4-D were subjected to non-linear log-logistic regression analysis in R using the drc package. Data from the tank mixtures of glyphosate + 2,4-D were compared using proc GLM in SAS and means were separated using LSD values at $\alpha = 0.05$. The 90% growth reduction (GR_{90}) values ranged from 2801 to 3352 g ae/ha glyphosate depending on size. The largest plants had the lowest GR_{90} values while the smallest plants had the highest GR_{90} values. In response to 2,4-D, the GR_{90} values ranged from 1120 to 3617 g ae/ha and also depended on horseweed size. The smallest plants had the lowest GR_{90} values while the largest plants had the largest GR_{90} values. The glyphosate + 2,4-D tank mixtures reduced dry weight biomass by greater than 90% in the four size groups in 8 (0-7), 7 (7-15), 4 (15-30), and 12 (30+) of the 25 treatments. Glyphosate had some activity on this glyphosate-resistant horseweed population, but tank mixes with 2,4-D were more effective at providing adequate control. Plants between 15 and 30 cm tall were the most difficult to control. Additionally, the larger plants were more susceptible to glyphosate than the smaller plants, but the opposite was true in response to 2,4-D. Neither glyphosate or 2,4-D alone reduced dry weight biomass by greater than 90% in this study. Therefore, we conclude tank mixes of glyphosate + 2,4-D should be considered to be more effective to control glyphosate-resistant horseweed populations versus either herbicide alone.

DIFFERENTIAL VISUAL AND PHYSIOLOGICAL RESPONSES OF SEVERAL WILD-TYPE AND HERBICIDE RESISTANT WEED POPULATIONS TREATED WITH DIFFERENT INHIBITORS OF PHOTOSYSTEM II AND CAROTENOID BIOSYNTHESIS. G.R. Armel*,[1] D.A. Kopsell,[1] J.J. Vargas,[1] B.R. Smith,[1] P.L. Rardon,[2] M. Ruggiero,[2] S.A. Gower[3]; [1]Plant Sciences, University of Tennessee, Knoxville, TN, [2]Herbicide Discovery, DuPont Crop Protection, Newark, DE, [3]Plant Diagnostic Service, Michigan State University, East Lansing, MI

ABSTRACT

Studies were conducted in 2008 at the University of Tennessee in Knoxville, TN to evaluate mixtures of herbicide inhibitors of specific target sites in carotenoid biosynthesis applied alone and in combinations with the triazine Photosystem II site A (group 5) inhibitor atrazine at 125 g ai/ha and the substituted urea Photosystem II site A (group 7) inhibitor diuron at 440 g ai/ha. Herbicide inhibitors for each site of action were chosen from commercial products and enzyme inhibitors disclosed in the literature. Herbicide rates were chosen based on previously published data in an attempt to target 50% inhibition of the target plants. The sites of action and application rates for these carotenoid biosynthesis inhibitors (CBI) are as follows: 1) zeta-carotene desaturase (ZDS)- DFPC at 62 g ai/ha, 2) phytoene desaturase (PDS)- norflurazon at 500 g ai/ha, 3) *p*-hydroxyphenylpyruvate dioxygenase (HPPD)- mesotrione 0.5 g ai/ha, 4) 1-deoxy-D-xylulose 5-phosphate reductoisomerase (DOXP reductoisomerase)- fosmidomycin at 125 g ai/ha, 5) 1-deoxy-D-xylulose 5 phosphate synthatase (DOXP synthase)- clomazone at 125 g ai/ha, 6) lycopene cyclase- CPTA at 625 g ai/ha. These herbicides were evaluated on wild type and herbicide resistant biotypes of redroot pigweed (*Amaranthus retroflexus*) and common purslane (*Portulaca oleracea*). One biotype of redroot pigweed evaluated was resistant to atrazine (TR-resistant), while another biotype was resistant to diuron (DR- resistant). A biotype of common purslane was also evaluated that was resistant to both atrazine and diuron (TR/DR-resistant). Five days after postemergence applications, plants were visually evaluated for injury and chlorophyll fluorescence was measured using an open chlorophyll fluorescence pulse modulation imager. Aboveground plant tissue was then harvested and analyzed for quantities of xanthophylls (violaxanthin, neoxanthin, antheraxanthin, lutein, and zeaxanthin), beta-carotene, chlorophyll *a*, and chlorophyll *b*. All CBI applied alone controlled all biotypes of redroot pigweed 3 to 67% and all biotypes of common purslane 0 to 48%. Diuron controlled the wild type and the TR-resistant redroot pigweed biotype 85 to 90%, while providing only 68% control of the DR-resistant biotype. Atrazine controlled the wild type and the DR-resistant redroot pigweed biotype 41 to 59%, while providing only 10 to 18% control of the TR-resistant biotype. The TR/DR resistant common purslane biotype was controlled 48% with diuron alone, while atrazine provided no activity on this weed. The wild type common purslane population was controlled between 22 and 57% with atrazine and diuron applied alone. In general, mixtures of Photosystem II inhibitors plus CBI provided better control, and often greater plant tissue necrosis then if either herbicide were applied alone. In general, measurements of chlorophyll fluorescence (Q_{max} or Fv/Fm= maximum quantum yield of PSII photochemistry) aligned closely with visual injury ratings. Xanthophylls, beta-carotene, chlorophyll *a*, and chlorophyll *b* levels in comparison to the untreated check varied depending on treatment and weed biotype. All CBIs applied alone negatively impacted antheraxanthin levels in the wild type populations of redroot pigweed and common purslane. However, antheraxanthin actually increased in all resistant weed biotypes when treated with CPTA, fosmidomycin, or clomazone. Violaxanthin, lutein, chlorophyll *a*, and chlorophyll *b* levels decreased in the wild type redroot pigweed population treated with any CBIs. Conversely, all resistant common purslane and redroot pigweed biotypes treated with fosmidomycin or clomazone produced increases in lutein, chlorophyll *a*, and chlorophyll *b*. Atrazine alone increased levels of all xanthophylls, chlorophyll, and beta-carotene in both the TR/DR resistant and wild type common purslane populations. Weeds that produced the most pronounced bleaching symptoms or necrosis were generally treated with herbicides alone, or in mixtures that increased the levels of zeaxanthin while reducing the levels of beta-carotene in comparison to the untreated check. Increases in zeaxanthin are indicative of increased environmental stress on plant photosynthetic mechanisms. In our study, increases in zeaxanthin were most likely the result from herbicide-induced bleaching or necrosis.

COMPARATIVE ACTIVITY OF CAROTENOID BIOSYSNTHESIS INHIBITORS COMBINED WITH ATRAZINE IN TARGET SITE-BASED TRIAZINE-RESISTANT REDROOT PIGWEED (*AMARANTHUS RETROFLEXUS*). J.A. Hugie*, D. Riechers; Crop Sciences, University of Illinois, Urbana, IL

ABSTRACT

Synergism has been previously documented between mesotrione (a HPPD inhibitor) and atrazine (a PSII inhibitor) on a whole-plant biomass basis and at the photosynthetic level in both triazine-sensitive (TS) and triazine-resistant (TR) biotypes of redroot pigweed. The unique synergistic properties of mesotrione and atrazine are useful for not only weed control, but also resistance management within crop production. Research has also indicated the potential for synergism between other carotenoid biosynthesis inhibitors, norflurazon (a PDS inhibitor) and clomazone (a DOXP synthase inhibitor) and PSII inhibitors. Using two chlorophyll fluorescence techniques, the activities of norflurazon and clomazone were compared with the activity of mesotrione as potential synergists in mixture with atrazine in target site-based TR redroot pigweed. Results from these studies revealed that synergism at the whole-plant biomass level was not achieved through combining norflurazon or clomazone with atrazine, and that mesotrione mixed with atrazine resulted in unique effects on certain chlorophyll fluorescence parameters. For example, area above a fluorescence curve was reduced in treatments of mesotrione combined with atrazine, but was not reduced by norflurazon or clomazone applied alone or in mixture with atrazine, implicating the electron acceptor plastoquinone as having a primary role in the unique synergism between mesotrione and atrazine. The comparative effects on the chlorophyll fluorescence parameters such as Area demonstrate the importance of plastoquinone as a biochemical and physiological component of the underlying mechanism for mesotrione-atrazine synergism that potentially allows for enhanced atrazine binding to the D1 protein, even in a TR plant.

GENETIC POLYMORPHISM IN THE EPSPS GENE OF GLYPHOSATE RESISTANT PALMER AMARANTH (*AMARANTHUS PALMERI*). E.L. Alcober*,[1] N. Burgos,[1] M. Sales,[1] V. Shivrain,[1] T. Tseng,[1] K. Smith[2]; [1]Crop, Soil and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]University of Arkansas, Monticello, AR

ABSTRACT

Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) has been documented in Georgia, South Carolina, North Carolina, Tennessee, Mississippi and Arkansas. Cases of confirmed resistance had spread rapidly since the first occurrence was reported. Glyphosate-resistant Palmer amaranth is now confirmed in 15 counties in Arkansas. Palmer amaranth is an obligate outcrossing species and produces copious amounts of tiny seeds. This mating behavior, high level of fecundity, and its aggressiveness promote its rapid spread and dominance in the southern U.S. The population genetics and evolutionary structure of Palmer amaranth is expected to be complex. Understanding this complexity and the diversification and spread of this species is critical in dealing with the issue of resistance to herbicides, which has become a threat to crop production. Glyphosate is one of the herbicides exerting high selection pressure on weed populations, including Palmer amaranth. The target enzyme, 5-enolpyruvylshikimate-3- phosphate synthase (EPSPS), could be one source of information on the impact of this type of selection pressure on weed populations. Resistance to glyphosate is most worrisome because of the extent that farmers depend on this technology. This project is being conducted to determine the changes that occurred in the EPSPS gene, which is under selection pressure, at the population level. Multiple populations representing different localities and cropping systems are included in this experiment. Degenerate primers were designed to amplify fragments of the Palmer amaranth EPSPS gene. This information was then used to design specific primers for Palmer. Preliminary information from one resistant and one susceptible population indicated that there are multiple alleles/isoforms of EPSPS; at least three were detected in the plants examined thus far. GR9 EPSPS clones 1 and 2 were 96% identical at the nucleotide level, with mutations in 24 nucleotides and 3 insertion/deletion sites. GR9 EPSPS clones 1 and 3 were 99% alike. These clones differed in 7 nucleotides and showed 3 insertion/deletion sites with respect to each other. GR9 EPSPS clones 2 and 3 were different in 25 nucleotide positions and had 7 insertion/deletion sites and thus were only 96% identical. Several of these mutations were silent such that the translated sequence for GR9 clones 1 and 2 were 99% identical. Only 94% percent of the translated sequence of GR9 clones 1 and 3 and GR9 clones 2 and 3 were identical. The Palmer amaranth EPSPS has 90% homology in amino acid sequence relative to *Amaranthus rudis*.

EXPLORING THE MECHANISMS OF AN ALLELOCHEMICAL-MEDIATED IRON UPTAKE IN PLANTS USING SYNCHROTRON X-RAY SPECTROSCOPY. N. Tharayil*,[1] D. Triebwasser,[1] K. Scheckel[2]; [1]Clemson University, Clemson, SC, [2]US EPA, Cincinnati, OH

ABSTRACT

Traits that serve more than one function may enhance the competitiveness of species. The replacement of an energy-demanding process by a more adaptive and energy-efficient mechanism would further enhance the overall species fitness. In a previous study, we showed that the invasive, allelopathic plant, *Centaurea diffusa*, utilizes a phytotoxin, 8-hydroxyquinoline (8HQ), for the acquisition of iron, a nutrient likely to be deficient in most of its alkaline invaded habitats. This novel Fe uptake mechanism is thought to be energy-efficient as the 8HQ-Fe complex (FeQ), due to its lipophilicity, is passively diffusing across the plasma membrane. We utilized synchrotron X-ray fluorescence (XFS) and X-ray absorption spectroscopy (XAS) to further examine the mechanism of this allelochemical mediated Fe uptake in wild and mutant (*YS1*) corn lines. Since *YS1* lines lack the carrier proteins to transport Fe-phytosiderophore complex across the plasma membrane, we predicted that, presence of undissociated FeQ inside the plant tissues will prove conclusively the passive uptake of FeQ. X-ray absorption measurement utilizes intense and energy-tunable source of x-rays. When an atom is exposed to an x-ray having a higher energy level than the binding energy of its core level, a photo-electron is created which is ejected from the atom. This excited state will rapidly decay within a few femtosecond and the electron reoccupies the core hole ejecting an x-ray of well defined energy. The fluorescence energies emitted is unique for every atom and can be used to identify and quantify atoms in a system. XAS can be utilized to characterize all elements and crystallinity of samples is not a prerequisite. X-ray absorption near-edge spectroscopy (XANES) can be utilized to understand the oxidation state and coordination chemistry of an element and was used to characterize the metal-ligand complexes. XAS spectrum revealed the distribution of Fe to be more on the mature root regions than on root tips. The experimenation techniques and the FeQ patterning inside the tissues will be discussed.

GENETIC AND EVOLUTIONARY CONSIDERATIONS OF BELOW-LABEL HERBICIDE RATES. M.J. Christoffers*; North Dakota State Univ., Fargo, ND

ABSTRACT

Herbicide resistance is the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal to the wild type plant. Herbicide resistance is heritable because of its genetic basis, and the frequency of resistance to herbicides in a weed population is thus subject to the evolutionary forces of migration (gene flow), mutation, selection, and genetic drift. The initial presence of herbicide resistance in a weed population may be due to mutation within the population or gene flow into the population. Herbicide use may then impart selection pressure by differentially decreasing fitness and fecundity so that resistant weeds produce more offspring than susceptible weeds. Definitions of selection pressure differ, but broadly defined, it is the intensity of selection as measured by the extent of gene frequency change per generation. A primary goal of herbicide-resistant weed management is to minimize selection pressure for resistance by controlling herbicide usage. However, a complicating factor in managing resistant weeds is that selection pressure, as defined above, cannot necessarily be measured by herbicide rate or efficacy. Compared to full herbicide rates, the use of below-label rates may indeed impart lower selection pressure due to greater maintenance of susceptibility in the gene pool. This is not likely to be true for all cases, however, because it's also possible for selection pressure to decrease with increases in herbicide rate and/or efficacy. This situation is most likely to occur when full rates maintain some control of resistant weeds, and do so to a greater extent than below-label rates. Compared to full rates, below-label rates in this circumstance would provide greater opportunity for resistant survivors to further mutate or hybridize among themselves, potentially producing offspring that survive herbicide treatment at the full rate. Where below-label rates decrease selection pressure by maintaining more susceptible weeds compared to full rates, the disadvantages of higher weed densities, including greater potential for a mutation event within the population, should also be considered.

USE OF BELOW LABEL HERBICIDE RATES CAN LEAD TO EVOLUTION OF HERBICIDE RESISTANT WEEDS. R. Busi*, S. Manalil Velayudhan, S.B. Powles; University of Western Australia, Perth, Australia

ABSTRACT

The selection pressure imposed by continuous use of herbicides on large weed populations determines evolution of resistant biotypes. Single major gene traits endow resistance in the great majority of documented cases of field-evolved herbicide resistant plants. However, the recurrent enrichment of several additive minor genes in weed populations under selection at sub-lethal herbicide rates can lead to herbicide resistance. Very few studies have analyzed the dynamics of this evolutionary path associated with below-label herbicide rates. Recent studies in an initially herbicide susceptible rigid ryegrass (*Lolium rigidum*) population subjected to recurrent selection at sub-lethal herbicide doses documented the evolution of resistance to diclofop-methyl or glyphosate. The level of resistance to diclofop-methyl resistance evident after three cycles of recurrent selection was much higher than what found with similar selection with glyphosate. It is clear that the magnitude and the rate of these evolutionary phenomena are dependent on the specifics of the herbicide molecule, the biology of the plant species (reproductive system) and any potential resistance mechanisms present in the originator population under selection. Herbicides should be used at the legal recommended rate to achieve high weed mortality and therefore minimize the possibility of accumulation of minor gene traits (creeping resistance) that may endow a level of resistance over a few generations. The rapid evolution of herbicide resistance due to the recurrent use of low (sub-lethal) herbicide doses warrants future research on other herbicide modes of action. Substantial actions by various sectors of the agricultural industry need to be taken to ensure that herbicides are used at the legal recommended rates.

REDUCED HERBICIDE RATES. AN INDUSTRY PERSPECTIVE. P. Doyle*,[1] M. Stypa[2]; [1]Syngenta Crop Protection Canada Inc., Guelph, ON, Canada, [2]Syngenta Crop Protection Inc., Greensboro, NC

ABSTRACT

Identification of the appropriate use rate is a critical first step in the herbicide development process because use rates affect product utility, market value, and the various risk assessments within the regulatory review process prior to registration. For a given herbicide to be commercially successful, it must provide consistent and sustained efficacy based on a use rate structure that meets customer requirements over a wide range of conditions. Recently, recommendations have been made that advocate the use of herbicide use rates below those outlined on registered product label text. Such advice tends to be based on field work and predictive models designed to identify specific conditions where reduced herbicide use rates are theoretically optimized as dictated by threshold values with assumed levels of commercially acceptable weed control. Unfortunately, many other studies indicate that the use of reduced herbicide rates is not without variability of herbicide efficacy and economic risk. Consequently, reduced use rate theories and related predictive models are often of limited practical value to growers. Aside from inconsistent performance, weed control strategies based on reduced herbicide use rates are not a solution to prevent or even delay target site resistance. In fact, prolonged use of sublethal use rates may select for metabolic resistance and add future weed management challenges by replenishing the weed seed bank. Much effort in terms of development time and resources are invested before product commercialization to ensure that product labels are easily understood and provide value to growers. In this regard, every effort is made to identify the lowest effective use rate that will consistently control target weeds and lead to economic optimization for both the grower and manufacturer.

CROP PRODUCTION IMPACTS OF BELOW-LABEL HERBICIDE RATES. J.T. O'Donovan*,[1] K.N. Harker,[1] R.E. Blackshaw,[2] R.N. Stougaard[3]; [1]Agriculture and Agri-Food Canada, Lacombe, AB, Canada, [2]Agriculture and Agri-Food Canada, Lethbridge, AB, Canada, [3]Montana State University, Kalispell, MT

ABSTRACT

Perceived advantages of below-label herbicide rates for weed control include reduced costs and enhanced profitability. Field experiments were conducted in Alberta and Montana over several locations and years (environments) to determine the influence of label and below-label herbicide rates for wild oat (*Avena fatua* L.) control in wheat (*Triticum aestivum* L.). Wild oat seed production, wheat yield and economic return as a function of rate varied considerably among environments. For example, reducing the herbicide rates to 50% of recommended resulted in a 3- to 5-fold increase in wild oat seed production. In most cases, economic returns were higher at 50 or 75% of the label rate but the economic benefit of reducing the rates was often marginal; and an economic loss occurred in six of the twenty environments assessed. Further studies indicated that seeding wheat at relatively high rates mitigated the risk associated with applying the herbicides at reduced rates, especially in terms of build-up of wild oat seed in the soil seed-bank; but reducing the rates below 75% of the label rate was often unacceptable even at the high wheat seeding rates. In studies with barley (*Hordeum vulgare* L.), combining below-label herbicide rates with optimal agronomic practices such as high seeding rates, tall varieties and diverse crop rotation often provided wild oat control and barley yields that were comparable to or better than those obtained when full-label rates (but sub-optimal agronomic practices) were employed. The studies suggest that while applying herbicides for wild oat control at below-label herbicide rates in cereal crops can be risky, the risk can be reduced considerably by adopting agronomic practices that enhance crop competitiveness.

REDUCED HERBICIDE APPLICATION RATES THE LESSER OF TWO EVILS? A WESTERN CANADIAN'S PERSPECTIVE. B.G. Murray*; University of Manitoba, Carman, MB, Canada

ABSTRACT

Repeated herbicide applications at reduced rates will result in the evolution of herbicide resistance. To date this has not been the experience in western Canada. Cut rate applications favor the evolution of polygenic traits. Thus far, there have been no confirmed instances of polygenic resistances in western Canada. In all but one instance, herbicide resistance in western Canada has been due to an altered target site. Additionally, the inheritance of the various herbicide resistances in western Canada have been determined to be due to single gene alterations. The one exception to the above trend was the occurrence of a metabolism based Group 2 resistant wild mustard population. Unfortunately the inheritance of this metabolism based resistance was not determined. There are a number of reasons for the predominance of these monogenic, alter target site resistances. First of all, producers are applying high levels of selection with repeated herbicide use. If producers employ cut rates of herbicides they are using dosages that still deliver high levels of selection pressure (>90%). These lower, but still efficacious dosages favor the selection of highly expressed, single gene mechanisms. Secondly, the majority of the important weed species in western Canada are self pollinated. Polygenic traits will evolve more rapidly within out-crossing weed populations. Over time the evolution of polygenic resistance in the western Canada is likely. Will intentional rate cutting be the main cause of this? I do not think so. Reduced rate applications are often unintentional. Applying a product too late, too close to a rainfall event, or under poor growing conditions could result in a reduction in the effective rate of application. Over time the breakdown of residual products will also bring about a reduction in the effective rate of application. These sources of dose reduction occur more often than intentional rate reductions and they do result in lower selection pressures. So what should the message be to the farmer? Don't cut dosages? Use full rates? Or should we continue to concentrate on the proper application of herbicides and emphasize the importance of IPM and its role in keeping weed populations down?

IMPACT AND LEGACY OF R. CHARUDATTAN IN BIOLOGICAL CONTROL OF WEEDS. E.N. Rosskopf*,[1] Y. Shabana,[2] J. DeValerio,[3] M. Elliott,[2] C. Yandoc Ables[4]; [1]USDA, ARS, Fort Pierce, FL, [2]University of Florida, Gainesville, FL, [3]University of Florida, Starke, FL, [4]National Academy of Sciences, Washington D.C., DC

ABSTRACT

Raghavan "Charu" Charudattan is highly regarded internationally as a scientist, professor, mentor, and friend. Charu has authored four books, more than 100 refereed manuscripts, 24 book chapters, and hundreds of other publications. He holds 11 patents in the area of biological control of weeds and served as a founder of the highly regarded journal, *Biological Control: Theory and Application in Pest Management*. Charu's career has focused on the use of plant pathogens to control weeds. This discipline requires creativity and integration of a vast array of skills in plant pathology, weed ecology, product formulation, and application technology. He has been recognized by his peers in several disciplines; being honored as a Fellow of both the American Phytopathological Society and the Weed Science Society of America. Early in his career, Charu applied classical biological control principles to weeds in aquatic, agronomic systems and natural areas. Because many weeds are exotic species, Charu assumed a global perspective to identify potential biological control agents. His diligent efforts to establish relationships with fellow scientists worldwide facilitated his ability to identify biocontrol agents for weeds in the southeast, and to advance the science of biological control of weeds internationally. He has collaborated with scientists and students from more than 15 countries and was instrumental in the development of protocols to regulate importation and release of foreign pathogens as biological control agents in the United States. Some examples of Charu's work include using *Phomopsis amaranthicola* on pigweeds, *Fusarium culmorum* on hydrilla, *Cercospora rodmanii* on water hyacinth, *Alternaria cassiae* on sicklepod, and *Dactylaria higginsii* on nutsedge. During the 1980s Charu discovered that microbial toxins could be used to enhance the efficacy of biological control agents or as natural herbicides and expanded his program to assess these novel herbicidal compounds from microbes. As a result of this highly successful research, the contribution of mycotoxins to weed suppression is routinely assessed, especially with respect to fungi. In 1989, Charu assisted scientists at Australia's CSIRO in identifying the host specific rust fungus, *Puccinia evadens*, as a biological control agent for *Baccharis halimifolia*, which was introduced from Florida and had become invasive in grazing lands in eastern Australia. Charu has consistently been on the cutting edge of plant pathology research and has applied newly emerging tools to weed biological control pathosystems taking risks and exploring approaches that were considered unconventional. In the mid-1990s he took a very novel approach in his attempts to genetically engineer *Xanthomonas* isolates with genes for bialaphos production, resulting in isolates with enhanced virulence. Charu and his students were the first researchers to routinely apply the use of nucleotide sequence information for the speciation of isolates used for biological control. His group also investigated the use of a multiple pathogen mixture to combat mixed grass weeds in several agroecosystems. Charu discovered that a novel, viral agent was lethal to tropical soda apple, resulting in the registration of a commercial biological control agent, Solvinix, and the founding of a private company, BioProdex, Inc., which shares the patent rights with the University of Florida. In addition to the novel scientific approaches that he applied to bioherbicide development, he has taken the practical aspects of crop production into account in his work as well. He and his students have performed some of the earliest investigations on the effects of pesticides that could be tank mixed with bioherbicides, as well as investigations of the role of adjuvants and surfactants in enhancing bioherbicide efficacy. While it is possible to continue to cite examples of Charu's contributions to the discipline of Biological Control of Weeds, it must be noted that those laurels share the stage with the contributions he has made to the lives of his colleagues, students, employees, and friends. Those close to Charu know a person who is naturally honest and fair who approaches all obstacles with integrity and tenacity. He possesses a natural curiosity for science; a trait that he has bestowed on everyone he has mentored. As his career at the University of Florida winds down we must celebrate the impact he has had on the weed science community, both professionally and personally, and know it will be felt for many years to come.

FORMULATING BACTERIA AND FUNGI FOR IMPROVED EFFICACY AND SHELF LIFE. R.K. Hynes*; Agriculture & Agri-Food Canada, Saskatoon, SK, Canada

ABSTRACT

Research into the development of microbial biopesticide formulations has been underway at AAFC for the past five years. Two major initiatives are to develop granular and foliar applied emulsion formulations of bioherbicidal bacteria and fungi that sustain large microbial populations over the shelf-life of the product. The main issues related to granular formulations are water activity, disintegration of the granule and dispersion of the bioherbicide active ingredient within a prescribed time to provide effective weed control. With foliar-applied spray formulations, the main challenges under semi-arid conditions are to reduce the bioherbicide's dependence on dew, protect it from desiccation and promote its infection of the weed. A modified pesta granule formulation was developed to deliver the bacteria, *Pseudomonas fluorescens*. The effect of fluidized bed drying duration on the survival of these strains was examined in pesta. Reducing the water activity (A_w) of pesta from 0.9 to 0.3 stabilized the population of *P. fluorescens*. The population of *P. fluorescens* in pesta dried to an A_w of 0.9 decreased from about 9 $\log_{10}$ cfu/g to 7.3 $\log_{10}$ cfu/g over six months, whereas, at A_w of 0.3 the population remained at 8.5 $\log_{10}$ cfu/g over six months. Some of the difficulties that up until now have hindered development of non-spore forming bacteria as biopesticidal products in granular formulations maybe overcome by drying pesta granules to an A_w of 0.3. Granule size is another important parameter with regard to bioherbicide efficacy. A granular formulation of *Phoma macrostoma*, for control of dandelion and chickweed, was extruded, spheronized and dried to produce granules of 0.4 - 0.8 mm; an appropriate size for optimum efficacy on weeds. Field testing of this new granular formulation of the bioherbicide in Canada and the United States demonstrated efficacious control of dandelion. Dispersion of granular formulations was investigated by determining the effect of incorporating various amounts of sodium, potassium and magnesium salts, sugars, starches, emulsifiers, and Metasperse, a commercial dispersant. Efficacy of the modified granular formulations of *Phoma macrostoma* and pesta disintegration and dispersal of *P. fluorescens* were examined in laboratory sand columns. Conclusions from these studies indicate that starch source, such as, corn, pea, rice or potato and concentration, significantly modifies the disintegration rate of the pesta granules and concommitant dispersion of bacteria from the granules. Water/oil/water (w/o/w) emulsions and complex coacervates were investigated as potential formulation technologies for foliar-applied bioherbicides. A list of w/o/w formulation ingredients compatible with the bioherbicidal agents, *Pyricularia setariae* and *Colletotrichum truncatum* 00-3B1, was developed. Invert emulsions of water and canola oil were prepared with surfactants ATSURF595/Tween80, Span80/Tween60, or Span80/Tween85. Freshly prepared w/o/w emulsions of *C. truncatum* were applied to scentless chamomile in a cabinet sprayer with 275 kPa constant air pressure and in the field with a back-pack sprayer, creating disease symptoms on weeds. However, additional research is required to determine ways of extending the shelf-life of these w/o/w formulated bioherbicides. Delivery of bioherbicides by microencapsulating vegetable oil-suspended bioherbicides in a coacervate (protein and carbohydrate) shell was advanced. The majority of biopesticides have hydrophilic outer cell walls; therefore, a modification, such as the addition of emulsifiers to the oil phase of the complex coacervate is required to retain the bioherbicide in the oil. The complex coacervate formulation has been used to formulate *C. truncatum*. Optimized parameters allowed up to 95% encapsulation of hydrophilic *C. truncatum* conidia in a complex coacervate. This coacervate formulation was efficacious both under greenhouse and field conditions. A dew period >16h was required for maximum infection by the bioherbicide. Under field conditions the formulated bioherbicide worked synergistically with reduced application rates of a chemical herbicide. A study in which fresh aqueous suspensions of *C. truncatum* were applied to scentless chamomile with one quarter rate Sencor showed similar control to that of the coacervate formulation, however without the benefit of a potentially extended shelf life.

INTEGRATED WEED MANAGEMENT AND BIOLOGICAL CONTROL PRODUCTS DEVELOPMENT.

R.A. Pitelli*; University of State of Sao Paulo, Jaboticabal, Brazil

ABSTRACT

The integrated weed management consists of the planned use of the available weed control measures aiming to reduce the populations above of the crops economic thresholds or above of the colonizing level which causes problems to the environmental equilibrium and urbanization processes. Among the weed control measures, the control using bioherbicides presents some important features, like high specificity to one or few species, high difficult and cost for inoculum production and relatively low stability in the control results. These are the most important features that must be considered in the development of a microbial as a profitable bioherbicide. Other features as storage and delivering must be considered later. The high host specificity is a problem for agriculture use under tropical and sub-tropical climates where the weed communities are highly diversified. The restrict control of few species does not solve the problem because the uncontrolled populations utilize the unexploited resources and the effects on global weed community interference probably will be low. However, there are some situations or conditions in which the control of one species can be very important in the reduction of weed interference in the agriculture and other men activities. These situations or conditions will be discussed with emphasis to: (i) weed populations selected by weed shifting due intensive use of one or few weed control practices, (ii) weeds biotypes resistant to herbicides, (iii) weeds which promote specific interference on crops or human activities, as parasitic weeds and toxic plants, (iv) weeds occurring in places where the conventional control measures are not permitted or even recommended. Obligate parasites are other promising opportunity for development of bioherbicides using the current and future knowledge on molecular biology and tissue culture. The biotechnology will be important in the reduction of inoculum production for other microorganisms. For these conditions, there is a great encouraging for bioherbicide development. The problems with the stability of the results in the weed control can be well solved with a strong effort formulation development. A great problem in the bioherbicide use in the integrated weed management is the easily for resistance development due the co-evolution process in biotic interactions. So, a careful plan of the use of the bioherbicide must be developed to avoid the growth of thre importance of the tolerant biotypes in the target population. So, the commercial perspectives for bioherbicides display an scenario of small companies having a large range of biocontrol agents, without a large scale production of an specific agent, but very versatile to attend the diversified market demand.

RISK ASSESSMENT AND COMMERCIALIZATION OF BROAD HOST RANGE PATHOGENS FOR WEED CONTROL. G.W. Bourdot*,[1] D.J. Saville[2]; [1]AgResearch Limited, Private Bag 4749, Christchurch 8140, New Zealand, [2]Saville Statistical Consulting Limited, 147 Bells Rd, West Melton, No. 1 R.D., Christchurch 7671, New Zealand

ABSTRACT

Broad host range pathogens are more appealing than host-specific pathogens as candidates for commercial development as bio-herbicides because of the wider market potential of a product that is effective against a range of weeds. But when economic crop species are also hosts, as is typically the case, scientists have an ethical responsibility to assess the crop disease risk that such products could pose, and to define use patterns under which such pathogens can be safely deployed in weed control. In the most usual case, when the pathogen of interest is already widespread in the geographical region where it is intended for use as a bio-herbicide, the questions of greatest importance are "how wide should a safety zone be?" and/or "how long should a withholding period be?" Using inoculum dispersal and decay models, these distances and times respectively, can be defined in terms of the ratio of the density of inoculum added by the bio-herbicide (to the susceptible crop's environment) to the density of naturally-occurring inoculum. In two cases where such models have been developed, *Chondrostereum purpureum* and *Sclerotinia sclerotiorum*, the 1:1 ratio of added:natural inoculum, corresponding to a doubling of inoculum density in the vicinity of susceptible crops, has been considered to be "acceptably safe". This is based on the assumption that an increase in a pathogen's inoculum density of at least one order of magnitude is generally necessary for a perceptible increase in plant disease level. Here we test this assumption by re-analysing the relationships between plant disease level and inoculum density evident in ten published experiments (found by a literature search) in which varying densities of spores of pathogenic fungi had been applied to seven different susceptible plant species: (1) *Colletotrichum truncatum* to *Matricaria perforata*; (2 & 3) *Septoria petroselini* to parsley; (4, 5 & 6) *C. gloeosporoides* to *Malva pusilla* and *Abutilon theophrasti*; (7 & 8) *Septoria lycopersici* to tomato; (9) *Alternaria alternata* to lettuce; (10) *Alternaria alternata* to *Sphenoclea zeylanica*. The plant disease levels were estimated visually from the published graphs and expressed as a percentage of the maximum in each experiment. In nine of the ten cases (for *S. zeylanica*, disease level did not change with spore density) the disease level followed a logistic relationship with $\log_{10}$ spore density, with a low level of disease (<12% of maximum) at spore densities below 10^3 spores/ml, rising to a maximum between 10^4 and 10^8 spores/ml. Disease levels modelled by the logistic equation necessarily increase most rapidly at the inflexion point of the curve, so that a doubling of spore density in this region results in the greatest absolute increase in disease. On the $\log_{10}$ scale, these inflexion-point spore densities, *i*, were 6.079, 3.853, 4.596, 6.198, 5.442, 5.578, 4.924, 4.965, 5.244 spores/ml for the nine cases respectively, and the maximum absolute increases in disease from doubling the spore densities [from (i-$\log_{10}(2)/2$) to (i+$\log_{10}(2)/2$) on the log scale] were 10, 12, 14, 29, 29, 17, 17, 20 and 36% respectively. The mean maximum disease increase was 21% ± 9% (standard deviation) and this occurred at a mean $\log_{10}$ spore density of 4.9 spores/ml ± 0.7 (standard deviation). These results indicate that doubling the natural spore density of a plant pathogen may, in the range of 10^4 to 10^6 spores/ml, result in unacceptable increases in disease in a susceptible crop. But doubling the density outside this range ($<10^4$ or $>10^6$) is likely to result in small and possibly imperceptible increases in disease. Given that the density of a pathogen's spores occurring naturally in a crop is likely to be in the low range associated with low crop disease levels, we can conclude that an "acceptable" safety zone for the pathogen's use as a bio-herbicide may be defined by the 1:1 ratio of added:natural inoculum. A "risk averse" stance, it has been suggested, would be to set a safety zone width for a bio-herbicide based on a 1:10 added:natural spore ratio rather than the 1:1 ratio. Here the spore density in the vicinity of susceptible crops would be no more than 10% higher than the natural background level. Using the same nine logistic models, the maximum absolute increases in disease from increasing the spore density by 10% [from (i-$\log_{10}(1.1)/2$) to (i+$\log_{10}(1.1)/2$) on the log scale] were 1.3, 1.7, 2.0, 4.1, 4.1, 2.4, 2.4, 2.9 and 5.2% respectively. The mean maximum disease increase was 2.9% ± 1.3% (standard deviation) and this occurred at a mean $\log_{10}$ spore density of 5.1 spores/ml ± 0.7 (standard deviation), i.e. $10^{5.1}$ spores/ml. Applying the same logic and assumptions as above, these results provide convincing evidence that an "added:natural" spore density ratio of 1:10 would define a "risk averse" safety zone for the deployment of a broad host-range pathogen as a bio-herbicide. The analyses here provide an objective basis for scientists, product developers and regulators to balance the risks and benefits of commercialising broad host range plant pathogens as bio-herbicides.

MODELS FOR COMMERCIALIZATION - FROM HIGH VALUE SITES TO LIMITED RESOURCE FARMERS. A. Watson*; McGill Univ., Ste-Anne-de-Bellevue, QC, Canada

ABSTRACT

Discovery and development of potential bioherbicides has been the role of university and government scientists while the deployment tasks were expected to lie with the crop protection industry. This has not happened. Major crop protection companies have had minimal interest in investing in host-specific bioherbicides, as niche-market products cannot generate sufficient profits. Bioherbicides for mainstream agricultural use has yielded little and does not hold much promise due to acknowledged limitations. Success has been achieved with broad host range pathogens using venture capital company, cottage-industry and University spin-off models. For limited resource farmers in developing countries, biopesticides are commonly fabricated by cottage-industries and encounter quality, safety and efficacy issues. A proposed *Striga* control strategy in Africa operates at a cottage level, utilizing a simple liquid fermentation process and cheap, easily available substrates such as sorghum straw and gum arabic.

INTERNATIONAL COLLABORATION FOR BIOLOGICAL CONTROL AGENT EXPLORATION AND DEVELOPMENT : A BRAZILIAN PERSPECTIVE. R.W. Barreto*; Universidade Federal de Viçosa, Viçosa, MG, Brazil

ABSTRACT

Historically, the discipline of biological control has depended on international cooperation in various forms. The first examples in weed biological control followed the classical (or inoculative) approach utilizing insect natural enemies. Such approach, which involves the search of biological control agents in the centre of origin of weeds that became invasive after being introduced into new ranges, and its release in new areas for the control of the target-weed predominated for almost seventy years. In the 1970s the use of pathogens was initiated both for the novel approach of developing biological herbicides and in the classical approach. In the first half of the XXth century weed biocontrol projects were conducted mainly by scientists based in the USA and Australia who went overseas in safari-like expeditions to collect agents to be released in the areas where the target-plant became a weed. The collecting strategy employed these days is sometimes referred to as "grab and run strategy". But the truth is that even in such early years of the discipline there are indications that, in general the projects involved at least some collaboration with locally based scientists or, at least, the knowledge and consent of the local/national authorities. Gradually the procedures for the discipline were changed, as groups of scientists with an interest in that field emerged in countries that were sources of biocontrol agents. Examples of collecting, screening and other activities in biocontrol projects became more commonly transferred to teams of scientists based in countries that were sources for biocontrol agents. In some cases, interest resulting from such involvement of scientists with classical biocontrol projects led to initiation of projects aimed at invasive weeds in countries that never had examples of weed biocontrol projects such as India, China and Brazil. In the case of Brazil, cooperation along the years between a group of scientists based at Curitiba (Parana) with the University of Florida - aiming at the biocontrol of Brazilian pepper tree (*Schinus terebinthifolius*) and also between the same group and the University of Hawaii for the biocontrol of strawberry guava (*Psidium cattleianum*) later served as an inspiration for a project aimed at the biocontrol of yellow bells (*Tecoma stans*) which is an invasive plant in Brazil that is native from Mexico. Also, cooperation between the University of Hawaii and the team based at Viçosa (Minas Gerais) aimed at finding biocontrol agents for miconia (*Miconia calvescens*) and with CAB International aimed at finding biocontrol agents for lantana (*Lantana camara*) and also with Landcare Research having as target *Tradescantia fluminensis* allowed for the accumulation of experience that is now encouraging the initiation of projects aimed at the classical biocontrol of two exotic weeds: wild ginger (*Hedychium coronarium*) and rubbervine (*Cryptostegia madagascariensis*). Another potential level of cooperation that may emerge for classical biocontrol is that of bilateral agreements on the exploration of this approach for countries that could swap biocontrol organisms for being each the centre of origin of weeds that are important in the other country. International cooperation towards the development of biological herbicides has also been of relevance and will prove critical for the future of the discipline as will also be discussed.

BIOLOGICAL CONTROL OF INVASIVE ALIEN CROFTON WEED USING *ALTERNARIA ALTERNATA* IN CHINA. S. Qiang*; Nanjing Agricultural University, Nanjing, China

ABSTRACT

To date, 315 species of invasive alien plants belonging to 50 families have been identified and recorded in China. Crofton weed (*Eupatorium adenophorum* Spreng) is one of the most important species which has invaded all over the southwestern and even central regions of China and is continuing to spread northeastward. *Alternaria alternata* (Fr.) Keissler is a natural pathogen of crofton weed, causing a brown leaf spot disease. Foliar application of mycelia suspensions of *A. alternate* was more effective than conidial suspensions in causing disease and death of the plants. Through bioassay-driven chemical analysis of *A. alternate* culture filtrates, tenuazonic acid (TeA) was found to be the main metabolic component responsible for a brown leaf-spot symptom on Crofton weed. In addition to Crofton weed, TeA also exhibited herbicidal activities against a broad spectrum of weeds in laboratory, greenhouse and field trials. TeA inhibited photosynthesis of Crofton weed on which oxygen-evolution rate and quanta efficiency declined evidently after the treatment. The main action site for the toxin was on the Thylakoid membrane of chloroplast. As a result, electron transfer of the photosynthesis was inhibited. Further studies revealed that the activity of the photosystem II was inhibited completely while that of the photosystem I was little affected. The following chlorophyll fluorescence parameters were impacted: coefficient of photochemical quenching, half-time value of fluorescence rise, and O-J-I-P curves for fluorescence induction kinetics. Specifically, TeA inhibited electron transfer from QA to QB in the photosystem II by competing for the binding site on D1 protein in the QB. Based on studies using D1-mutants of the photosynthesis model alga *Chlamydomonas reinhardtii*, the No. 256 amino acid played a key role in TeA binding to the QB niche. The results of competitive replacement with [^{14}C] atrazine combined with JIP-test and D1-mutants indicated that TeA is a photosystem II inhibitor with a unique binding behavior within the QB niche. Bioassays on TeA and its analogues indicated that 3-acyl-5-alkyltetramic or tetramic acid might represent a structural framework for the new toxin. Oxidative burst in chloroplasts caused by TeA contributed to the quick killing of weeds. It is believed that *A. alternaria* and its TeA toxin have the potential to be developed into a bioherbicide.

FUNGAL PATHOGENS FOR CLASSICAL BIOLOGICAL CONTROL OF INVASIVE ALIEN WEEDS. H. C. Evans*; CAB International, Egham, United Kingdom

ABSTRACT

The history, principles and concepts of classical biological control of invasive alien weeds are discussed in relation to coevolved fungal pathogens. Specific emphasis is given to the problems encountered in developing and implementing projects - from the logistical to the scientific through to the legislative. Examples of highly successful projects are analysed showing how they evolved over time - notably against mistflower (*Ageratina riparia*) in Hawaii and rubbervine (*Cryptostegia grandiflora*) in Australia - and that have been, or could be, successfully transferred to similarly affected countries. In the case of mistflower, a white smut (*Entyloma ageratinae, Basidiomycota*) - originally identified as a *Cercosporella* sp. (*Ascomycota*) - from the Caribbean was released in Hawaii with almost immediate and spectacular success against this highly invasive weed of upland pastures and pre-montane ecosystems. Since then, similar results have been achieved in South Africa and New Zealand. Rubbervine weed which posed the major threat to tropical ecosystems in Australia has now been brought under control following the release of the rust fungus, *Maravalia* cryptostegiae, from Madagascar; making it amongst the most lucrative weed biocontrol programs, with a benefit-cost ratio of 108:1. Along the way, several major hurdles had to be cleared, including ambiguous results from host-range screening - especially, artificial host extension - and taxonomic problems with both plant and fungal populations. Hopefully, this technology could be transferred to other rubbervine-invaded regions, especially in the Americas (north-east Brazil, Curaçao, Florida); although, thus far, funding has proven to be elusive. Projects that have failed to make a significant impact on their target weeds are also assessed, with particular reference to the possible reasons for their perceived failure. These include insufficient or erratic funding, lack of monitoring, as well as the failure to match weed biotype to fungal pathotype. Interestingly, a recent retrospective assessment of such "failed" projects has shown, in fact, that many of them have contributed in part to stabilising or mitigating the impact of their target weeds. Of more immediate concern, however, is the fact that the acceptance of this highly cost-effective, environmentally-benign management strategy as a sustainable solution for the ever-increasing threat posed by invasive alien plants is far from universal and, paradoxically, despite the proven safety and successful track record of fungal pathogens of weeds, is now viewed with more suspicion than previously. This has been based mainly on several well-publicised instances of non-target damage of insect biocontrol agents to indigenous plants or crops, rather than fungal agents, but, inevitably, this has had a knock-on effect. Once again, a more judicious analysis of the data reveals that, either these host-range extensions were predicted pre-introduction or they were abnormal, one-off events. In addition, previously unforeseen problems concerning the interpretation of the Convention on Biological Diversity are also testing both the short- and long-term future of classical biological control as countries seek to ban the export and, therefore, the use of their germplasm as biocontrol agents. Finally, recent and on-going projects - against itch grass (*Rottboellia cochinchinensis*) and Japanese knotweed (*Fallopia japonica*) - are discussed in order to highlight the somewhat precarious, current situation: for itch grass, the introduction of a head smut (*Sorosporium ophiuri*) from Madagascar into Costa Rica was stopped at the eleventh hour because of failure to agree on funding for the final implementation phase, despite the fact that all the science had been done to the satisfaction of the local authorities and quarantine services; plans to introduce biocontrol agents, including a leaf-spot pathogen, into the UK against Japanese knotweed have been put on hold because legislation is still not in place to sanction the release of exotic organisms. Even more worrying, perhaps, is that, although initial surveys in the centre of origin of Himalayan balsam (*Impatiens glandulifera*) have identified highly promising coevolved natural enemies - including rust fungi - obtaining permission to export these potential agents is, so far, proving to be a challenge.

PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF AQUATIC WEEDS. J.F. Shearer*; Engineer Research and Development Center, Vicksburg, MS

ABSTRACT

Biological control of aquatic plants in the United States had its beginnings with the sudden decline of Eurasian watermilfoil in the Chesapeake Bay watershed in the late 1960's. Initial reports suggested a virus as the causal agent, although it was later determined that abiotic factors most likely induced the decline. This notable event however spurred interest in researching the potential for pathogen biocontrol of nuisance aquatic plants. The University of Florida, Gainesville took the lead in much of the early research and continues to this day to be a major center for research on aquatic plants. First as a post doctoral associate and then as a professor at the University of Florida, Raghavan Charudattan has authored or coauthored over fifty articles dedicated to or referencing pathogen biocontrol of aquatic plants. The University of Wisconsin, Madison, and the University of Massachusetts, Amherst, also initiated research on biological management of nuisance aquatic species. Taking the lead at the federal level was the U.S. Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS. Target species have included Eurasian watermilfoil (*Myriophyllum spicatum*), alligatorweed (*Alternanthera philoxeroides*), waterlettuce (*Pistia stratiotes*), waterhyacinth (*Eicchornia crassipes*), hydrilla (*Hydrilla verticillata*) and Brazilian egeria (*Egeria densa*). Much early research concentrated on the use of indigenous pathogens particularly *Cercospora piaropi* on waterhyacinth and *Mycoleptodiscus terrestris* on Eurasian watermilfoil. Both underwent development as mycoherbicides but unfortunately formulation problems prevented them from coming to market. Interest in the two agents has continued and *C. piaropi* and *M. terrestris* are currently being researched as biocontrol agents in a number of countries. Although inundative biocontrol has received most of the emphasis over the past 30 years in the U.S. the classical approach has not been ignored. Overseas surveys have been conducted in Brazil, India, Europe, and the Peoples Republic of China for host specific classical agents of aquatic plants. The surveys yielded over 500 isolates and although a few were efficacious on the target aquatic plants none proved host specific. These results however should not stop the search to find classical agents because few host ranges have been surveyed to date. Unfortunately lack of time and resources are the largest deterrent to this effort.

EXPLORING BACTERIA FOR BIOLOGICAL WEED CONTROL. S.M. Boyetchko*; Agriculture and Agri-Food Canada, Saskatoon, SK, Canada

ABSTRACT

The utilization of microbial agents for biological weed control has a long and successful history worldwide. While the majority of bioherbicides have been predominantly fungal pathogens, the search for bacteria with weed suppressive attributes are being aggressively pursued. Research at Agriculture and Agri-Food Canada (AAFC) on bacteria for biological weed control began in 1991 and has led to the discovery of several bacterial strains with bioherbicidal activity against annual grass weeds, including green foxtail and wild oat. During the evolution of this research program, it was determined that a focused screening and evaluation regime was required to optimize the discovery phase for promising bacteria. A Tier 1 agar bioassay was developed where those bacterial strains with >80% suppression were selected and advanced into Tier 2 testing which included growth pouch and soil bioassay (greenhouse) evaluations, ultimately determining which strains should be tested in the field. Screening of the bacteria against other grass weed species also allowed for the identification of bacterial strains with broad-spectrum activity. Additional screening for control of herbicide-resistant wild oat and green foxtail populations confirmed that the bacteria possess modes of action that differ from several existing chemical herbicides and multiple modes of action are speculated. As a result, *Pseudomonas fluorescens* strain BRG100 has been selected for detailed assessment and development as a biological herbicide, with the aim of registering and commercializing it for control of annual grass weeds. Optimization of fermentation parameters investigating nutritional factors (e.g. carbon, amino acid sources, etc.) that promote i) bacterial cell production and ii) efficacy (root and shoot suppression) have been conducted. Detailed information was collected to better understand which carbon and amino acids are involved in enhancing bacterial growth, population stability, and efficacy. This study provided a platform to further evaluate complex nutritional fermentation media and its effect on biomass production. Fermentation media have been custom-designed for the leading bacterial strains which has resulted in the generation of a minimum of 9 $\log_{10}$ colony-forming units per ml of fermentation broth. In addition, fermentation strategies are being evaluated to produce highly efficaceous and stable bacterial cells. Pre-emergent soil application of selected bacterial strains resulted in significant reductions in growth of green foxtail and wild oat in the field. When formulated into a pesta granule and applied to soil, the bacteria suppress weed emergence and aboveground biomass. We have observed reductions in weed emergence of over 85% under a range of environmental conditions and several improvements to the pesta formulation have been made in order to preserve and extend shelf life beyond 6 months. Prior to large-scale release and registration approval, fundamental knowledge about spatio-temporal interactions and environmental fate in soil are required. Factors such as soil moisture, temperature, and texture can significantly affect the establishment, colonization, and survival of the bacterial agent, and this becomes even more critical when determining efficacy of the bioherbicide product under a broad range of environmental conditions. Moreover, large-scale agronomic field trials are essential to optimize efficacy through strategic placement of the bioherbicide in relation to the crop. Current and future research activities using soil bacteria for biological control of the grass weeds include i) stabilization of bacterial cells through fermentation for improved shelf life in granular formulation; ii) optimization of bacterial production and enhanced efficacy using low-cost fermentation media; iii) improvements in the pesta formulation and/or development of additional novel formulation(s) that lead to long shelf life and ease of handling for field application; iv) evaluating placement of granules in the field that improve efficacy and lead to reduced rates of application that are economical to farmers; v) development of molecular markers for environmental risk assessment; and vi) improved field performance in crop competition and through other agronomic practices. The result of these research efforts is the development of a biopesticide strategy which encompasses four major pillars in an innovation chain: bioprospecting, biological and environmental risk assessment, biopesticide optimization and technology/scale-up for commercialization.

A REFLECTION ON 38 YEARS OF RESEARCH IN WEED BIOLOGICAL CONTROL: USING WHAT WE HAVE LEARNED FOR FUTURE APPLICATIONS. R. Charudattan*; University of Florida, Gainesville, FL

ABSTRACT

When I began my foray into the field of biological control of weeds in 1971, the concept of deliberately using pathogens to control weeds was quite novel and untested and met with skepticism and resistance. Soon, a worldwide network of plant pathologists, weed scientists, microbial technologists, formulation specialists, and regulatory agencies came together to research, develop, and use pathogens in safe and effective ways to control a variety of weeds in crops and natural areas. Several new weed-pathogen systems were studied, a few dozen products and pathogens were brought to use, and, along the way, some valuable lessons were learned in phytopathology and weed ecology. A seminal body of information was published on the etiology and epidemiology of several diseases of weeds, many new pathogens were discovered and described, and methods were developed for mass production, formulation, and storage of pathogens. Numerous pathogen-produced herbicidal metabolites were discovered and characterized. Protocols were developed, tested, and applied for safe importation and release of exotic pathogens and for registration of microbial herbicides. Some spectacular successes were achieved with pathogens used as classical biocontrol agents and a new class of herbicides, the bioherbicides, came on the scene. Yet some key opportunities were missed. Notably, while great strides were made during this period in phytopathology to understand the genetic-molecular basis of virulence, host range, host specificity, host response to infection, cell death, and pathogen population structure, the weed biocontrol research remained largely preoccupied with agent or product development and deployment at the expense of molecular, mechanistic, and ecological/population studies. Nevertheless, the accomplishments in this field are truly significant. Certainly, we are poised to apply the knowledge gained towards the discovery and development of additional weed-control pathogens as well as to the application of pathogen genes, gene products, and genetic mechanisms for weed control. Continued investment in this field will help to gain insights into genetically programmed host-pathogen interactions that can be exploited to kill weeds, restrain weed growth, or knockout traits for invasiveness. In our continuing struggle to manage weeds, biocontrol with pathogens remains a resourceful option.

PLANTING DATES TO OPTIMIZE WEED SUPPRESSION WITH BUCKWHEAT IN FLORIDA. P. Huang*,[1] C.A. Chase,[1] B.M. Santos,[2] X. Zhao[1]; [1]Horticultural Sciences, University of Florida, Gainesville, FL, [2]Horticultural Sciences, GCREC, University of Florida, Balm, FL

ABSTRACT

Buckwheat (*Fagopyrum esculentum*) is a promising cover crop for weed suppression in sustainable and organic cropping systems. To examine optimal planting dates for buckwheat cover crop production, buckwheat growth and canopy closure were evaluated in spring 2007 and 2008 in Citra, Florida with a split-plot experimental design with planting date as a fixed main plot factor. Six planting dates spaced at 2-week intervals (from Mar. 13 to May 22 in 2007, and from Feb. 28 to May 8 in 2008) were chosen as main plot treatments and 3 fallow treatments (buckwheat, harrowed, and weedy control) were assigned randomly to subplots and replicated 3 times. Weed suppression during the cover cropping period and persistence of suppression after termination of the buckwheat were compared with harrowed and weedy controls. Data were analyzed using the Mixed procedure of SAS and least square means were compared using the PDIFF option. Maximum buckwheat biomass occurred at planting dates of Apr. 24 in 2007 (247.2 g/m^2) and Apr. 10 in 2008 (123.4 g/m^2), and plant height was greatest with April and early May planting dates in 2007, and with the May 8 planting date in 2008. Buckwheat canopy closure averaged over year was best when planted in Mar. 13 and Apr. 24 with higher leaf areas indices and cover percentage and lower photosynthetically active radiation penetrating the canopy than other planting dates. Before buckwheat termination, the rate of increase in total and monocot weed biomass was greater in the weedy control than in the buckwheat control. As a result, total and monocot weed biomass in the weedy control was 3.7 and 3.3-fold more, respectively, than with buckwheat by the May 22 planting date in 2007. Averaged over planting date, there were 2.0-fold more weeds in the weedy fallow than with buckwheat in 2008. Dicot weed biomass was lowest with the Mar. 13, Mar. 27, and Apr. 24 planting dates in 2007, but did not differ with planting date in 2008. Dicot weed biomass was 3.1 and 3.8-fold less with buckwheat than with the weedy control averaged over planting dates in 2007 and 2008, respectively. After termination, total and monocot weed biomass were suppressed more effectively with buckwheat planted in Mar. and Apr. than in May in 2007. In 2008 suppression persisted only with the Mar. 13 planting date. Persistence of suppression of total and monocot weed biomass by buckwheat was similar to the harrowed control but better than weedy control in 2007. In 2008, it was intermediate between the harrowed and weedy control in 2008. No persistence of dicot weed suppression was apparent after cover crop termination in both years. These results suggest that in north central Florida weed suppression will be most effective when buckwheat cover crops are planted between late April and early May.

APPLICATION TIMINGS AND RATES OF SAFLUFENACIL (KIXOR) IN NO-TILL COTTON. L.N. Owen*, L.E. Steckel, C.L. Main, T.C. Mueller; Plant Sciences, University of Tennessee, Knoxville, TN

ABSTRACT

Saflufenacil was investigated in 2008 and 2009 as a burndown for glyphosate resistant (GR) horseweed in cotton. Saflufenacil is a PPO inhibitor that will be labeled in major agronomic crops including field corn (*Zea maize*), grain sorghum (*Sorghum bicolor*), wheat (*Triticum spp*.), and soybeans (*Glycine max*). Research has also been implemented to determine efficacy and crop safety in upland cotton (*Gossypium hirsutum*). For this study, the cotton variety Phytogen 485 WRF was planted in four 38 in rows by 30 ft plots. Experimental design was a randomized complete block design (RCBD) with four replications. Four preemergence application timings were evaluated in the field study; 21 days before planting (DBP), 14 DBP, 7 DBP, and PRE. At each application timing two rates were investigated; 1 oz/ac and 2 oz/ac. Visual ratings were recorded on a 0-100 scale (0 = no control and 100 = complete control). Cotton injury data was also collected using a percent injury scale of 0-100 (0 = no stand loss and 100 = complete stand loss). Treatments were tank mixed with glyphosate at 22 oz/ac to illustrate control of GR horseweed. All treatments in the study controlled GR horseweed. However, the 2 oz/ac rate when applied PRE severely injured cotton, reducing stands by 25%. This was statistically worse than the 2 oz/ac rate applied 7 DBP which only reduced stands by 4%, and the 14 and 21 DBP applications which reduced stands by 3 % at $P< 0.05$ level. There was no reduction in stand for any application timing at the 1 oz/ac rate. Saflufenacil has potential to help producers who continually battle GR horseweed

PALMER AMARANTH (*AMARANTHUS PALMERI*) MANAGEMENT IN COVINGTON AND BEAUREGARD SWEETPOTATO USING DENSITY MODELS AND HERBICIDES. S.L. Meyers*, K.M. Jennings, D.W. Monks, J.R. Schultheis; Horticultural Science, North Carolina State University, Raleigh, NC

ABSTRACT

Field studies were conducted in North Carolina in 2008 to evaluate season-long competition from Palmer amaranth (AMAPA) in sweetpotato. AMAPA densities included 0, 1, 2, 3, 6, and 12 plants per 1.8 m of sweetpotato row. Data collected included light interception and sweetpotato yield. Results indicate that 1 AMAPA per 1.8 m of row can reduce marketable sweetpotato yield by 51 %. Yield loss appears to be primarily attributed to light interception by AMAPA as light interception and yield loss have a positive correlation (R^2 = .95). Studies were also conducted in 2007 and 2008 to evaluate flumioxazin and *S*-metolachlor for AMAPA control and crop tolerance. Treatments included flumioxazin applied preplant at 0, 91, and 109 g ai/ha followed by *S*-metolachlor PRE immediately after transplanting or 13 DAP at 0, 0.81, 1.08, and 1.35 kg ai/ha. No visual crop injury was observed in any treatment. AMAPA control at harvest for treatments including *S*-metolachlor applied immediately after transplant ranged from 91 to 100% in both years when combined with flumioxazin at 91 or 109 g ai/ha. Control for treatments including *S*-metolachlor applied 13 DAP ranged from 95 to 100% and 30 to 79% in 2007 and 2008, respectively when combined with flumioxazin at 91 or 109 g ai/ha. *S*-metolachlor applied alone provided control ranging from 80 to 96% and 13 to 58% when applied immediately after transplant and 13 DAP, respectively. Flumioxazin applied alone at 91 or 109 g provided 60% control. Treatments that included flumioxazin had 41% greater control in 2007. In 2008 treatments that included flumioxazin at 109 g provided 9% greater control than treatments that contained flumioxazin at 0 and 91 g. In 2007 marketable yield was similar for all treatments containing flumioxazin at 91 and 109 g. Yield for treatments containing *S*-metolachlor alone was greater when applied immediately after transplant than 13 DAP. Yield from *S*-metolachlor applied 13 DAP was greater when applied after flumioxazin preplant at 91 or 109 g. In 2008 marketable yield was greatest for treatments containing *S*-metolachlor applied immediately after transplant, regardless of flumioxazin rate. Yield for treatments with *S*-metolachlor applied at 1.35 kg was greater than treatments with 1.08 kg. The addition of flumioxazin increased yield at both *S*-metolachlor application times. Flumioxazin applied at 109 g provided greater marketable yield when compared to treatments without flumioxazin.

WEED CONTROL WITH GLUFOSINATE IN LIBERTY LINK SOYBEAN. B.M. Davis*,[1] R.C. Scott,[1] T.W. Dillon,[1] K.L. Smith[2]; [1]University of Arkansas, Cooperative Extension Service, Lonoke, AR, [2]University of Arkansas, Cooperative Extension Service, Monticello, AR

ABSTRACT

Studies were conducted over five locations across Arkansas to evaluate the potential of Liberty Link soybean and Ignite (glufosinate) herbicide in various soybean production systems of Arkansas. The experiments were conducted at sites near Furlow (stale/no-till seedbed), Clarkdale (glyphosate-resistant horseweed), Lonoke (conventional rice rotation), Stuttgart (red rice and hemp sesbania), and Newport (conventional tillage pigweed). Liberty Link soybean was grown using production practices for the area and following the various production scenarios mentioned above. Herbicide treatments consisted of Ignite at 22 oz/A applied 22 days after emergence. These early-post applications were followed by a sequential Ignite application of 22 oz/A applied at 44 days after emergence (DAE). The sequential Ignite treatments were applied alone or in combination with various residual herbicides applied preemergence after planting. The residual treatments included: Valor (2 oz/A), Valor XLT (3 oz/A), Gangster (1.8 oz/A), Valor (2 oz/A) + Sencor (4.6 oz/A), and Prefix (1 qt/A). In addition, two sequential treatments of Ignite (22 oz/A) were applied alone at 22 followed by 44 DAE and at 10 DAE followed by another application 12 days later. All Ignite treatments contained Ammonium Sulfate at 8.5 lb/100 gal. Treatments were applied using a CO_2 backpack sprayer at 10 gallons per acre using drift guard 110015 tips. During the course of these studies treatments of Ignite alone provided adequate control (above 90%) of barnyardgrass, large crabgrass, Palmer amaranth, broadleaf signalgrass, prickly sida, and entireleaf morningglory. At Newport, the later sequential applications of Ignite did not initially control pigweed as well as all other treatments; however, at 55 days after treatment all treatments controlled pigweed 90% or more. At Lonoke, Prefix provided the best barnyardgrass control of all residual treatments evaluated. However, once Ignite was applied following a preemergence herbicide all treatments controlled barnyardgrass and crabgrass above 95%. Similarly at Stuttgart Prefix provided the best red rice control of all residual treatments evaluated. However, once Ignite was applied following a preemergence herbicide all treatments controlled red rice and hemp sesbania above 90%. At the Furlow location, large crabgrass, prickly sida and entireleaf morningglory were controlled greater than 90% with all treatment combinations. While sequential post applications of Ignite did control most weeds, there were benefits of using a residual herbicide program, which depended on weed species. For example, Valor was the best preemergence on pigweeds; however Prefix was the best at controlling barnyardgrass across locations. In addition, earlier Ignite applications provided better control than later applications at all locations. Liberty Link soybean does have a fit in Arkansas production systems when the right steps are taken in the weed control programs. The use of a preemergence herbicide and early applications of Ignite are key for season-long control.

TOLERANCE OF BELL PEPPER IN PLASTICULTURE TO S-METOLACHLOR AT VARIOUS RATES AND TIMINGS. R.A. Pekarek*, D. Monks, K. Jennings; Horticultural Science, North Carolina State University, Raleigh, NC

ABSTRACT

Due to the phase-out of methyl bromide under the Clean Air Act and the Montreal Protocol, new weed management strategies are needed in bell pepper, a crop produced almost exclusively with methyl bromide fumigation. Studies were conducted in eastern (Kinston) and western (Fletcher) North Carolina in 2008 to determine the effects of *S*-metolachlor applied PRE under polyethylene mulch on bell pepper tolerance, stand, height, and yield. Treatments were applied in a split-plot layout with four replications and included three pre-transplant intervals (*S*-metolachlor applied approximately 1, 3, and 4 wk before transplanting) and *S*-metolachlor applied at 0.35, 0.72, 1.1, and 1.4 kg/ha. A nontreated check was included for comparison. Data were subjected to analysis of variance with PROC GLM of SAS ($p = 0.05$). Although differences by location were evident, *S*-metolachlor applied at all pre-transplant intervals and rates did not affect plant height at 2 and 4 wk after transplanting (WAT), or crop stand, and injury 2 WAT. No injury was observed 4 WAT at Fletcher. At Kinston 4 WAT, injury did not differ by *S*-metolachlor rate. However, bell pepper injury increased as pre-transplant interval decreased. Pepper injury was 11, 16, and 17% averaged over rates of *S*-metolachlor when applied 4, 3, and 1 wk before transplanting. Total (sum of Fancy, No. 1, and cull grades), marketable (sum of Fancy and No. 1 grades), and cull yields were not affected by pre-transplant interval or *S*-metolachlor rate. Fancy yield was not reduced by *S*-metolachlor rates. Averaged over rates, *S*-metolachlor applied 1 (27,460 kg/ha) wk before transplanting reduced fancy yield compared to application at 3 (30,310 kg/ha) or 4 (30,450 kg/ha) wk before transplanting. No. 1 yield was affected by the interaction of pre-transplant interval and *S*-metolachlor rate although clear trends in differences were not evident. Overall, bell pepper was generally tolerant of *S*-metolachlor at the rates tested, and injury and yield reductions can be reduced by increasing the interval between application and transplanting.

HERBICIDE SYSTEMS FOR CONTROL OF GLYPHOSATE RESISTANT ITALIAN RYEGRASS. R. Bond*,[1] V.K. Nandula,[1] C.H. Koger,[2] D. Poston[3]; [1]Weed Science, Mississippi State University, Stoneville, MS, [2]Mississippi State University Extension Service, Stoneville, MS, [3]Mississippi State University, Stoneville, MS

ABSTRACT

To date, fifteen weed species have evolved resistance to glyphosate worldwide. In Mississippi, glyphosate-resistant (GR) horseweed (*Conzya canadensis*), Italian ryegrass (*Lolium perenne* ssp. *multiflorum*), and Palmer amaranth (*Amaranthus palmeri*) have been confirmed. The first GR Italian ryegrass in a field crop environment was documented in Mississippi in 2005. Glyphosate is widely used in GR cropping systems at burndown, postemergence, and preharvest application timings. Previous research documented that GR Italian ryegrass was not effectively controlled with spring postemergence herbicide programs. Italian ryegrass residue present at planting creates challenges to growers utilizing no-till or reduced tillage farming practices. Research was conducted at an on-farm site near Tribbett, MS, to 1) evaluate fall applications of residual herbicides for control of GR Italian ryegrass and 2) determine the most effective timing for application of paraquat plus residual herbicide tank-mixtures. The first study evaluated fall-applied herbicides and was designed as a randomized complete block with four replications. Herbicide treatments included soil incorporated applications of trifluralin at 1.6 kg ai ha^{-1} and pendimethalin at 1.59 kg ai ha^{-1} and surface applications of pendimethalin at 1.59 kg ha^{-1}, *S*-metolachlor at 1.79 kg ai ha^{-1}, clomazone at 1.12 kg ai/A, KIH-485 at 0.16 kg ai ha^{-1}, and flumioxazin at 0.072 kg ai ha^{-1}. Glyphosate-resistant Italian ryegrass control was visually estimated 100 and 180 days after treatment (DAT). Data were analyzed using ANOVA and means separated with Fisher's protected LSD at 5% significance level. All treatments, except surface applications of pendimethalin, controlled GR Italian ryegrass at least 90% 100 DAT. *S*-metolachlor, clomazone, and KIH-485 provided at least 91% control 180 DAT. The second study evaluated application timings for paraquat plus residual herbicide tank-mixtures for control of GR Italian ryegrass. Treatments were arranged as a two-factor factorial within a randomized complete block design with four replications. The first factor included a nontreated, paraquat at 0.56 kg ai ha^{-1} alone and in combination with diuron at 1.12kg ai ha^{-1}, linuron at 1.12 kg ai ha^{-1}, flumioxazin at 0.072 kg ai ha^{-1}, or oxyfluorfen at 0.56 kg ai ha^{-1}. The second factor was application timings of fall (November), early spring (March), or late spring (April). Control of GR Italian ryegrass was visually estimated 10 days after late spring applications. After visual evaluation, all GR Italian ryegrass from 1 m^2 in each plot was harvested to determine dry weight. Data were analyzed using ANOVA and means separated with Fisher's protected LSD at 5% significance level. Fall applications of paraquat plus linuron or diuron controlled GR Italian ryegrass 83 to 93% 10 days after the late-spring application. Tank-mixtures of residual herbicides with paraquat provided no additional control over paraquat alone at the late spring application timing. All treatments reduced GR Italian ryegrass dry weight compared with the respective nontreated control for each application timing. Greatest dry weight reduction was observed following fall applications of paraquat plus diuron. Glyphosate-resistant Italian ryegrass poses a serious threat to cotton production in Mississippi. However, results of this research demonstrate that GR Italian ryegrass can be effectively managed in a cotton production system. Control of GR Italian ryegrass should be based on fall-applied residual herbicides. Fall applications of *S*-metolachlor, clomazone, and KIH-485 provided residual control that lasted until the following spring. Paraquat plus diuron applied in the fall offered the best combination of postemergence and residual control of GR Italian ryegrass.

DEVELOPMENT OF AN INVASIVE ASSESSMENT PROTOCOL FOR NORTH CAROLINA NURSERY CROPS. C.A. Englert*, J.C. Neal, T.G. Ranney; Horticultural Science, North Carolina State University, Raleigh, NC

ABSTRACT

While a small proportion of nonindigenous species successfully naturalize and even fewer become invasive, those that do may alter ecosystem processes and negatively impact native community composition. Many potentially invasive species were introduced and sold for horticultural purposes. The North Carolina Nursery and Landscape Association (NCNLA) has supported the development of a science-based invasive assessment protocol designed to systematically assess the potential invasiveness of ornamental plants in the region. While the North Carolina assessment protocol incorporates elements of existing weed risk assessment models, the protocol evaluates the potential invasiveness of plant species in natural areas in accordance with regional environmental conditions. The invasive protocol is non-predictive and intended for species that are present in the horticultural trade. The North Carolina assessment criteria are based on a framework of weighted sets of indices that evaluate and rate ecological impacts, potential for expanded distribution, management difficulty, and the economic value of non-native ornamental species. According to the combined weighted results, the model generates a final recommendation for evaluated species ranging from 'unlikely to be invasive' to ‘invasive and not recommended for use.' The draft model incorporates a cost/benefit analysis and weighs economic benefits against the ecological risk of selling potentially invasive ornamental plants. Initial model validation identified market value as a significant data gap. To address this issue, an online survey of NCNLA members was designed to assess the market value of potentially invasive plant species sold in the nursery industry. The survey and assessment protocol will evaluate approximately 20 taxa that are sold in the North Carolina horticultural trade, and have been listed as invasive plants by other state assessments or identified as problematic species of concern according to North Carolina land managers. The North Carolina assessment incorporates quantitative evaluations wherever possible and requires that all scores must reference scientific research results. Using this assessment system, the North Carolina nursery industry may evaluate whether particular plant species that present great ecological risk should be discouraged from being sold in the trade.

EFFECT OF PYRITHIOBAC AND S-METOLACHLOR CO-APPLICATION ON COTTON GROWTH AND YIELD. R.E. Ferguson*,[1] D.O. Stephenson,[1] D.K. Miller,[2] A.M. Stewart[1]; [1]Dean Lee Research and Extension Center, LSU AgCenter, Alexandria, LA, [2]Northeast Research and Extension Center, LSU AgCenter, St. Joesph, LA

ABSTRACT

Research was conducted in 2008 evaluating the effects of various glyphosate formulations co-applied with pyrithiobac and/or *S*-metolachlor on cotton growth and yield at the Dean Lee Research Center in Alexandria, LA. The experiment was a 4 x 4 factorial arranged as a randomized complete block with four replications. The first factor consisted of four glyphosate formulations and the second factor included four co-application partners. Glyphosate formulations were a 0.9 g ae ha^{-1} (Roundup PowerMax), 0.9 g ae ha^{-1} (Touchdown Total), 0.8 g ae ha^{-1} (Cornerstone Plus), and no glyphosate. Co-application herbicides were pyrithiobac at 0.05 kg ai ha^{-1}, *S*-metolachlor at 1.4 kg ai ha^{-1}, pyrithiobac plus *S*-metolachlor, and no co-application herbicide. All treatments were applied on 17 June 2008 to 6-7 node cotton. Data collected included visual cotton injury recorded 3 to 41 d after treatment (DAT) (0 = no injury, 100 = cotton death), plant weights (23 DAT), cotton node number (29 DAT), cotton plant heights (29 DAT) and seed cotton yields. Trial was maintained weed free using blanket applications of glyphosate. Data was subjected to analysis of variance and means were separated with Fisher's Protected LSD at the 0.05 significance level. The main effects of glyphosate formulation and co-application herbicide were significant for cotton injury only at the 3 and 9 DAT ratings. When averaged across co-application herbicides, cotton injury was greater following Roundup PowerMax application (12%) compared to Cornerstone Plus (9%), but neither was different than Touchdown Total (10%). Regardless of co-application herbicide, no differences in cotton injury were observed among glyphosate formulations 9 DAT with injury averaging 4%. Cotton injury, averaged across glyphosate formulation, was greatest following pyrithiobac plus *S*-metolachor (24%), followed by pyrithiobac (12%), and *S*-metolachlor (3%) 3 DAT. Pyrithiobac plus *S*-metolachor injured cotton 9% 9 DAT which was greater than either pyrithiobac or *S*-metolachlor applied individually, but no phytotoxic injury was observed 14 DAT or later in the growing season. Glyphosate formulation and co-application herbicide did not influence cotton plant weight (61-82 g), node number (15-16), plant height (45-49 cm), and seed cotton yield (2050-4370 kg ha^{-1}). Data indicates that co-applying pyrithiobac or *S*-metolachlor with any of the glyphosate formulations evaluated did not cause excessive cotton injury or reduce cotton growth and yield. However, co-applying pyrithiobac plus *S*-metolachlor with any glyphosate formulation caused substantial injury 3 DAT, but phytotoxic injury was not observed after 14 d and cotton growth and yield were not reduced. Research will be continued to confirm the findings observed in this research.

CHANGES IN SEASONAL GROWTH AND SHADING POTENTIAL OF SUGARCANE: A STUDY IN WEED/CROP COMPETITION. M. Bittencourt*, J.L. Griffin; School of Plant, Environmental, and Soil Sciences, Louisiana State University, Baton Rouge, LA

ABSTRACT

Sugarcane variety recommendations in Louisiana are based primarily on yield (tonnage and sugar), stubble longevity, disease/insect reaction, and cold tolerance. Seasonal growth characteristics and shading ability of 'LCP 85-384', 'L 97-128', 'HoCP 96-540', 'Ho 95-988', 'L 99-226', and 'L 99-233' during the second production year were compared as well as bermudagrass and johnsongrass growth response to a shade environment. For the variety study, a significant variety by date interaction was observed for all growth parameters and for reduction in photosynthetically active radiation (PAR). For each variety, trend analysis of data collected over time showed a significant linear trend. Differences in shoot emergence among the varieties were observed beginning in early April and as the season progressed, shoot production and shoot height increased for L 97-128, Ho 95-988, L 99-226, and L 99-233 but lagged for HoCP 96-540 and LCP 85-384. Beginning in mid-April ground cover increased most rapidly for L 99-233. In late May ground cover was around 60% for LCP 85-384 and HoCP 96-540; around 70% for L 97-128, Ho 95-988, and L 99-233; and was approaching 90% for L 99-226. Sugarcane canopy height across the growing season was consistently greater for L 97-128 and L 99-233 and averaged 21% more than for the other varieties in early June and 15% more in mid-July. Based on PAR data collected in the row middles, sunlight in the sugarcane canopy at ground level was reduced an average of 61% in early June for L 97-128 and L 99-226 compared with 29% for LCP 85-384 and HoCP 96-540. By late July PAR reduction was equal and averaged 90% for L 97-128, Ho 95-988, L 99-226 and L 99-233 compared with 78% for LCP 85-384 and HoCP 96-540. Differences in growth characteristics among varieties suggest that variety selection could play an important role in the management of problematic weeds. For the weed shade study, enclosures (0.61 x 0.61 x 0.61m) covered with shade cloth providing 30, 50, 70 and 90% shade were used in fields with natural infestations of bermudagrass and johnsongrass. A significant linear trend in response to shade level was observed for growth parameters of both weeds. At 55 days, bermudagrass ground cover under full sunlight was 88% compared with 10% for 90% shade; above ground biomass for 90% shade was reduced 95%. Exposure to 90% shade for 35 days decreased johnsongrass plant population 86% and above ground biomass 90%. With 30% shade, dry weight of bermudagrass was reduced 30% and johnsongrass biomass was reduced 45%. Because of the prostrate growth habit of bermudagrass and the sensitivity to shade, competition from the sugarcane crop could impact ability of bermudagrass to reestablish. Sugarcane varieties that emerge early in the spring following the winter dormant period and that produce a high population of stalks per hectare with leaves less upright in growth habit would be expected to be more competitive with bermudagrass. Based on this research the varieties L 97-128, L 99-226, and L 99-233 would be very competitive with bermudagrass. In contrast, the open canopy of HoCP 96-540 would be conducive to bermudagrass reinfestation.

EVALUATION OF VARIOUS GRAMINICIDES FOR SELECTIVE BERMUDAGRASS CONTROL IN ZOYSIAGRASS FAIRWAYS. D.F. Lewis*,[1] J.S. McElroy,[2] J.C. Sorochan,[1] J.T. Brosnan,[1] G.K. Breeden[1]; [1]Plant Sciences, University of Tennessee, Knoxville, TN, [2]Agronomy and Soils, Auburn University, Auburn, AL

ABSTRACT

Graminicides are used for selective control of grassy weed species. Aryloxyphenoxypropionate (AOPP) herbicides are members of the graminicide chemical family used to control bermudagrass (*Cynodon dactylon*). However, applying these materials alone can cause phytotoxic injury to other turfgrass species, such as zoysiagrass (*Zoysia* spp.). While research has shown that applications of these materials can be safened when tank-mixed with triclopyr, there is no data illustrating the extent of bermudagrass control and zoysiagrass tolerance when these two herbicides are combined. Research was conducted to evaluate the efficacy of various AOPP graminicides applied alone, and tank-mixed with triclopyr, for selective bermudagrass control in zoysiagrass fairways. Treatments included: triclopyr (1.12 kg ai/ha); fluazifop (0.11 kg ai/ha); fluazifop plus triclopyr (0.11 kg ai/ha + 1.12 kg ai/ha); fenoxaprop (0.14 kg ai/ha); fenoxaprop plus triclopyr (0.14 kg ai/ha + 1.12 kg ai/ha); cyhalofop (0.32 kg ai/ha); cyhalofop plus triclopyr (0.32 kg ai/ha + 1.12 kg ai/ha); quizalofop (0.09 kg ai/ha); and quizalofop plus triclopyr (0.09 kg ai/ha + 1.12 kg ai/ha). Each treatment was applied three times on a 28 day interval to the following turfgrasses: 'Tifway' bermudagrass (*Cynodon dactylon* x *transvaalaensis*); 'Diamond' zoysiagrass [*Zoysia matrella* (L.) Merr.]; 'Palisades' zoysiagrass (*Zoysia japonica* Steud.); and 'Zenith' zoysiagrass (*Zoysia japonica* Steud.). All sites were maintained as golf course fairways with respect to irrigation, fertility, and mowing. Plots ($2.25m^2$) were arranged in a randomized complete block design with four replications. Herbicides were applied with a CO_2 pressurized sprayer calibrated at 280 L/ha. Bermudagrass control was visually rated every two weeks on a 0-100% scale (0%=no visible turfgrass injury; 100%=complete turfgrass death), with >70% injury considered acceptable control. Zoysiagrass injury was also rated visually using the same 0-100% scale, with <15% injury considered acceptable tolerance. In addition, percent turfgrass cover was evaluated every two weeks using digital image analysis (DIA) and correlated with visual ratings. Fluazifop, fenoxaprop, cyhalofop, and quizalofop applied alone did not provide acceptable bermudagrass control (<70%). However, when applied in combination with triclopyr, fluazifop, fenoxaprop, and quizalofop provided acceptable levels of bermudagrass control (>70%). Triclopyr alone resulted in a notable level of control as well (47.5%). All herbicides caused unacceptable injury to 'Diamond' zoysiagrass (>17.5%). Applications of fluazifop, fenoxaprop, and quizalofop applied alone resulted in unacceptable injury to both 'Palisades' and 'Zenith' zoysiagrass (>23%); however, tank-mixing triclopyr with these graminicides reduced phytotoxic injury to acceptable levels (<15%).

COTTON TOLERANCE TO PROPAZINE/GLYPHOSATE POSTEMERGENCE COMBINATIONS. K.S. Verett*,[1] J.W. Keeling,[2] P.A. Dotray[2]; [1]Texas AgriLife Research/Texas Tech University, Lubbock, TX, [2]Texas AgriLife Research, Lubbock, TX

ABSTRACT

In 2007, Roundup Ready Flex cultivars were planted on 45% of the cotton acres on the Texas Southern High Plains. This number rose to approximately 70% in 2008. With the increasing number of Roundup Ready Flex cotton acres being planted and the increasing and continued high volume of glyphosate being applied, the probability of developing glyphosate-resistant weeds has increased dramatically. Because of the increased threat of herbicide resistant weeds, it is essential to include different herbicide modes of action in a weed management program. Previous research conducted on the Texas Southern High Plains evaluated different residual herbicides for improved Palmer amaranth (*Amaranthus palmeri*) and ivyleaf morningglory (*Ipomoea hederacea*) control. Although not currently labeled for use in cotton, it is believed that propazine in combination with glyphosate would make a valuable tank-mix for cotton producers. The objectives of this study were to evaluate postemergence (POST) applications of glyphosate alone or in combination with propazine for improved Palmer amaranth and ivyleaf morningglory control, compare POST application timings and propazine rates in combination with glyphosate in Roundup Ready Flex cotton, and determine the effects of propazine alone and in combination with glyphosate on cotton growth and yield as affected by soil type**.** All treatments received a preplant application of trifluralin, which was incorporated using a tandem disc. Glyphosate was applied alone at an early and mid POST timing. Glyphosate was applied alone or in combination with three rates of propazine at an early or mid POST timing. Propazine rates were 0.5, 0.75, and 1.0 lb ai/A. Percent weed control and cotton injury was assessed 7, 14, and 28 days after treatment and at the end of the season. In 2007 there was no difference in Palmer amaranth control between glyphosate applied alone or any propazine rate in combination with glyphosate. All of the glyphosate or glyphosate/propazine treatments controlled Palmer amaranth 100%. In 2008 the addition of propazine to glyphosate improved Palmer amaranth control over glyphosate applied alone at the early POST timing. The glyphosate only treatment controlled Palmer amaranth 80 to 85%, but when propazine was added to the glyphosate control increased to at least 97%. In 2007, all treatments controlled ivyleaf morningglory greater than 85%. There was no difference in ivyleaf morningglory control following the glyphosate alone and the glyphosate/propazine combinations at the end of the growing season. In 2008, because of the lack of timely rainfall ivyleaf morningglory control was ineffective (50 to 75%) following the early-POST timing, and control ranged from 75 to 80% following the mid-POST timing. In 2007 and 2008 early-season leaf chlorosis (<10%) was observed in the weed-free cotton tolerance study, but no injury was apparent by 28 days after treatment. In 2008 the same early-season chlorosis was observed at the Lubbock location (Acuff loam soil), but no differences in yield or fiber quality were observed. The Lamesa tolerance study (Amarillo fine sandy loam soil) exhibited the same leaf chlorosis observed at Lubbock, but slight stunting occurred as well. These results indicate that although consistent improvements in residual Palmer amaranth and ivyleaf morningglory control were not observed with propazine/glyphosate tank mixes compared to glyphosate alone, propazine could be an effective weed management option in Roundup Ready Flex cotton**.**

INFLUENCE OF INCREASING COMMON RAGWEED (*AMBROSIA ARTEMISIIFOLIA* L.) AND COMMON COCKLEBUR (*XANTHIUM STRUMARIUM* L.) DENSITIES ON FORAGE QUALITY AND YIELD IN TALL FESCUE PASTURES. K.K. Payne*, K.W. Bradley; Univ. of Missouri, Columbia, MO

ABSTRACT

Separate field trials were conducted in 2007 and 2008 to investigate the effects of increasing densities of common ragweed or common cocklebur on total forage quality and yield in tall fescue (*Festuca arundinacea* Schreb.) pastures. In early spring of 2007 and 2008, increasing densities of common cocklebur or common ragweed seed were spread evenly across separate 3 by 12 meter plots that contained natural stands of tall fescue. Prior to and after seeding, all plots were rotary hoed to enhance seed-to-soil contact and germination. In all experiments, weed densities were arranged in a completely randomized design with five replications. All plots were maintained free of weeds other than common ragweed and common cocklebur for the duration of the experiments. Total forage (weeds + tall fescue) yields were determined in response to each weed density and species by harvesting 2, 1 by 12 meter strips from each plot with a Carter forage harvester. Pure samples of tall fescue, common ragweed or common cocklebur were also hand collected from each plot at the time of the total forage harvest; the pure samples were mixed in various proportions to create artificial samples for an NIR (near-infrared) spectroscopic equation for the prediction of botanical composition. NIR spectroscopy was also used to predict crude protein and *in vitro* true digestibility (IVTD) of the total harvested forage, pure tall fescue, and pure weed species in each plot. Initial results from 2007 experiments revealed few differences in forage yield, quality, or IVTD between the common ragweed or common cocklebur densities evaluated in this research. Increasing the common ragweed density also resulted in poorer forage quality of pure common ragweed samples. Results from these experiments indicate that even very high densities of common ragweed or common cocklebur may not reduce the quality, quantity, or digestibility of the harvested forage in tall fescue pastures, but also that additional research is necessary to understand why these species are not consumed by cattle and continue to be significant weed problems in many pastures and hay fields in Missouri.

TEXASWEED (*CAPERONIA PALUSTRIS*) RESPONSE TO RICE HERBICIDES IN GREENHOUSE SCREENING. J.R. Meier*,[1] K.L. Smith,[2] R.C. Doherty,[1] J.A. Bullington[1]; [1]Division of Agriculture, University of Arkansas, Monticello, AR, [2]Division of Agriculture Cooperative Extension Service, University of Arkansas, Monticello, AR

ABSTRACT

Texasweed is a dicotyledonous summer annual species that has recently been identified in soybean and rice fields in Southeast Arkansas. Two greenhouse experiments were conducted in 2008 to examine control of Texasweed with rice herbicides. Texasweed seed was planted 1.3 cm deep into pots containing Sharkey clay soil in both trials. Experiments were established in a randomized complete block design with four replications and applications were made with a CO_2 backpack sprayer calibrated to deliver 12 GPA. Treatments in the first experiment included a nontreated control, penoxsulam + halosulfuron at 35 + 52 g ai/ha, penoxsulam + bensulfuron at 35 + 42 g/ha, penoxsulam + triclopyr at 35 + 286 g/ha, propanil + triclopyr at 4,430 + 286 g/ha, propanil + acifluorfen at 4,430 + 277 g/ha, orthosulfamuron + triclopyr at 111 + 286 g/ha, orthosulfamuron + bensulfuron at 111 + 42 g/ha, saflufenacil at 100 g/ha, aminopyralid at 17 g/ha, halosulfuron + GWN 3124 at 35 + 16 g/ha, and carfentrazone + halosulfuron at 17 + 52 g/ha applied to Texasweed at the 2- to 3-leaf and 4- to 5-leaf growth stage. Treatments in the second trial included a nontreated control, penoxsulam at 35 g/ha, triclopyr at 286 g/ha, propanil at 4,430 g/ha, bensulfuron at 42 g/ha, acifluorfen at 277 g/ha, saflufenacil at 25, 50, and 100 g/ha, aminopyralid at 17 and 35 g/ha, penoxsulam + bensulfuron at 35 + 42 g/ha, penoxsulam + triclopyr at 35 + 286 g/ha, propanil + triclopyr at 4,430 + 286 g/ha, propanil + acifluorfen at 4,430 + 277 g/ha, and propanil + bensulfuron at 4,430 + 42 g/ha were applied to Texasweed at the 4- to 5-leaf growth stage. Adjuvants were added to treatments as recommended in both trials. Texasweed control was evaluated on a percent basis (0-100) and data were subjected to ANOVA and means separated using Fisher's Protected LSD test (P=0.05). In the first experiment, propanil + triclopyr or acifluorfen, saflufenacil, and aminopyralid provided 100% control of Texasweed 21days after the 2- to 3-leaf application, which was greater than control provided by penoxsulam + halosulfuron (53%) and halosulfuron + GWN 3124 (81%) but not different from other treatments. When applied to 4- to 5-leaf Texasweed, saflufenacil again provided 100% control 21 DAA. Aminopyralid and propanil + acifluorfen provided 95% control at this timing, and control with propanil + triclopyr was 83%. Control with saflufenacil and aminopyralid was similar as plant size increased, whereas control with penoxsulam + bensulfuron, orthosulfamuron + bensulfuron, and carfentrazone + halosulfuron decreased as plant size increased. In trial 2, saflufenacil and aminopyralid at all rates and triclopyr provided 100% control of Texasweed 21 DAA. Control with these herbicides was greater than penoxsulam (51%), propanil (74%), bensulfuron (71%) and acifluorfen (85%). The addition of triclopyr to penoxsulam and propanil increased control to 90% and 98%, and when propanil and acifluorfen were combined, control increased to 98%. Control with propanil + bensulfuron (93%) increased; however, control with Grasp + Londax (74%) was similar to Londax alone. Of the herbicides currently labeled for use in rice, triclopyr provided greater control than penoxsulam, bensulfuron, propanil, and acifluorfen. Combinations of these herbicides with triclopyr or propanil increased Texasweed control. Saflufenacil and aminopyralid provided excellent control (>98%) of Texasweed at rates as low as 25 and 17 g/ha.

RESPONSE OF NON-TRANSGENIC RICE TO SIMULATED GLYPHOSATE AND IMAZETHAPYR DRIFT. J.B. Hensley*, E.P. Webster, S.L. Bottoms, T.P. Carlson; Louisiana State University, Baton Rouge, LA

ABSTRACT

Two studies were conducted at the LSU AgCenter Rice Research Station near Crowley, Louisiana in 2005, 2006 and 2007 to evaluate the effects of simulated herbicide drift on 'Cocodrie' rice. The experimental design for each study was a randomized complete block with four replications in an augmented two-factor factorial arrangement of treatments. A nontreated was added for comparison. Factor A consisted of herbicide rate. The herbicides were applied at drift rates of 12.5 and 6.3% of the labeled usage rate of glyphosate as 22 oz/A of Roundup WeatherMax, 2.8 and 1.4 oz/A, respectively, and imazethapyr as 4 oz/A of Newpath, 0.5 and 0.25 oz/A, respectively. Each application was made with the carrier volume varying proportionally to herbicide dosage based on a carrier volume rate of 25 gallons per acre (GPA). The 12.5% herbicide rate was applied with a carrier volume of 3.1 GPA and the 6.3% herbicide rate was applied with a carrier volume of 1.6 GPA. Each application was made with a compressed air tractor driven sprayer calibrated to deliver a constant carrier volume. Speed was adjusted to vary application rate. Factor B consisted of application timings at different growth stages: 1-tiller, panicle differentiation (PD), boot, and physiological maturity. Each herbicide was evaluated in a separate study. Rice plant height at harvest and rough rice yield for the primary, ratoon, and total crop were obtained. Total crop yield was calculated as a combination of primary and ratoon crop yields. Rice plant height and primary, ratoon, and total crop rough rice yield data are presented as percent of the nontreated. For the Roundup WeatherMax study, nontreated rice plant height at harvest and primary, ratoon, and total crop rough rice yield was 37 inches and 6240, 1160, and 7400 lbs/A, respectively. Rice plant height at harvest was 88 to 90% of the nontreated with 1.4 oz/A rate of Roundup WeatherMax applied at 1-tiller, PD, and boot and the 2.8 oz/A rate applied at 1-tiller and boot. The 2.8 oz/A rate applied at PD resulted in a rice plant height 85% of the nontreated. A primary crop yield response was observed. Roundup WeatherMax applied at 1.4 oz/A at 1-tiller and PD resulted in a yield 65 to 75% of the nontreated. Primary crop yield was 54 to 55% of the nontreated with 2.8 oz/A applied at 1-tiller and PD and 1.4 oz/A was applied at boot. A 2.8 oz/A application at boot resulted in a primary crop yield 36% of the nontreated. A yield response was also observed with the ratoon crop. A 1-tiller and PD application at 1.4 oz/A resulted in ratoon yields 62 to 66% of the nontreated. Rice treated at boot, regardless of rate, resulted in an increased ratoon yield 148 to 149% of the nontreated. Roundup WeatherMax applied at this timing resulted in excess tiller production which did not produce a panicle in the primary crop; however, a panicle was produced on the excess tillers in the ratoon crop causing a yield increase. However, even with an increased ratoon crop yield, the 1-tiller, PD and boot applications all resulted in reduced total crop yields, compared with the nontreated. Total crop yield was 66 to 70% of the nontreated for rice treated with 1.4 and 2.8 oz/A of Roundup WeatherMax at PD and 1-tiller, respectively. The 1.4 oz/A at 1-tiller, the 2.8 oz/A rate at PD, and either rate at boot resulted in total crop yields 44 to 57% of the nontreated. Roundup WeatherMax applications at maturity had no effect on plant height or yield. For the Newpath study, rice plant height at harvest and nontreated primary, ratoon, and total crop rough rice yields were 38 inches and 6100, 1180, and 7280 lbs/A, respectively. Rice plant height at harvest was 90 to 92% of the nontreated when 0.25 and 0.5 oz/A Newpath were applied at boot and 1-tiller and 0.5 oz/A was applied at PD. A primary crop yield response was observed. Newpath applied at 0.25 and 0.5 oz/A to rice at 1-tiller and 0.5 oz/A at PD resulted in yields 62 to 74% of the nontreated. Applications at either rate at boot resulted in a yield 31 to 44% of the nontreated. Ratoon crop yield was 77% of the nontreated when Newpath was applied at 0.5 oz/A at PD. Similar to the Roundup WeatherMax study, a boot application of Newpath, regardless of rate, resulted in an increased ratoon crop yield 131 to 137% of the nontreated. Even with this yield increase, the 1-tiller, PD, and boot application timings resulted in total crop yields lower than the nontreated. Newpath applied at boot at either rate and the 1-tiller application at 0.5 oz/A resulted in the greatest yield reductions, 41 to 53% of the nontreated. Newpath applications at maturity had no effect on plant height or yield.

PERFORMANCE OF HALOMAX IN RICE. R.S. Helms*, M. Hackworth; G & H Associates, Stuttgart, AR

ABSTRACT

Halosulfuron is a commonly used herbicide in rice for broadleaf weeds and sedges. Halomax 75 is a new halosulfuron product developed by Aceto Agricultural Chemical Corporation. Halomax 75 is a 75% wetable dry granule (WDG) formulation. Halomax 75 was evaluated in several rice field trials in 2007. At the Stuttgart Arkansas location Halomax 75 provided good control (60 - 90%) of yellow nutsedge (*Cyperus esculentus)*, hemp sesbania (*Sesbania exaltata)*, morningglories (*Ipomola wrightii*)and (*Ipomola lacunose)*, Pennsylvania smartweed (*Polygonum pensylvanicum)* and red root pigweed (*Amaranthus retroflexus)* at rates of 21 to 63 g ai ha^{-1} applied preemergence. Halomax 75 hemp sesbania control was similar to halosulfuron at rates of 26 to 52 g ai ha^{-1} applied preemergence or postemergence at the Lonoke or Rohwer, Arkansas locations. At the Mississippi location, Halomax 75 or halosulfuron alone or tank-mixed provided similar control (78 - 99%) to morningglories, hemp sesbania and pigweed. At the Louisiana location yellow nutsedge control was identical (90%) with Halomax 75 and halosulfuron. In the water-seeded California location both Halomax 75 and halosulfuron provided excellent control of rice field bulrush (*Scirpus macronatus)* and water hyssop (*Bacopa rotundifolia)*.

IMPACT OF HERBICIDE DRIFT ON RICE. R.J. Levy*,[1] J.B. Hensley,[2] E.P. Webster,[3] S.L. Bottoms[2]; [1]LSU AgCenter, LSU, Alexandria, LA, [2]School of Plant, Environmental, and Soil Sciences, LSU, Baton Rouge, LA, [3]LSU AgCenter, School of Plant, Environmental, and Soil Sciences, LSU, Baton Rouge, LA

ABSTRACT

Two studies were conducted at the LSU AgCenter Rice Research Station near Crowley, Louisiana in 2005 and 2006 to evaluate the effects of simulated herbicide drift on 'Cocodrie' rice. The experimental design for each study was a randomized complete block with four replications in an augmented two-factor factorial arrangement of treatments. A nontreated was added for comparison. Factor A consisted of herbicide rate. The herbicides were applied at drift rates of 12.5 and 6.3% of the labeled usage rate of glufosinate as 24 oz/A of Ignite, 3 and 1.5 oz/A, respectively, and imazamox as 5 oz/A of Beyond, 0.63 and 0.31 oz/A, respectively. Each application was made with the carrier volume varying proportionally to herbicide dosage based on a carrier volume rate of 25 gallons per acre (GPA). The 12.5% herbicide rate was applied with a carrier volume of 3.1 GPA and the 6.3% herbicide rate was applied with a carrier volume of 1.6 GPA. Each application was made with a compressed air tractor driven sprayer calibrated to deliver a constant carrier volume. Speed was adjusted to vary application rate. Factor B consisted of application timings at different growth stages: one-tiller, panicle differentiation (PD), boot, and physiological maturity. Each herbicide was evaluated in a separate study. Rice plant height at harvest and rough rice yield for the primary, ratoon, and total crop were obtained. Total crop yield was calculated as a combination of primary and ratoon crop yields. Rice plant height and primary, ratoon, and total crop rough rice yield data are presented as percent of the nontreated. For the Ignite study, nontreated rice plant height at harvest and primary, ratoon, and total crop rough rice yield was 38 inches and 6090, 1460, and 7550 lbs/A, respectively. Averaged across rates, rice treated with Ignite at PD and boot resulted in a lower plant height at harvest than rice treated at maturity. Averaged across timings, plant height at harvest was 98 to 99% of the nontreated with an application of Ignite at 1.5 and 3 oz/A. A primary crop yield response was observed. Compared with the nontreated, an Ignite application at boot, regardless of rate, resulted in a primary crop yield of 85 to 86% of the nontreated. An application of Ignite at 1-tiller, PD, and maturity resulted in little or no difference in primary crop yield, compared with the nontreated. A ratoon crop yield reduction, 72% of the nontreated, resulted from an application of 3 oz/A of Ignite to rice at 1-tiller. Ignite applied to rice at 3 oz/A at 1-tiller and 1.5 and 3 oz/A at boot resulted in a total crop yield 90 to 93% of the nontreated. For the Beyond study, nontreated rice plant height at harvest and primary, ratoon, and total crop rough rice yield was 37 inches and 5940, 1350, and 7290 lbs/A, respectively. Rice plant height at harvest was 90 to 93% of the nontreated when Beyond was applied at 0.63 and 0.31 oz/A at 1-tiller and boot and 0.63 oz/A at PD. A primary crop yield response was observed. Compared with the nontreated, primary crop yield was reduced when Beyond was applied at 0.63 and 0.31 oz/A at 1-tiller and boot and 0.63 oz/A at PD. Rice treated with Beyond at boot, regardless of rate, increased ratoon yield of 135 to 156% of the nontreated. Beyond applied at this timing resulted in excess tiller production which did not produce a panicle in the primary crop; however, a panicle was produced on the excess tillers in the ratoon crop causing a yield increase. However, total crop yield was reduced, compared with the nontreated, when Beyond was applied at 0.63 and 0.31 oz/A at 1-tiller and boot and 0.63 oz/A at PD. This research indicates that drift of either herbicide evaluated in these studies can be detrimental to rice. The primary crop yield was reduced in both studies when a drift event occurred at the boot growth stage. However, in both studies, total crop yield was reduced when a drift event occurred at the 1-tiller and boot growth stages. A drift event to rice at physiological maturity was not detrimental in either study. Applicators should be aware of environmental conditions such as high winds and temperature inversions before applying these herbicides near a susceptible rice crop, especially when the rice is in the 1-tiller and boot stages.

CONTROL OF GLYPHOSATE-RESISTANT WEEDS IN MISSISSIPPI RICE PRODUCTION. J.A. Bond*, T.W. Walker, J. Manning, L.C. Vaughn; Delta Research and Extension Center, Mississippi State University, Stoneville, MS

ABSTRACT

Glyphosate is the cornerstone of burndown herbicide programs, and it is also relied upon heavily for in-crop weed control in soybean (*Glycine max*) and cotton (*Gossypium hirsutum*). The reliance on glyphosate has placed an exorbitant amount of selection pressure on common weed species. Mississippi populations of horseweed (*Conyza canadensis*), Italian ryegrass (*Lolium perenne* ssp. *multiflorum*), johnsongrass (*Sorghum halepense*), and Palmer amaranth (*Amaranthus palmeri*) have evolved resistance to glyphosate. Glyphosate-resistant (GR) horseweed has become increasingly troublesome for Mississippi rice (*Oryza sativa*) growers over the last four years. Furthermore, rice growers often encounter problems with volunteer GR soybean. Approximately 95% of rice in Mississippi is grown in rotation with GR soybean. Mild, dry conditions during the winter months in Mississippi often stimulate early-spring emergence of volunteer GR soybean from the previous year's crop. Research was conducted in 2007 and 2008 at the Mississippi State University Delta Research and Extension Center in Stoneville to (1) evaluate the efficacy of rice herbicides on GR horseweed, (2) evaluate volunteer GR soybean control with at-planting burndown herbicides, and (3) determine the efficacy of postemergence rice herbicides against volunteer GR soybean. The first study was conducted in a fallow field with a history of GR horseweed. Herbicide treatments included propanil (4.48 kg ai ha^{-1}), quinclorac (0.43 kg ai ha^{-1}), a tank-mixture of propanil plus quinclorac (4.48 plus 0.43 kg ha^{-1}), triclopyr (0.31 kg ai ha^{-1}), bispyribac-sodium (0.033 kg ai ha^{-1}), penoxsulam (0.044 kg ai ha^{-1}), halosulfuron (0.053 kg ai ha^{-1}), and orthosulfamuron (0.074 kg ai ha^{-1}). All treatments were applied to 10- to 15-cm GR horseweed, and control was visually estimated at 7, 14, 21, 28, and 35 days after application (DAT). Only penoxsulam or propanil plus quinclorac provided >60% control 14 DAT. At 21 and 28 DAT, penoxsulam and propanil plus quinclorac controlled more horseweed than all other treatments with control ranging from 80 to 92%. By 35 DAT, horseweed control with quinclorac, propanil plus quinclorac, and penoxsulam was equivalent (77 to 87%), and control following these applications was better than that from all other treatments. At-planting treatments targeting volunteer GR soybean included the maximum labeled rate and one-half the labeled rate of three burndown herbicides. Paraquat (1.05 and 0.53 kg ai ha^{-1}), glufosinate (0.59 and 0.3 kg ai ha^{-1}), and thifensulfuron plus tribenuron (0.031 and 0.016 kg ai ha^{-1}) were applied to volunteer GR soybean in the V4 growth stage the day of rice planting. A nontreated control and weed-free check were included for comparison of rice yields. Control was visually estimated at 7, 14, and 28 DAT. Application rate did not influence volunteer GR soybean control 7, 14, or 28 DAT. Paraquat controlled volunteer GR soybean at least 95% at all evaluations both years. Control with glufosinate was greater in 2007 than 2008 due to rainfall received following application the second year. Thifensulfuron plus tribenuron provided equivalent control both years, but control never exceeded 71%. Rice yields were reduced 16% from season-long volunteer GR soybean interference (weed-free check vs. nontreated control). All plots that received a herbicide application produced rice yields greater than the nontreated control, but only plots treated with paraquat and glufosinate produced yields similar to the weed-free check. Postemergence herbicides targeting volunteer GR soybean were also applied at the maximum labeled rate and one-half the labeled rate. Treatments included propanil (4.48 and 2.24 kg ha^{-1}), bispyribac-sodium (0.038 and 0.019 kg ha^{-1}), penoxsulam (0.049 and 0.025 kg ha^{-1}), halosulfuron (0.071 and 0.035 kg ha^{-1}), and triclopyr (0.43 and 0.21 kg ha^{-1}) applied to volunteer GR soybean in the V5 growth stage. Control was visually estimated at 7, 14, 28, and 56 DAT. Propanil controlled more volunteer GR soybean (79%) than all other herbicides 7 DAT. Control across all herbicides and application rates was equivalent (>95%) 28 and 56 DAT except for propanil, which provided less control than other treatments. Averaged across herbicide and application rate, rice yields were 5% higher in 2008 than 2007. This difference was attributed to greater (20%) volunteer GR soybean density in 2007 than 2008. Horseweed management in rice remains problematic because complete control was not achieved with any herbicides evaluated. If GR horseweed is present at rice planting, quinclorac, propanil plus quinclorac, and penoxsulam are best options for suppression until rice is flooded. Volunteer GR soybean can be effectively managed in rice with at-planting or postemergence herbicide applications. If volunteer GR soybean survives spring burndown application or emerges between that application and rice planting, paraquat or glufosinate (if no rainfall is anticipated) should be applied prior to seeding. If volunteer GR soybean emerges during the interval between rice planting and flood establishment, full or half rates of triclopyr, bispyribac-sodium, penoxsulam, or halosulfuron are the best options for season-long control.

INFLUENCE OF ADJUVANT SELECTION ON BARNYARDGRASS CONTROL WITH CLINCHER IN RICE. J.A. Still*, J.K. Norsworthy, S. Bangarwa, M.J. Wilson, G.M. Griffith, R.C. Scott, L.E. Estorninos; Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR

ABSTRACT

Experiments were conducted for 2 years at Stuttgart, AR, at the Rice Research and Extension Center to determine whether adjuvant selection influences barnyardgrass control with cyhalofop. 'Wells' rice was drill-seeded at 24 seed/ft of row on April 18, 2007, and May 1, 2008, in 7.5-in-wide rows. The test site contained a natural infestation of barnyardgrass and was flooded both years at the 5- to 6-leaf stage of rice. All adjuvants were applied alone or with cyhalofop at 0.28 lb ai/A 14 d after establishment of the permanent flood. The experimental plots were 6 by 25 ft in 2007 and 6 by 20 ft in 2008. Each treatment was replicated four times. The spray volume was 10 gal/A in 2007 and 15 gal/A in 2008. The adjuvants evaluated were Activator 90 at 0.25% v/v, Agri-Dex at 1% v/v, methylated seed oil at 1% v/v, Dash at 1% v/v, DynePak at 2.5% v/v, and UAN (28%N) at 2.5% v/v. Barnyardgrass control and rice injury were rated 2, 3, and 7 weeks after treatment (WAT) in 2007 and 2 and 4 WAT in 2008. No injury to rice was observed either year. Barnyardgrass control was <13% with all adjuvants applied alone at 2 WAT both years. Cyhalofop alone provided 63 to 71% control 2 WAT and 66 to 71% control 3 to 4 WAT. In both years at 2 WAT, no adjuvant applied with cyhalofop improved or reduced barnyardgrass control compared with cyhalofop alone. In 2007 at 3 WAT, UAN applied with cyhalofop resulted in only 48% control, which was statistically less than the 71% control obtained with cyhalofop alone. In 2008 at 4 WAT, barnyardgrass control was 53% following Dash plus cyhalofop, which was less than the 66% control obtained with cyhalofop alone. All other adjuvants in both years applied with cyhalofop resulted in barnyardgrass control comparable to cyhalofop alone at 3 to 4 WAT. Although not statistically different, the addition of crop oil concentrate or methylated seed oil to cyhalofop did result in numerically greater barnyardgrass control at 2 WAT in both years. Currently, the cyhalofop label for rice requires that crop oil concentrate or a methylated seed oil be applied with cyhalofop.

RICE WEED CONTROL IN LOUISIANA. E. P. Webster*; School of Plant, Environmental, and Soil Sciences, LSU AgCenter, Baton Rouge, LA

ABSTRACT

Several studies were conducted at the LSU AgCenter Rice Research Station near Crowley Louisiana in 2008. In these studies grass, broadleaf, and sedge weeds were evaluated for control under differing rice production systems in Louisiana. Tolerance of rice cultivars to Command was also evaluated. In the first study different formulations of propanil were applied at a rate of 3 lb ai/A in combination with imazethapyr at 0.625 lb ai/A sold as Newpath at a rate of 4 oz/A. Each treatment received two applications of Newpath applied early postemergence (EPOST) to two- to three-leaf rice and late POST (LPOST) to four- to five-leaf rice. The propanil formulations were applied in combination with Newpath in the EPOST or LPOST application. The propanil formulations evaluated were Stam M4, Stam SC, Riceshot, Superwham, and Stam EDF. All of the propanil formulations are formulated as 4 lb ai/gal, except Stam EDF is formulated as an 80 WG. A crop oil concentrate was added at a rate of 1%v/v when Newpath was applied alone or when mixed with Stam SC, Superwham, and Stam EDF. When Newpath was mixed with Stam M4 and Riceshot no crop oil concentrate was added. At 5 weeks after the LPOST application red rice control was 95 to 98% for all treatments evaluated. Barnyardgrass control increased when the EPOST application of Newpath was mixed with Stam M4, Stam SC and Riceshot compared with mixing in the LPOST timing. Newpath mixed with a propanil in the EPOST timing resulted in higher rice yields. This was probably due to increased weed control and the elimination of early season weed competition. The second study evaluated the tolerance of different rice cultivars to Command. Command was applied preemergence at a rate of 1 lb ai/A of clomazone. Eight rice cultivars were evaluated: Pirouge, short grain; Neptune, Jupiter, and Bengal, XC-065, XC-068, medium grains; Trenasse and Catahoula, long grains. XC-065 and XC-069 are experimental Clearfield lines. At 21 days after treatment the short grain Pirouge was injured 66% and all the medium grains had injury ratings from 33 to 44%. XC-065 appeared to be slightly more tolerant of Command than the other medium grains evaluated. As with previous research the long grain cultivars are generally more tolerant to Command when compared with the medium and short grain cultivars. Rice yields indicate that early season injury does not correlate into a reduction in yield. This research indicates that weed control options for rice producers will continue to provide options for weed management. In many cases a weed control program can be developed to control most weeds infesting production rice fields.

EFFECT OF RATE AND TIMING ON BROADLEAF WEED CONTROL IN RICE WITH DPX-KJM44.
M.J. Wilson*, J.K. Norsworthy, S. Bangarwa, G. Griffith, J. Still, R. Scott; Crop, Soils, and Environmental Sciences, University of Arkansas, Fayetteville, AR

ABSTRACT

DPX-KJM44 is an experimental auxin-type herbicide that is being considered for development in rice by DuPont Crop Protection. An experiment was conducted in 2008 in Stuttgart with object being to determine the effectiveness of DPX-KJM44 on weeds common to Arkansas rice culture, and the tolerance of rice to the herbicide over a range of rates and application timings. DPX-KJM44 was applied at 0.5 0.75, 1.0, and 1.5 oz ai/A at 20 GPA after planting (PRE), at the 2- to 3-lf stage of rice, 1-d prior to flooding, and 2 weeks after flooding. Triclopyr at 0.25 lb ai/A was applied at the same timings as DPX-KJM44. A nonionic surfactant was added to all postemergence (POST) treatments at 0.25% v/v. Weed control was visually assessed throughout the growing season. Fenoxaprop at 1.2 oz ai/A was applied at the 4-lf stage of rice once it became obvious that DPX-KJM44 was not going to control barnyardgrass, the major grass weed at the test site. DPX-KJM44 provided effective PRE and POST control of hemp sesbania, pitted morningglory (preflood), ducksalad, and eclipta. DPX-KJM44 at all rates provided preemergence control of hemp sesbania (76 to 86%) at 6 weeks after treatment that was superior to triclopyr which provided 45% control. DPX-KJM44 rates ranging from 0.75 to 1.5 oz/A controlled all broadleaf weeds in excess of 80% throughout the season based on assessments taken at least 2 weeks after treatment. Rice showed a high degree of tolerance to DPX-KJM44, with no more than 3% injury observed. Furthermore, the effect of herbicide treatment on rice yields was nonsignificant, with yields ranging from 113 to 152 bu/A for all DPX-KJM44 treatments. Additional research is needed to further define the spectrum of weeds effectively controlled with DPX-KJM44, influence of adjuvant selection on efficacy, safety to rotational crops, and rice tolerance in the absence of weed interference.

WEED CONTROL IN GLUFOSINATE-RESISTANT SOYBEANS. A. Hopkins*, S. Garris, M. Weber, J. Allen; Bayer CropScience, Research Triangle Park, NC

ABSTRACT

Glufosinate-resistant soybeans will gain full commercialization in 2009 with a limited launch in the US. Initial acreage is expected to be about one million with gradual increase expected in subsequent years. Soybean maturity groups are expected to range from 0.5 to 4.8 with well-adapted varieties for the soybean-growing region from the Dakotas through the Midsouth. Since the first introduction of glyphosate-resistant crops in the mid 1990's, US growers have steadily increased the use of glyphosate, a non-selective herbicide, on most broad-acre crops including soybean, corn and cotton in the southern US. Rapid adoption of this technology in the Midwest and Southern US, has contributed to the development of several glyphosate-resistant weed species. Glufosinate has a unique mode of action that can provide an alternative control measure for weeds resistant to glyphosate. A new formulation of glufosinate sold under the trade name IGNITE® 280 Herbicide has been labeled for use on all glufosinate-resistant crops, including soybean, corn, cotton and canola. Glufosinate-resistant crops will be designated as Liberty Link®. Weed control trials for glufosinate-resistant soybeans were conducted by Bayer CropScience, universities and private consultants in the soybean-growing regions of the US. Trials evaluated the use of glufosinate in glufosinate-resistant soybeans for efficacy across a broad spectrum of grass and broadleaf weeds. Weed control was influenced by weed species, herbicide timing and use of a preemergence herbicide. Data from more than 20 trials conducted in the Southern US indicated excellent potential for weed control and soybean tolerance. Several trials conducted in Arkansas focused on performance against Palmer amaranth (glyphosate-resistant and -susceptible). Excellent control was observed in most trials. Best performance was observed where a preemergence herbicide was used prior to two well-timed glufosinate applications. These data also suggest that timing of the postemergence application was the most important factor in performance of glufosinate against Palmer amaranth and other important weed species. Data from trials conducted in the Southern US will be used to establish use recommendations for weeds and situations unique to the Midsouth and Southeastern US.

ROUNDUP READY SOYBEAN: NEXT GENERATION YIELD RESULTS. P. Pedersen*,[1] K. Nelson,[2] W. Wiebold,[2] L. Paul,[3] R. Esgar,[4] S. Conley,[5] J. Gruber,[6] B. Burdick,[2] E. Adee,[3] B. Young,[7] M. Vose,[3] J. Beuerlein,[8] T. Vyn[9]; [1]Iowa State University, Ames, IA, [2]University of Missouri, Columbia, MO, [3]University of Illinois, Urbana, IL, [4]Agronomy, University of Illinois, Urbana, IL, [5]Univeristy of Wisconsin, Madison, WI, [6]Ag Consultants, New Holland, OH, [7]Southern Illinois University, Carbondale, IL, [8]Ohio State University, Columbus, OH, [9]Purdue University, West Lafayette, IN

ABSTRACT

Glyphosate [*N*-(phosphonomethyl)glycine] is a non-selective herbicide that kills both annual and perennial grass and broadleaf weeds, as well as woody species. The development of glyphosate-tolerant crops was pursued in the early 1980's and glyphosate-resistant soybean was one of the first major applications of genetic engineering. Glyphosate-resistant soybean cultivars were adopted very rapidly by U.S. farmers. The major reasons were that it improved soybean management systems by offering the farmer a new wide spectrum weed control option, provided a new herbicidal mode of action for in-season weed control, offered compatibility with minimum or no-tillage conservation systems, and provided cost-effective weed control. Roundup Ready 2 Yield™ (RR2Y) soybeans are the second generation of glyphosate-tolerant soybeans from Monsanto Company and will be released in 2009. Roundup Ready 2 Yield™ soybeans were made possible by using technology that was not available when the first Roundup Ready (RR) products were developed. Gene mapping was used to identify yield positive areas of the soybean genome and then created multiple insertion events were created using *Agrobacterium tumefaciens*, a less disruptive insertion technique. Finally, advanced selection technology was used to select an event with a yield increase over RR soybean. The objective of this study was to evaluate near isogenic lines of the first generation of glyphosate-tolerant soybeans compared with Roundup Ready 2 Yield™ soybeans. Research was conducted at 10 locations in 2007 and 12 locations in 2008 by third-party researchers at Universities or by private consultants. Two near isogenic lines of the cultivar AG3244 (first generation RR and second generation RR2Y) were used in the studies. The experimental design was a 6 by 6 Latin square with the two near isogenic lines nested within each column and row with 6 replicates. Data varied among locations and years because of disease, freeze, flooding, and hail damage. Overall, RR2Y soybeans yielded significantly higher in both years compared to the first generation RR soybeans. It was concluded that the yield improvement from this new technology equates to a 4 to 7 fold increase in soybean yield in a single product introduction over historical average annual yield increases by traditional breeding efforts.

COMPARISON OF PREEMERGENCE HERBICIDE PROGRAMS IN GLYPHOSATE-RESISTANT SOYBEAN. K.W. Bradley*, K.K. Payne; Division of Plant Sciences, University of Missouri, Columbia, MO

ABSTRACT

Field trials were conducted in 2007 and 2008 to investigate the degree and duration of annual grass and broadleaf weed control with a variety of single and multiple ingredient preemergence (PRE) herbicides in glyphosate-resistant soybeans. Each PRE herbicide treatment received a postemergence (POST) application of glyphosate at 0.86 kg/ha once the average size of all grass and/or broadleaf weed escapes reached 15 cm in height. PRE herbicide treatments followed by glyphosate were compared to a standard program consisting of two POST applications of glyphosate. All treatments were arranged in a randomized complete block design with four replications, and individual plots measured 3 by 14 meters in length. In both years, similar broadleaf weed density was observed with a variety of PRE herbicide treatments but only *S*-metolachlor plus fomesafen at 1.2 kg/ha plus 0.27 kg/ha, *S*-metolachlor plus metribuzin at 1.54 kg/ha plus 0.36 kg/ha, and alachlor at 2.2 kg/ha resulted in substantial reductions (46 to 99%) in grass weed density compared to the untreated control at the time of the POST glyphosate application. In 2007, the time required for weed escapes to reach 15 cm in height varied by only 7 days across all PRE herbicide treatments while in 2008 this time period extended to 18 days. In both years, there were no differences in soybean yield between the PRE herbicide treatments followed by glyphosate POST or the sequential POST glyphosate program. Results from these experiments indicate that a variety of current PRE soybean herbicides provide good control of common annual broadleaf weeds, but few provide acceptable control of annual grass species commonly encountered in Midwestern production systems. Additionally, these results indicate the length of residual control and timeframe from PRE herbicide application to POST glyphosate treatment can vary significantly across PRE herbicide treatments in glyphosate-resistant soybean.

FOMESAFEN + GLYPHOSATE: A NEW PREMIX FOR MANAGING GLYPHOSATE RESISTANT WEEDS IN SOYBEAN. E.W. Palmer*, D.E. Bruns, B.D. Black, J.C. Holloway, S.H. Martin, T.H. Beckett, D.J. Porter; Syngenta Crop Protection, Inc., Greensboro, NC

ABSTRACT

Fomesafen + glyphosate is a premix of two proven soybean herbicides developed by Syngenta Crop Protection, Inc. The brand name for this new premix is Flexstar® GT. The Flexstar GT use pattern will be postemergence for control of glyphosate-resistant dicot weeds that require a non-glyphosate component to obtain commercial efficacy. Flexstar GT controls numerous annual broadleaf and grass weeds such as velvetleaf (*Abutilon theophrasti* Medik.), common ragweed (*Ambrosia artemisiifolia* L.), Pennsylvania smartweed (*Polygonum pensylvanicum* L.), barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], broadleaf signalgrass [*Brachiaria platyphylla* (Griseb.) Nash], large crabgrass [*Digitaria sanguinalis* (L.) Scop.], in addition to glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S.Wats.) and tall waterhemp [*Amaranthus tuberculatus* (Moq.) J.D.Sauer]. Efficacy with this premix is comparable to a tank-mixture of protoporphyrinogen oxidase herbicides + glyphosate with the added benefit of convenience and improved crop safety. The market introduction of this novel product concept will help sustain the glyphosate tolerant soybean production system. Flexstar GT Federal registration is projected for April 2009.

HERBICIDE COMBINATIONS WITH SAFLUFENACIL FOR PREPLANT BURNDOWN WEED MANAGEMENT IN SOYBEAN. A.C. Hixson*, J.S. Harden, L.D. Charvat, T.D. Klingaman, W.E. Thomas; Biology, BASF Corporation, Research Triangle Park, NC

ABSTRACT

Saflufenacil is a new herbicide being developed for broadleaf weed control in several crop and non-crop use patterns with federal registration expected in late 2009. Control of sensitive broadleaf weed species is through the inhibition of the protoporphyrinogen IX oxidase enzyme. Field research trials have been conducted across the United States and Canada to evaluate weed control and crop safety of saflufenacil in soybean. Saflufenacil provides rapid burndown of emerged broadleaf weeds when applied in conservation till or no-till soybean management systems. Saflufenacil has been shown to effectively control many key broadleaf species, including glyphosate or ALS resistant biotypes, such as horseweed (*Conyza canadensis*), prickly lettuce (*Lactuca serriola*), common lambsquarters (*Chenopodium album*), ragweed species (*Ambrosia* spp), and pigweed species (*Amaranthus* spp). Research has focused on a burndown use rates of 18-25 g ai/ha. Results indicate that saflufenacil can be tank mixed with glyphosate to increase the burndown weed spectrum to include emerged grasses. Imazethapyr, imazaquin, or pendimethalin can be added to saflufenacil and glyphosate to further extend the residual weed control period up to an in-crop application of glyphosate in glyphosate-tolerant soybean cropping systems. These herbicide combinations with saflufenacil have provided greater than 80% broadleaf and grass weed control for 4 to 8 weeks following application. Research has indicated that soybean tolerance is good to excellent at the planned burndown use rates. Saflufenacil in combination with glyphosate and a residual herbicide can provide an effective treatment for preplant burndown and residual weed control in soybean cropping systems.

EFFECT OF SOIL TYPE, SPRAY AND INCORPORATION METHODS ON WEED CONTROL EFFICACY OF TRIFLURALIN IN COTTON IN N-W INDIA. S. Singh*,[1] S.S. Punia,[1] A. Singh,[2] A.P. Brar,[3] R. Chandolia,[4] E. Dagan,[5] Y. Goldschmidt[5]; [1]Agronomy Department, Haryana Agricultural University, Hisar, India, [2]Agronomy-Extension, Haryana Agricultural University, Hisar, India, [3]Agronomy-Extension, Punjab Agricultural University, Ludhiana, India, [4]Atash International, Mumbai, India, [5]Makhteshim Agan, Tel Aviv, Israel

ABSTRACT

Field studies were carried out in cotton growing regions of Haryana and Punjab States of north-west India during 2008 using trifluralin 1.2 kg ai/ha. Pendimethalin (1.0 kg ai/ha farmers' practice) was compared at six out of 26 locations. Herbicide was applied using backpack sprayer with 3 or 9 nozzle boom (two spray pumps), tractor sprayer (9 and 20 nozzle boom) and incorporated by rotavator, cultivator or disc harrow followed by planker. The experimental plot size (both Bt and non-Bt cotton) ranged from one quarter to three acres for each treatment. Farmers' practice (local tractor sprayer with hollow cone nozzle) was compared with standard sprayer. There were large variations in soil types and weed flora in the plots across the widely scattered region. Observations were recorded on weed species and their control under different treatments 40-50 days after sowing (DAS) and before the harvest of crop. Unsprayed control treatments were maintained for 50 days; later on all the treatments had tractor inter-cultivation or manual weeding. Trifluralin sprayed by flat fan nozzles whether by tractor or backpack sprayer was better than hollow cone nozzle sprayer in controlling the weeds. Trifluralin provided better control than pendimethalin; however, due to incessant rain, weed control efficacy in all the treatments reduced 50 DAS. Incorporation of trifluralin by rotavator had higher weed control efficacy compared to disc or cultivator followed by planker under heavy weed infestation. Similarly, plant height of cotton, branching, number of bolls per plant and lint cotton weight was more in trifluralin incorporated by rotavator than other methods or control plots.

CONTROLLING ALS-RESISTANT PALMER AMARANTH IN VIRGINIA COTTON. D. Holshouser*,[1] H. Wilson[2]; [1]Tidewater AREC, Virginia Tech, Suffolk, VA, [2]Eastern Shore AREC, Virginia Tech, Painter, VA

ABSTRACT

Conservation tillage and cover crops are widely used in Virginia's cotton production system. New infestations of Palmer amaranth is rapidly are being found, indicating a rapid movement of the weed through the state. There is a need to develop to effective Palmer amaranth control options in such systems to prevent further spread of the weed. The objective of this research to determine the benefit of preemergence fluometuron, fomesafen, or pendamethalin applications or a postemergence tank mixture with metolachlor for controlling Palmer amaranth with glyphosate or glufosinate. Liberty-Link and Roundup-Flex cotton was planted in a strip-tillage system containing a rye and vetch cover crop. Only two of the four replications in the glufosinate experiment contained a rye/vetch cover crop, therefore the effect of the cover crop was evaluated. Palmer amaranth populations in this field were resistant to ALS-inhibiting herbicides. All treatments included a layby application of either flumoxazin and MSMA or glyphosate and flumoxazin. Weed control ratings were obtained approximately every 10 days. Greater than 95% season-long control of Palmer amaranth was obtained with glufosinate when preemergence herbicides were used. Greater than 95% control was obtained when glyphosate applied twice or tank-mixed with metolachor or when preemergence herbicides were used. The cover crop increased early season control 18, 11, and 18 percent with no herbicide, glufosinate + metolachlor, or preemergence herbicides, respectively.

LONG-TERM TILLAGE SYSTEMS IN A COASTAL PLAIN COTTON-PEANUT ROTATION. T.M. Webster*,[1] P. Timper,[1] L.M. Sosnoskie[2]; [1]Crop Protection and Management Research Unit, USDA-ARS, Tifton, GA, [2]Crop and Soil Sciences, University of Georgia, Tifton, GA

ABSTRACT

Previous long-term studies have evaluated shifts in weed species composition in response to tillage, crop rotation, and weed management. However, there has been limited research on shifts in weed species composition in long-term cotton-peanut rotations. The objective of this study was to evaluate the influence of three tillage systems on shifts in weed species composition, where weed control programs are based upon weed density thresholds, in a cotton-peanut rotation. The study was established in 2000 into an area with a 15-year history of reduced tillage. Treatments included conventional tillage (CT, moldboard plow followed by two diskings), strip tillage (ST, in-row subsoiler that disturbs a 21 cm band into which the crop is planted, leaving 71 cm undisturbed between crop rows), and no-tillage (NT, undisturbed prior to tillage). Tillage systems were in a cotton-peanut rotation, with each crop and tillage combination occurring each year, with four replications of each combination. In the spring following tillage treatments, five soil cores (each 10.2 cm in diameter) were sampled to a depth of 10.2 cm in each treatment. Soil cores were spread in a thin layer in greenhouse flats and watered frequently to promote weed emergence. Weed emergence was quantified and removed weekly for 10 weeks. Soil samples were dried, mixed, and emergence monitoring repeated for a total of three times. Following crop planting in the field, fluometuron and pendimethalin were applied in cotton PRE; pendimethalin was applied PRE in peanut for the first six yrs and pendimethalin +metolachlor +flumioxazin PRE for the last three yrs. Emerged weed populations were evaluated at least twice each season in peanut (at-crack and POST) and cotton (POST and late Post-directed) to determine herbicide recommendations. Herbicide recommendations were generated using HADSS-Georgia, a decision support system developed at NCSU, with a weed efficacy database tailored to reflect Georgia recommendations. Due to lack of tillage by year interactions, data were presented by tillage system for each crop. There were differences in estimated yield losses (as calculated by HADSS using scouted weed data) among tillage treatments. In cotton, estimated yield loss from HADSS was lowest in CT compared to ST and NT. In spite of these differences, the costs of the weed control systems were similar among tillages. There were a total of 39 POST or Post-directed applications in cotton between 2000 and 2008 (average of 1.4 applications/yr/tillage). Of these 39 applications in cotton: 1) 69% were similar among the tillages, 2) 64% were glyphosate alone, and 3) 79% were single product applications. Averaged over years, cotton yields were similar in ST and CT. Estimated peanut yield losses from HADSS were lower in CT relative to ST. Unlike cotton, the cost of weed control in peanut tended to be less in CT compared to ST. There were a total of 60 at-crack/POST applications (2.2 applications/yr/tillage). Of these 60 applications in peanut: 1) 60% were similar among tillages, 2) 17% were single product applications, and 3) 35% were three-product, 3-mode of action applications. Averaged over years, peanut yields were similar in CT and ST. The most common weeds in the soil seedbank were pink purslane (*Portulaca pilosa*), yellow nutsedge (*Cyperus esculentus*), Palmer amaranth (*Amaranthus palmeri*), and henbit (*Lamium amplexicaule*). In the season following cotton (prior to peanut planting), winter annual weeds were twice as abundant in CT seedbank compared to NT and ST. Following both cotton and peanut, sedges were twice as abundant in ST seedbank compared to CT. Weeds classified as summer species were lower in CT seedbank relative to ST and NT, while small seeded broadleaf weeds were more abundant in CT than ST. The absence of large differences among tillage treatments in terms of crop productivity and potential yield loss could be attributed to several factors. Weeds were managed using thresholds, which likely minimized the ability of troublesome weeds to become problematic. In addition, while disturbance was minimal in ST and NT prior to crop planting, peanut harvest required digging and inverting of the crop. This disturbance could be a factor that promotes vertical soil mixing, mitigating some of the differences among the systems. Finally, cotton and peanut do have different crop canopy architectures and different herbicide tools, but their timing for planting and weed control in the field is nearly synchronous. More diverse rotations that include crops with different temporal patterns of disturbance (i.e. planting, weed control, harvest) may provide greater expected differences in a rotation with either cotton or peanut.

METOLACHLOR FORMULATION AND GROUND COVER EFFECTS ON COTTON AND WEED GROWTH - GREENHOUSE EXPERIMENTS. G.S. Cutts*,[1] T.L. Grey,[2] T.M. Webster,[3] P.M. White,[3] T.L. Potter[3]; [1]Crop and Soil Science, Univeristy of Georiga, Athens, GA, [2]Crop and Soil Science, Univeristy of Georiga, Tifton, GA, [3]USDA-ARS, Tifton, GA

ABSTRACT

With the advent of glyphosate resistant crops, certain weed species have begun to exhibit resistance to glyphosate. This is due to the over-use of a single herbicide with one mode of action, causing selection pressure. Some of the most pervasive resistant weeds have come from the *Amaranthus* family. Metolachlor, a PRE herbicide, provides control of *Amaranthus* species, and is an important tool for managing glyphosate-resistant and/or ALS-resistant *Amaranthus* species in cotton and peanut. Conservation tillage can impede the effectiveness of metolachlor. Studies have shown that the liquid spray form of herbicides can be intercepted by mulch residues, therefore not achieving adequate contact with the soil surface, reducing weed control. Feasible methods of glyphosate and/or ALS-resistant weed control need to be evaluated for uses in conservation tillage systems. Knowing the effects of an alternate mode of action herbicide, such as metolachlor, by various application methods would be beneficial in a conservation tillage system. In order to compare the effects of three formulations of metolachlor as a function of mulch cover, greenhouse experiments were conducted with the following ground covers: no cover, full cover, and simulated strip tillage. Circular pots measuring 30 cm in diameter by 16 cm deep, were filled to a depth of 14 cm with Tifton sandy loam. Rye mulch was collected (from a field planted to a winter cover crop rotation) by clipping plants to the ground and then air dried. Forty gram mulch samples were weighed and then used to cover the potted soil surface (707 cm^2) to a depth of 10 to 13 cm. This was representative of a full ground cover in a no-tillage system. Cotton (*Gossypium hirsutum* L.), Palmer amaranth (*Amaranthus palmeri* L.), and cereal rye (*Secale cereale*) were planted in separate equal thirds of each pot, to a depth of 0.2 to 1.3 cm. For the strip-tillage field simulation, a single row of cotton (4 seed) was planted through the center of the pot, being bordered by two 16.3g samples of rolled rye mulch to a depth of 10 to 13 cm. Palmer amaranth and rye were planted on opposing sides of the cotton row underneath the mulch cover. Metolachlor treatments were applied by impregnation on a clay-alginate bead (MTC), on 10-10-10 fertilizer (IFRT), or sprayed using a water carrier (typical application method). The target application rate of metolachlor in all experiments and treatments was 10 μgrams ai cm^{-2}, or 1.4 kg ai ha^{-1}. Spray treatments were applied using a backpack sprayer calibrated to deliver 140 L ha^{-1}. During the four weeks after application, measurements included stand counts, plant width and canopy height. At four weeks after planting, plants were harvested for biomass by clipping to the soil surface, dried, and then weighed. Pots were then replanted with the same species in the existing soil and herbicide residues; no additional herbicide or fertilizer applications were made. This four week procedure was repeated twice, replanting in existing soil with no further herbicide treatments. Data were analyzed in SAS using PROC MIXED procedure for a factorial arrangement of treatments. The study was conducted twice. Emergence of plant species was examined to determine the effect of metolachlor application method and mulch cover. There was a significant interaction between metolachlor treatment and cotton emergence. Cotton emergence was 92% for spray treatments, 82% for IFRT, and reduced to 72% by MTC. Effective weed control was demonstrated by inhibiting Palmer amaranth and rye emergence across all metolachlor treatments. However IFRT allowed rye emergence of 3%. Mulch cover also had a significant affect. Cotton emergence was 95% for no cover, 80% for full mulch cover, and 71 % for the strip-tillage cover. Emergence reduction from full cover to strip-tillage could be attributed to potential deflection of metolachlor during application by surrounding cover, causing an over-application of herbicide in the cotton planted zone. Metolachlor is not currently registered for PRE application in cotton, due to excessive crop injury. Instead, metolachlor must be applied following cotton emergence, but prior to weed germination. Metolachlor is a valuable alternative mode-of-action to control glyphosate and/or ALS-resistant Palmer amaranth in cotton, controlling weedy species prior to emergence.

EFFICACY OF PENDIMETHALIN IN IRRIGATED COTTON AS AFFECTED BY APPLICATION METHOD. W.B. McCloskey*; Plant Sciences, Univ. of Arizona, Tucson, AZ

ABSTRACT

Experiments conducted in 2004 to 2008 at the University of Arizona Maricopa and Safford Agricultural Centers (MAC and SAC) investigated the early season weed suppression of Palmer Amaranth (AMAPA) and ivyleaf morningglory (IPOHE) resulting from different methods of applying pendimethalin and trifluralin in RR Flex cotton and Liberty Link cotton. The herbicides were simultaneously applied to flat ground and incorporated with a field cultivator or were applied with a roto-mulcher following listing (i.e., bed formation). Another factor investigated was the interaction between planting method (dry plant and irrigated to germination versus planting to moisture) and the application method of the dinitroaniline herbicides. The preplant incorporated (PPI) application of pendimethalin with a field cultivator prior to bed formation provided excellent control of Palmer amaranth (AMAPA) and suppression of ivyleaf morningglory (IPOHE) in terms of both reduced weed density and slower growing weeds. These two effects resulted in a longer early season topical glyphosate or glufosinate application window and improved weed control later in the season. For example at MAC in 2005 at 34 DAP (days after planting), AMAPA plants were 6.8 cm tall with 8.8 leaves per plant and there were 205 plants m^{-2} in the absence of pendimethalin compared to plants that were 2.5 cm tall with 6 leaves per plant with a density of 5.2 plants m^{-2} in the presence of pendimethalin (1.06 kg/ha). Similarly, at 34 DAP, IPOHE plants were 4.8 cm tall with 4 leaves per plant and there were 48 plants m^{-2} in the absence of pendimethalin compared to plants that were 2.0 cm tall with 2 leaves per plant and a density of 13.3 plants m^{-2} in the presence of pendimethalin. The effects of pendimethalin on weed size resulted superior Palmer amaranth control after early season topical herbicide applications and in greater suppression of ivyleaf morningglory after two sequential postemergence herbicide applications (either glyphosate or glufosinate). In a dry-plant experiment at MAC in 2008, the control treatment not treated with a dinitroaniline herbicide contained 85 and 79 AMAPA and IPOHE plants m^{-2}, respectively, 40 DAP (i.e., after the germinating irrigation). Treatments that had pendimethalin (0.92 kg/ha) or trifluralin (0.7 kg/ha) applied with the field cultivator had 0.2 AMAPA plants m^{-2} and 37 and 18 IPOHE plants m^{-2} at 40 DAP, respectively. Similarly, treatments that had pendimethalin (0.92 kg/ha) or trifluralin (0.7 kg/ha) applied with the roto-mulcher after bed listing had 0.8 and 1.3 AMAPA plants m^{-2}, respectively, and 27 and 35 IPOHE plants m^{-2} at 40 DAP, respectively. The herbicide treatments had significantly fewer weeds compared to the control but the differences in AMAPA and IPOHE densities as a function of herbicide application method (field cultivator versus roto-mulcher) were not significantly different. Thus, in furrow-irrigated cotton production systems, growers can eliminate a preplant pass across cotton fields by combining preemergence herbicide applications with roto-mulching that is necessary as a part of bed formation thereby reducing crop production costs.

POLLEN-MEDIATED GENE FLOW AND HYBRIDIZATION BETWEEN CLEARFIELD® WHEAT (*TRITICUM AESTIVUM*) AND JOINTED GOATGRASS (*AEGILOPS CYLINDRICA*) IN A COMMERCIAL PRODUCTION FIELD. A. Perez-Jones*, S. Macnab, C. Mallory-Smith; Crop and Soil Science, Oregon State University, Corvallis, OR

ABSTRACT

Clearfield® wheat (*Triticum aestivum*) carries the *AHASL1D* gene mutation Ser_{653} to Asn of chromosome 6DL, also known as *Imi1*, which confers resistance to the imidazolinone herbicides (e.g., imazamox). This technology allows wheat growers to selectively control jointed goatgrass (*Aegylops cylindrica*), a winter annual grass weed that infest over 3 million ha of winter wheat in the Pacific Northwest and Great Plains regions of the USA. However, jointed goatgrass and winter wheat are closely related. They have the D genome in common and can hybridize and backcross under natural field conditions and set seed. During the summer of 2008, jointed goatgrass by winter wheat hybrids (F_1) were collected from a Clearfield® wheat commercial production field. Four hundred F_1 spikes were evaluated for seed production. The average seed set was 3%, and the average germination of the first-generation backcross (BC_1) seed was 70%. BC_1 plants were grown in the greenhouse and treated with imazamox at 0.026, 0.053, and 0.130 kg a.i. ha^{-1}. The percentage of survival for the BC_1 was 100% at 0.026 and 0.053 kg a.i. ha^{-1}, compared to 10 and 0%, respectively, for a jointed goatgrass collection used as a control. At 0.130 kg a.i. ha^{-1}, the percentage of survival was 55 and 0% for the BC_1 and the jointed goatgrass collection, respectively. Total DNA from 14 F_1 plants and 16 BC_1 plants was extracted. The presence of the *Imi1* imidazolinone-resistance gene was confirmed through a PCR-based allele specific assay in all F_1 and BC_1 plants tested. Three chloroplast and seven nuclear microsatellite markers were used to evaluate the parentage of the 14 F_1 plants and 16 BC_1 plants. All F_1 plants tested had jointed goatgrass as the female parent and wheat as the male parent. All BC_1 plants tested originated from F_1 plants that had jointed goatgrass as the female parent, and had wheat as the male backcross parent. Our results confirm the first report of the presence of imidazolinone-resistant jointed goatgrass by winter wheat hybrids in a Clearfield wheat® commercial production field. The F_1 plants were produced with wheat as the predominant pollen donor, and were able to backcross and set seed producing imidazolinone-resistant BC_1 plants. These results confirm the potential for gene flow from wheat to jointed goatgrass under natural field conditions by hybridization and backcrossing events.

MANAGEMENT OF ITALIAN RYEGRASS (*LOLIUM MULTIFLORUM*) IN WHEAT. R.L. Ritter*, H. Menbere, J. Ikley; Plant Science and Landscape Architecture, Univ of MD, Laurel, MD

ABSTRACT

Studies have been conducted at the Central Maryland Research and Education Center located in Beltsville, MD, for the control of Italian ryegrass in wheat. Early research demonstrated the utility of preemergence (PRE) applications of s-metolachlor or flufenacet+metribuzin for Italian ryegrass control in wheat with minimal injury to wheat. Flufenacet has been examined as a PRE treatment with good Italian ryegrass control. However, wheat injury and resulting yield loss was experienced as rates increased. Pendimethalin was examined as a PRE treatment. Depending upon rate and time of application, it provided good Italian ryegrass control, no wheat injury, and resulted in good yields. KIH-485 has also been examined as a PRE and delayed-PRE herbicide. Injury has been observed with both types of applications, but this may be rain dependent. Also, in some years, better control was obtained with the delayed-PRE applications, but this also may be rain dependent. Mesosulfuron-methyl and pinoxaden have been examined for postemergence (POST) control of Italian ryegrass control in wheat. Both products have provided excellent weed control, good crop tolerance, and resulting good yields. Chlorsulfuron + flucarbazone-sodium have also been investigated for control of Italian ryegrass in wheat. Applications were made early fall, mid-fall, and early spring. Injury was noted with all rates and timings. However, excellent Italian ryegrass control was noted with no loss in wheat yield.

REPLACING CHEMICAL WEED CONTROL WITH ALLELOPATHY IN WHEAT: A CASE STUDY IN PUNJAB, PAKISTAN. Z.A. Cheema*, A. Khaliq, M. Farooq, M.N. Mushtaq; Agronomy, University of Agriculture, Faisalabad, Faisalabad, Pakistan

ABSTRACT

Though herbicides offer effective weed control in most of the field crops nevertheless, their use involves several concerns as development of resistant weed biotypes, ground water pollution and crop and human health hazards. Allelopathy is eco-friendly natural phenomenon having great potential to replace herbicides. Field trials were conducted during 2005-06 and 2006-07 in Punjab, Pakistan to evaluate the potential of sorghum and sunflower allelopathic water extracts in combination with lower isoproturon dose for weed management in wheat. Sorghum and sunflower water extracts were combined with 50-75% less than label dose of the herbicide. Sorghum and sunflower water extract mixture with lower herbicide dose gave weed control comparable to label dose of isoproturon during both the years. Interestingly, during year 2006-07 combination of sorghum and sunflower water extracts with 67% less herbicide dose gave 15% higher grain yield compared with label dose of isoproturon. In crux, use of allelopathy can be employed to reduce herbicidal use for eco-friendly and sustainable weed management in field crops.

TWENTY YEARS OF UNIVERSITY CORN YIELD DATA: WITH AND WITHOUT ATRAZINE. R.S. Fawcett*; Fawcett Consulting, Huxley, IA

ABSTRACT

Efficacy studies reporting corn yields published in the North Central Weed Science Society Research Report were analyzed to calculate average corn yields for treatments either containing atrazine or not containing atrazine. To prevent unequal comparisons, studies and treatments had to meet conservative selection criteria. Treatmants had to control both broadleaf and grass weeds (normally containing at least two active ingredients), and active ingredients had to be currently registered for use and used at label rates. For the 20-year period, 1986-2005, 236 qualifying studies were indentified, with a total of 5,871 qualilfying treatments. For the period 1986-1995, corn yielded an average 6.3 bushels/acre higher or 5.9% higher with atrazine than without. For the period 1996-2005, corn yielded an average 5.4 bushels/acre higher or 4.6% higher with atrazine. For the entire 20-year period, the average yield with atrazine was 5.7 bushels/acre higher or 5.1% higher with atrazine than without. Corn yields with atrazine continued to be higher than with non-atrazine treatments as new active ingredients and new technologies such as herbicide-tolerant corn hybrids were introduced. University researchers have increasingly added atrazine to new active ingredients to improve efficacy. In 1986, 55% of all evaluated treatments in studies contained atrazine. Treatments containing atrazine dropped to 17% in 1995, as many new active ingredients were initially evaluated. However, by 2005, 79% of all treatments in the studies evaluated contained atrazine. Considering the value of increased corn yields with atrazine and the lower cost of atrazine compared to alternatives, atrazine use added an estimated $25.74 per acre income to farmers in 2005, with a total U.S. benefit to farmers of $1.39 billion.

WEED CONTROL, ENVIRONMENTAL IMPACT AND PROFITABILITY OF WEED MANAGEMENT OPTIONS IN GLYPHOSATE-TOLERANT CORN. P.H. Sikkema*,[1] N. Soltani,[1] R.E. Nurse,[2] R.J. Vyn,[1] L.L. Van Eerd,[1] C. Shropshire[1]; [1]Ridgetown Campus, University of Guelph, Ridgetown, ON, Canada, [2]Agriculture Canada, Harrow, ON, Canada

ABSTRACT

Eleven field trials were conducted at various locations in Ontario, Canada over a three-year period (2006 - 2008) to study the effect of various weed management strategies in glyphosate tolerant corn on environmental impact, weed control, corn yield, and profit margin. There was no visible injury with the herbicide treatments evaluated. Results were field specific. At 8 wks after treatment, depending on location, glyphosate EPOST, glyphosate LPOST, dicamba/atrazine plus glyphosate EPOST, isoxaflutole/atrazine PRE fb glyphosate LPOST, and glyphosate EPOST fb glyphosate LPOST provided 45-97, 91-100, 40-98, 97-100, and 98-100% control of annual grasses and 65-97, 69-100, 83-100, 97-100, and 98-100% control of annual broadleaf weeds in glyphosate tolerant corn, respectively. The most consistent weed control was provided by the two-pass programs when a residual herbicide (PRE) was followed by glyphosate LPOST or when a sequential application of glyphosate was applied EPOST followed by LPOST. Yield was reduced as much as 86% when weeds were not controlled. There was no difference in yield among the two-pass herbicide programs evaluated. The isoxaflutole/atrazine PRE fb glyphosate LPOST had the lowest environmental impact of the two-pass herbicide programs evaluated. Among the 11 location-years, treatments that had recurring significantly lower profit margins compared to other treatments were atrazine PRE, s-metolachlor/atrazine/benoxacor PRE, dicamba/atrazine EPOST and glyphosate LPOST. Overall, profit margins tend to be somewhat higher for treatments that included glyphosate applications. On average, the most profitable weed management program in corn was a sequential application of glyphosate.

TOTAL PRE AND TOTAL POST WEED CONTROL PROGRAMS FOR ARKANSAS CORN (*ZEA MAYS*). J.A. Bullington*, K.L. Smith, R.C. Doherty, J.R. Meier; Divison of Agriculture, University of Arkansas, Monticello, AR

ABSTRACT

Weed control is an integral part of an effective corn production system. Traditionally, two or more herbicide applications per season are required to provide effective weed control. The objective of this research was to evaluate weed control with single application herbicide programs. We hypothesize weeds can controlled using a total PRE or a total POST herbicide program. Two field experiments were conducted at the University of Arkansas's Southeast Research and Extension Center branch station near Rohwer, AR on a Desha Silt Loam soil. Experiments were conducted in 2008 using a randomized complete block design with four replications. Pioneer 31N30 was planted in four row plots at 81,000 seeds per hectare on 97 cm beds. All treatments in both studies were applied using an eight nozzle boom and CO_2 propelled backpack sprayer calibrated to apply 112.4 liter per hectare. In both studies, percent control ratings were made for morningglory *Ipomoea lacunosa*, barnyardgrass *Echinochloa crus-galli*, and Palmer amaranth *Amaranthus palmeri*. The PRE study consisted of sixteen treatments including: Untreated Check, atrazine (Aatrex) 1.12 kg ai/ha + COC 1 % v/v applied V4 <Local Standard>, atrazine + S-metolachlor + mesotrione (Lexar) at 2.53 kg ai/ha PRE fb glyphosate(Roundup PowerMax) 0.86 kg ai/ha + Aatrex 1.12 kg ai/ha + COC 1% v/v applied V4 <Local Standard>, atrazine + S-metolachlor (Bicep II Magnum) at 1.57 kg ai/ha + Aatrex 1.12 kg ai/ha, Lexar 3.12 kg ai/ha, mesotrione (Callisto) at 0.21 kg ai/ha, rimsulfuron + nicosulfuron + isoxadifen-ethyl (Steadfast Q) at 0.0481 kg ai/ha, rimsulfuron + thifensulfuron + isoxadifen-ethyl (Resolve Q) at 0.0276 kg ai/ha, acetochlor + atrazine (Harness Xtra) at 3.14 kg ai/ha, isoxaflutole (Balance Flexx) 0.078 kg ai/ha, isoxaflutole + thiencarbazone + safener (Corvus) 0.114 kg ai/ha, dimethenamid-P + atrazine (Guardsman Max) 4.2 kg ai/ha, sulfentrazone (Spartan) at 0.07 kg ai/ha, S-metolachlor (Dual II Magnum) 1.6 kg ai/ha, atrazine (Aatrex) 1.12 kg ai/ha, and metribuzin (Sencor) at 0.105 kg ai/ha. All treatments other than the local standards in the study were applied PRE and received 8.4 cm of rainfall within 7 days after application. The POST study consisted of twenty-five treatments including: Untreated Check, atrazine + S-metolachlor + mesotrione (Lexar) at 2.53 kg ai/ha PRE fb atrazine (Aatrex) 1.12 kg ai/ha + COC 1% v/v applied V4, Lexar 2.53 kg ai/ha PRE fb glyphosate 0.86 kg ai/ha + Aatrex 1.12 kg ai/h + COC 1% v/v applied at V4, S-metolachlor + mesotrione + glyphosate (Halex GT) at 2.2 kg ai/ha + NIS 0.25% v/v, Lexar 3.12 kg ai/ha + glyphosate 0.86 kg ai/ha + COC 1% v/v, S-metolachlor + glyphosate (Sequence) at 1.84 kg ai/ha + Aatrex at 2.24 kg ai/ha, glyphosate 0.86 kg ai/ha and rimsulfuron + nicosulfuron + isoxadifen-ethyl (Steadfast Q) at 0.0481 kg ai/ha, glyphosate 0.86 kg ai/ha and rimsulfuron + thifensulfuron + isoxadifen-ethyl (Resolve Q) at 0.0276 kg ai/ha, glyphosate 0.86 kg ai/ha and mesotrione (Callisto) at 0.21 kg ai/ha, glyphosate 0.86 kg ai/ha and topramezone (Impact) at 0.0164 kg ai/ha, glyphosate 0.86 kg ai/ha and acetochlor + atrazine (Harness Xtra) at 3.14 kg ai/ha, glyphosate 0.86 kg ai/ha and acetochlor + atrazine (Degree Xtra) at 2.24 kg ai/ha, tembotrione + thiencarbazone + safener (Capreno) 0.091 kg ai/ha + atrazine (Aatrex) 0.56 kg ai/ha + COC 1% v/v + UAN 0.985 kg ai/ha, and tembotrione (Laudis) at 0.092 kg ai/ha + COC 1% v/v + UAN 0.985 kg ai/ha. All treatments other than the local standards in the study were applied POST to corn at the V2 or V4 stage. In the PRE study, Palmer amaranth was controlled >90% across all treatments throughout the season. At 57 DAP (days after PRE), pitted morningglory was controlled 83% with metribuzin (Sencor) at 0.105 kg ai/ha, 84% with sulfentrazone (Spartan) at 0.07 kg ai/ha, 84% with atrazine (Aatrex) at 1.12 kg ai/ha, 86% with mesotrione (Callisto) at 0.21 kg ai/ha, 89% with atrazine + S-metolachlor (Bicep II Magnum) at 1.57 kg ai/ha + atrazine (Aatrex) at 1.12 kg ai/ha and > 90% with all other treatments. Barnyardgrass was controlled 62% with Spartan, 64% with Sencor, 74% with Callisto, 79% with Aatrex, 87 % with rimsulfuron + thifensulfuron + isoxadifen-ethyl (Resolve Q) at 0.0276 kg ai/ha, and > 91% with all other treatments. In this study atrazine + S-metolachlor + mesotrione (Lexar) at 3.12 kg ai/ha provided > 97% control of pitted morningglory and barnyardgrass throughout the entire season. In the POST study, Palmer amaranth was controlled >90% across all treatments throughout the season. At 44 DAB / 32 DAC (days after V2 / days after V4) , pitted morningglory was controlled 85% with glyphosate (Roundup PowerMax) 0.86 kg ai/ha and rimsulfuron + thifensulfuron + isoxadifen-ethyl (Resolve Q) at 0.0276 kg ai/ha applied at V2, 92% with tembotrione (Laudis) at 0.092 kg ai/ha, applied at V2, 92% with glyphosate and topramezone (Impact) at 0.0164 kg ai/ha applied at V4, and > 94% with all other treatments applied V2 and V4. Barnyardgrass was controlled 83% with glyphosate and Resolve Q applied at V2, 89% with Laudis applied at V2, and > 95% with all other treatments applied at V2 or V4. In this study atrazine + S-metolachlor + mesotrione (Lexar) at 3.12 kg ai/ha and glyphosate 0.86 kg ai/ha applied at V2 or V4 provided > 98% control of pitted morningglory and barnyardgrass throughout the entire season. In conclusion, these studies show that pitted morningglory and barnyardgrass can be controlled season long with a single application PRE, POST-V2, or POST-V4.

KIH-485 (PYROXASULFONE): BROADLEAF SIGNALGRASS (*UROCHLOA PLATYPHYLLA*) CONTROL WITH EARLY PRE-PLANT APPLICATIONS IN MINIMUM AND CONVENTIONAL TILLAGE CORN. M.E. Kurtz*,[1] Y. Yamaji,[2] Y.T. DeLoach[1]; [1]Mississippi Research Station, K-I Chemical USA Inc., Leland, MS, [2]K-I Chemical USA Inc., White Plains, NY

ABSTRACT

Pyroxasulfone is a pre-emergence herbicide with a broad spectrum of herbicidal activity on grass and broadleaf weeds. It has a wide application flexibility from early pre-plant (EPP) to early postemergence, on a variety of crops. The objective of this study was to evaluate an EPP application for control of broadleaf signalgrass (BRAPP) in minimum-tillage (MT) and conventional tillage (CT) corn. The following herbicides were applied EPP to MT (disked 2X in October 07) and CT (disked 2X in October 07 and 1X on March 28, 08) areas on March 28, 08 on silt loam in Mississippi: pyroxasulfone at 125, 166, 209, and 332 g ai/ha; S-metolachlor at 1423 g/ha; acetochlor at 2233 g/ha; and dimethenamid at 957 g/ha. Paraquat and or glyphosate were used as burndown treatments in early Spring, 08. Corn was planted 35 days after the EPP (DAEPP) application. At 46 DAEPP, BRAPP control was 98-100% with pyroxasulfone in the MT system and 90-100% in the CT system across rates. S-metolachlor provided 80 & 100%, acetochlor provided 13 and 100%, and dimethenamid provided 47 and 100% in the MT and CT systems respectively. COPDI control was 80% or less with all treatments in the MT system. In the CT system, all pyroxasulfone treatments gave 99-100% COPDI control while S-metolachlor, acetochlor and dimethenamid gave 83, 92 & 88% COPDI control respectively. At 81 DAEPP, the X rate of pyroxasulfone 166 g/ha, provided 85% BRAPP control (the 2X rate gave above 95% control on both tillage systems) while S-metolachlor, acetochlor and dimethenamid provided less than 5% BRAPP control. In CT, pyroxasulfone 166 g/ha provided 84% BRAPP control while S-metolachlor, acetochlor and dimethenamid gave 53, 28, and 35% BRAPP control. All treatments gave poor COPDI control in the MT system, while in the CT system, only pyroxasulfone gave acceptable control (98-100%) control with all rates. Based on these results, pyroxasulfone at 166 g/ha on silt loam soil can provide season-long control of BRAPP at about 85% in either tillage system, while competitor products did not last as long in either system. Pyroxasulfone did provided excellent COPDI control preemergence in the CT system. Pyroxasulfone can protect corn from early season grass competition even when applied 35 days EPP in minimum-tillage and conventional tillage. It will become a new tool for corn and soybean growers.

ONE-SHOT WEED CONTROL PROGRAMS IN CORN. L.R. Oliver*,[1] K.L. Smith,[2] M.T. Bararpour,[1] F.H. Lyons, IV[1]; [1]Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR, [2]Southeast Research and Extension Center, University of Arkansas Monticello, Monticello, AR

ABSTRACT

For corn production to be most profitable in the Mississippi Delta region, input costs must be reduced. One input cost that potentially could be reduced is a reduction in herbicide applications. A one-shot herbicide program in corn is designed to reduce input costs by eliminating additional application trips across the field. The objective of a 2-year study was to evaluate the efficacy and crop tolerance of various corn herbicides and tank mixtures for full-season weed control when applied only once. Herbicide programs (25) were evaluated at Fayetteville and Keiser, AR, in 2007 and 2008 on a silt loam and silty clay loam, respectively. Corn (DKC 69-71or DKC 64-79) planting dates ranged from April 24 to May 5. Herbicides evaluated were Aatrex (atrazine), Bicep II Magnum (S-metolachlor + atrazine), Balance Pro (isoxaflutole), Define (flufenacet), Lumax and Lexar (S-metolachlor + atrazine + mesotrione), Callisto (mesotrione), Accent (nicosulfuron), Impact (topramezone), Option (foramsulfuron), Steadfast (nicosulfuron + rimsulfuron), Stout (nicosulfuron + thifensulfuron), Roundup WeatherMax and Touchdown Total (glyphosate), Resolve (rimsulfuron), and Radius (flufenacet + isoxaflutole). The treatments were applied either preemergence (PRE), 2- to 4-inch weeds, or 5- to 8-inch corn. The weed spectrum was pitted (*Ipomoea lacunosa*) and entireleaf (*I. hederacea integriuscula*) morningglory, Palmer amaranth (*Amaranthus palmeri*), velvetleaf (*Abutilon theophrasti*), prickly sida (*Sida spinosa*), and broadleaf signalgrass (*Urochloa platyphylla*). When data were pooled over year and location, all herbicide treatments outperformed the untreated check, which yielded 138 bu/A. Treatments with yield equivalent to the weed-free check (224 bu/A) were Callisto (0.188 lb ai/A), Callisto + Aatrex (1 lb ai/A), Lexar (2.78 to 3.24 lb ai/A), and Lumax (2.46 to 2.96 lb ai/A), PRE; Lexar (2.17 lb/A) or Lumax (1.97 lb/A) + Touchdown Total (0.78 lb/A) or Impact (0.016 lb ai/A) + Aatrex (1.5 lb/A) + COC or Impact + Aatrex (0.5 lb/A) + MSO + AMS or Stout (0.034 lb ai/A) + Callisto (0.047 lb/A) + Aatrex (1.5 lb/A) + COC or Roundup WeatherMax + Aatrex (1.5 lb/A) + COC or Roundup WeatherMax + Radius (0.0412 lb ai/A) + Aatrex (0.5 lb/A) + AMS applied postemergence to 2- to 4-inch weeds; and Roundup WeatherMax (0.75 lb ae/A) or Steadfast (0.0351 lb ai/A) + Aatrex (0.5 lb/A) + COC applied at 5- to 8-inch corn. Aatrex (2.0 lb/A) and Balance Pro (0.074 lb ai/A) + Define (0.64 lb ai/A) applied PRE failed to give acceptable (< 75%) full-season control of broadleaf signalgrass and pitted and entireleaf morningglory. Callisto (0.094 lb/A) with or without Accent (0.015 lb ai/A) + COC applied postemergence to 5- to 8-inch corn failed to control broadleaf signalgrass and reduced corn yield 23 bu/A compared with treatments with Callisto applied PRE. Pitted and entireleaf morningglory and broadleaf signalgrass were the most difficult to control full season. Excellent weed control and corn yield can be obtained with single or tank-mixed herbicides applied only once early in the growing season.

WEED MANAGEMENT IN CORN AND SORGHUM WITH SAFLUFENACIL. C.A. Judge*, S.J. Bowe, L.D. Charvat, T.D. Klingaman, W.E. Thomas; BASF, Research Triangle Park, NC

ABSTRACT

Saflufenacil (BAS 800H) is a selective herbicide currently under development by BASF for preplant and preemergence broadleaf weed control in field corn and grain sorghum. In field research trials across the US from 2005 to 2008, saflufenacil provided residual control (> 80%) of many small- and large-seeded broadleaf weeds including common cocklebur (*Xanthium strumarium*), common lambsquarters (*Chenopodium album*), common ragweed (*Ambrosia artemisiifolia*), giant ragweed (*Ambrosia trifida*), morningglory species (*Ipomoea* spp.), pigweed and waterhemp species (*Amaranthus* spp.), and velvetleaf (*Abutilon theophrasti*). Rates of saflufenacil that have been evaluated were based upon soil texture, organic matter, and length of residual weed control desired ranging from 50 to 125 g ai/ha. In a planned two-pass weed control program, lower rates of saflufenacil have provided residual broadleaf weed control until a postemergence herbicide application (such as glyphosate). At higher rates, saflufenacil has provided residual broadleaf weed control until canopy closure. For broad-spectrum residual weed control, a combination of saflufenacil with dimethenamid-P was evaluated and provided control of many broadleaf, grass, and sedge weeds. In research, corn and sorghum have demonstrated excellent tolerance to saflufenacil applied prior to emergence. Tolerance of sweet corn, popcorn, seed corn, and specialty sorghum to saflufenacil is currently under evaluation.

DELAYED WEED REMOVAL AND NITROGEN STRESS IN GLYPHOSATE-RESISTANT CORN. C.L. Smith*,[1] R.J. Smeda,[2] P.C. Scharf[2]; [1]Mississippi State University, Starkville, MS, [2]University of Missouri, Columbia, MO

ABSTRACT

Nitrogen is an important nutrient in corn production and deficiency can severely limit yield. The introduction of glyphosate-resistant corn has led to greater reliance on post-emergence (POST) weed management, allowing for possible early season weed competition. Our objective was to measure the effect of delayed glyphosate applications on corn nitrogen stress and yield. Studies were established at two locations over two years in Missouri with preplant herbicide treatments to favor grass, broadleaf, or mixed weeds, with a range of post-emergence glyphosate timings in each group. Mixed weed populations had a higher overall biomass than either grasses or broadleaves alone. However, delaying initial weed applications from 5 to 10 cm to 10 to 15 cm did not significantly increase the overall weed biomass of the plot. Grain yield from sequential glyphosate applications were equivalent in weed biomass, yield and independent of timing. Grass weeds were more detrimental to yield than broadleaf weeds. Early season chlorophyll meter readings documented nitrogen deficiency; however readings taken later in the season better documented nitrogen loss over time. Chlorophyll meter readings from corn with grasses and broadleaves often had variations in readings depending on weed size and species, however readings taken at tasseling correlated strongly to the resultant grain yield ($R^2 \geq .84$). Year-end stalk nitrate evaluations were an accurate predictor of grain yield. However differentiation in between treatments was difficult due to unusual weather that likely skewed the data.

DUPONT HERBICIDES WITH MULTIPLE MODES OF ACTION AND FLEXIBLE UTILITY FOR USE ON OPTIMUM® GAT® CORN AND SOYBEAN. D.W. Saunders*, H. Flanigan, M. Holm, K. Hahn, L.H. Hageman, W.J. Schumacher; DuPont Crop Protection, Johnston, IA

ABSTRACT

Corn hybrids and soybean varieties containing the Optimum® GAT® trait will be tolerant to applications of glyphosate as well as a wide range of ALS-inhibitor herbicides. This broad herbicide tolerance will allow the development of new DuPont herbicide blends designed to meet changing weed control needs in row crops. Data will be presented supporting the development of DuPont™ Diligent™, Instigate™ and Trigate™ herbicides that will deliver broader-spectrum weed control, soil-residual activity plus additional herbicidal modes-of-action for difficult-to-control weeds and many herbicide resistant weeds. Weed control data will also be presented which supports the development of DuPont™ Traverse™ and Freestyle™ herbicides. These herbicides will provide additional broader spectrum weed control while maintaining crop rotation and expanded application flexibility. Seed products with the Optimum GAT trait will be available for sale pending regulatory approvals and field testing. New DuPont herbicides for the Optimum GAT trait are not currently registered for sale or use in the United States.

WEED CONTROL IN OPTIMUM GAT CORN AND SOYBEAN IN MISSISSIPPI. J.T. Irby*, D.B. Reynolds; Plant & Soil Sciences, Mississippi State University, Mississippi State, MS

ABSTRACT

Weed control in corn and soybeans has evolved rapidly over the last decade. According to a survey conducted by the United States Department of Agriculture, 23% of corn and 92% of soybean acreage in the United States was planted with herbicide tolerant varieties in 2008 (USDA 2008).These estimates were up from 2001 when only 7% of corn and 54% of soybean acreage was planted using herbicide tolerant varieties (USDA 2008). With this rapid adoption of herbicide tolerant cropping systems, a large focus has been placed on developing new and improved herbicide tolerant technologies. These new technologies include the Optimum® GAT® (Glyphosate ALS Tolerance) trait which is being developed by DuPont Crop Protection. Experiments were conducted in 2008 at the Blackbelt Branch Experiment Station in Brooksville, MS. Pioneer® brand corn and soybean seed containing the Optimum® GAT® trait were planted in 2 row plots that were 30 feet long. Multiple herbicides were applied in order to observe the overall crop tolerance to glyphosate and ALS herbicides as well as the overall weed control achieved from the different herbicide combinations. Visual ratings for crop tolerance and weed control were collected 21, 28, 35, and 42 days after preemergence (PRE) applications and 7, 14, 21, and 28 days after postemergence (POST) applications. With respect to Optimum® GAT® corn, 90% control of pitted morningglory (*Ipomoea lacunosa*) was achieved 42 days after application (DAA) with a PRE application of rimsulfuron at 22.8 grams of active ingredient/hectare (g ai/ha) + 22.8 g ai/ha chlorimuron + 140.1 g ai/ha mesotrione. This herbicide combination also provided 83 and 80% control of large crabgrass (*Digitaria sanguinalis*) and common barnyardgrass (*Echinochloa crus-galli*) at 42 DAA, respectively. Adding metolachlor at 1070.4 g ai/ha to this tank-mixture showed 94% control of pitted morningglory and 96% control of both large crabgrass and common barnyardgrass 42 DAA. A POST application tank-mixture of 870 g ae/ha glyphosate + 17.5 g ai/ha thifensulfuron + 8.8 g ai/ha tribenuron + 13.2 g ai/ha chlorimuron + 1120.8 g ai/ha atrazine applied POST provided 98% control of pitted morningglory, large crabgrass, and common barnyardgrass 28 DAA. With respect to Optimum® GAT® soybeans, 99% control of pitted morningglory and 97% control of both large crabgrass and common barnyardgrass was achieved 42 DAA with a PRE application of rimsulfuron at 17.5 g ai/ha + 17.5 g ai/ha chlorimuron + 70.8 g ai/ha flumioxazin + 870 g ae/ha glyphosate. A POST application of thifensulfuron at 17.5 g ai/ha + 8.8 g ai/ha tribenuron + 5.8 g ai/ha chlorimuron provided 98% control of pitted morningglory and 82% control of both large crabgrass and common barnyardgrass 28 DAA. In summary, no crop injury was observed for any of these herbicide combinations. Excellent weed control for the rated species was achieved with both PRE and POST applications in corn and soybean. Other tank-mixtures showed similar results with no injury to the crop.

OPTIMUM® GAT® HERBICIDE PROGRAMS AS TOOLS FOR MANAGING ALS AND/OR GLYPHOSATE RESISTANT WEEDS. R. Forney*,[1] D.W. Saunders,[2] J. Beitler,[1] S.D. Strachan[1]; [1]DuPont Crop Protection, Newark, DE, [2]DuPont Crop Protection, Johnston, IA

ABSTRACT

As new herbicide tolerance traits are commercialized in row crops, a broader range of herbicide tools for managing resistant weeds will be possible. Improved management tools from DuPont will allow for: a) the choice of the most efficacious active ingredients within an herbicide family independent of native crop tolerance; b) the introduction of new herbicidal modes-of-action not presently available for use on a particular weed problem; and c) the development of new herbicide programs that will integrate multiple herbicide families and sequential application timings to fit local agronomic practices. Weed control strategies developed for managing weed resistance problems in crops containing the Optimum® GAT® trait are founded on three simple fundamentals: 1) Use an effective alternate mode-of-action (MOA) herbicide in addition to ALS and/or glyphosate to control known herbicide-resistant weeds; 2) Include an effective alternate MOA at least every-other year for "at-risk" weeds (per local University experts); and 3) Scout fields to monitor effectiveness of the herbicide program. Products with the Optimum GAT trait will be available for sale pending regulatory approvals and field testing. New DuPont herbicides for the Optimum GAT trait are not currently registered for sale or use in the United States.

UNIVERSITY TRIALS WITH OPTIMUM® GAT® HERBICIDES IN 2008. S.K. Rick*, M.T. Edwards, J.D. Harbour, D.W. Saunders; DuPont Crop Protection, Johnston, IA

ABSTRACT

Weed control programs designed for use on corn and soybean crops containing the Optimum® GAT® trait are under development. Integrated herbicide programs making use of preemergence, postemergence, and 2-pass weed control strategies were evaluated by 25 universities in 2008. Data will be presented supporting the use of Optimum GAT trait crops as new tools for managing weed control needs across the United States. Seed products with the Optimum GAT trait will be available for sale pending regulatory approvals and field testing. New DuPont herbicides for the Optimum GAT trait are not currently registered for sale or use in the United States.

WIDE ROW LUPIN (*LUPINUS ANGUSTIFOLIUS*) SYSTEMS MAY SUSTAIN LUPIN PRODUCTION IN WESTERN AUSTRALIA. A. Hashem*,[1] M. Collins,[2] D. Bowran,[1] P. Blackwell[3]; [1]Centre for Cropping Systems, Department of Agriculture and Food Western Australia, Northam, WA 6155, Australia, [2]Lot 12 York Road, WANTFA, Northam, WA 6155, Australia, [3]PO Box 110, Department of Agriculture and Food Western Australia, Geraldton, WA 6531, Australia

ABSTRACT

Lupin (*Lupinus angustifolius* L) area in Western Australia is rapidly declining mainly due to difficulty in controlling resistant weeds by selective herbicides. Five experiments evaluated alternative weed control options in lupins. sown in 50-80 cm wide rows in WA to evaluate the efficacy of paraquat + diquat and tank mixes of knockdown herbicides with alternative molecules for inter-row weed control, and propyzamide and simazine for intra-row weed control. In Experiment 1, paraquat + diquat at 500 g a.i./ha controlled 93% of the blue lupin and 88% of the wild radish plants, giving 58% greater lupin yield than the untreated control. In Experiment 2, paraquat + diquat at 250 or 500 g a.i./ha controlled 95-100% annual ryegrass on the inter-rows and increased lupin yield by 11-43%. In Experiment 1 and 2, mowing followed by knockdown herbicide (glyphosate or paraquat + diquat) was equally effective on weeds but the effect of mowing time with regard to crop growth stage was not clear. In Experiment 3, propyzamide 1 kg a.i./ha or simazine 1 kg a.i./ha banded on lupin rows at sowing time reduced annual ryegrass density on lupin rows by 55-69%. In Experiment 4, alternative non-selective herbicide molecules from other mode of action, as tank mix with glyphosate or paraquat + diquat provided optimum control of inter-row annual ryegrass in wide row lupins. In Experiment 5 conducted at the farm scale, blue lupin control by glyphosate (94%) and paraquat + diquat (95%) was statistically similar to Boom spray (Farmer practice). The trend in the grain yield of lupin was similar to that of weed control. Results clearly showed that inter-row weed control with paraquat + diquat provided optimum inter-row weed control and increased grain yields in wide row lupins. Although none of the herbicides above are currently registered in lupins, farmers desperately need alternative herbicides like these to sustain the productivity of this important leguminous break crop.

EVALUATION OF GRAIN SORGHUM SENSITIVITY TO SOIL APPLIED LUMAX. M.J. Urwiler*,[1] B. Minton,[2] C.N. Nichols,[3] V.H. Lengkeek,[4] G.D. Vail[5]; [1]Syngenta Crop Protection, Lubbock, TX, [2]Syngenta Crop Protection, Cypress, TX, [3]Syngenta Crop Protection, Lenexa, KS, [4]Syngenta Crop Protection, St. Johns, MI, [5]Syngenta Crop Protection, Greensboro, NC

ABSTRACT

Ten field trials were conducted over a three year period (2006 - 2008) in West Texas and Oklahoma to determine the tolerance of grain sorghum to soil applied Lumax (mesotrione, s-metolachlor and atrazine). Lumax was applied 10-14 days pre-plant or pre-emergence to grain sorghum at 2765 g ai/ha and 5530 g ai/ha. The 2765 g ai/ha rate was considered the standard rate whereas the 5530 gai/ha rate was considered a double rate. In all ten trials, the 2765 g ai/ha rate applied 10 - 14 days pre-plant resulted in little to no crop injury and no yield reduction. In two of the 10 trials, significant crop injury and yield reduction occurred when the 2765 gai/ha rate was applied pre-emergence. In one of these trials, crop injury and yield loss occurred when Lumax was applied to a sandy clay loam soil and wet conditions occurred immediately after planting and application. Lumax will not be labeled for use on grain sorghum in sandy soil types (sand, sandy loam and sandy clay loam). These data demonstrate that Lumax can be safely soil applied to grain sorghum. The data further demonstartes that the safest rate and timing would be 2765 g ai/ha applied 10 - 14 days pre-plant.

POTENTIAL USE OF EPTC IN SUGARCANE. J. Mite*, J.L. Griffin; School of Plant, Environmental, and Soil Sciences, Louisiana State University, Baton Rouge, LA

ABSTRACT

EPTC herbicide, trade name Eptam, was used extensively at one time in corn. Its strength was control of nutsedge and suppression of rhizome johnsongrass and bermudagrass, but its weakness was that it required immediate incorporation into the soil to prevent loss due to volatilization. In sugarcane in Louisiana the most prevalent weeds are johnsongrass, bermudagrass, and nutsedges. During the fallow year when fields are prepared for replanting, efforts are made to reduce populations of troublesome weeds. Glyphosate is used extensively in fallowed fields but is not highly effective on bermudagrass and nutsedges. In 2008 Eptam was labeled for use in fallow ground when applied at least 45 days before planting. In 2007 and 2008 Eptam was evaluated at 2, 3, 4, and 5 pt/A incorporated on pre-formed sugarcane beds using a rolling cultivator or a hipper/bedder. Bermudagrass control at 30 and 45 days after treatment (DAT) did not differ among Eptam rates or between application methods either year. In 2007 Eptam reduced bermudagrass ground cover an average of 78% 30 DAT and 73% 45 DAT, but a reduction in ground cover between Eptam and the nontreated control was not evident in 2008. Because Eptam suppressed bermudagrass growth, the follow up application of glyphosate both years was delayed 14 days compared with a glyphosate alone treatment. Glyphosate was equally effective on bermudagrass whether or not Eptam was used. Johnsongrass control with Eptam was evaluated in 2008 and as observed for bermudagrass, control was not affected by rate or application method. Johnsongrass control with Eptam averaged 83% 30 DAT and 68% 45 DAT. In 2007 when Eptam was incorporated with a bedder, purple nutsedge ground cover was reduced an average of 77%. This level of control is significant considering that glyphosate is not effective on purple nutsedge. An Eptam rate of 2 pt/A was as effective as the higher rates and at a cost of around $10/A would be an economical component of a fallow program utilizing glyphosate products. The two-week delay in the initial glyphosate application when Eptam was used would allow the grower more flexibility in making applications. Eptam is also effective on many vining weeds which would be beneficial. Eptam applied in all fallow experiments did not negatively affect stand establishment of sugarcane. Research is ongoing to determine the value of Eptam application in fallowed fields in regard to weed control in the planted crop. In 2008 Eptam was also evaluated for sugarcane tolerance and weed control when applied at-planting at 3, 5, and 7 pt/A. Treatments were incorporated with a rolling cultivator after sugarcane was planted and covered with 3 to 4 inches of soil. Sugarcane shoot population was not negatively affected by Eptam. However, rainfall has been limited and the effect may not be seen until the next spring when sugarcane emerges from the winter dormant period.

MALE:FEMALE RATIOS IN PALMER AMARANTH AS INFLUENCED BY GLYPHOSATE INDUCED STRESS. R.C. Doherty*, K.L. Smith, J.A. Bullington, J.R. Meier; Southeast Research and Extension Center, University of Arkansas, Monticello, AR

ABSTRACT

Glyphosate-resistant Palmer amaranth is present in Georgia, North Carolina, Tennessee, Mississippi, and in 16 counties in Arkansas. Field observations of mature Palmer amaranth have shown an increase in male plants after surviving glyphosate applications. Resistance can be transmitted through pollen. Incomplete control with a high number of resistant male plants left in an area produces a high concentration of resistant pollen and could enhance the spread of resistance. The objective of this research was to evaluate the influence of sub-lethal glyphosate rates on male:female ratios of Palmer amaranth with varying levels of glyphosate resistance. In October 2008 a greenhouse experiment was established in Monticello, AR at the Southeast Research and Extension Center. Four biotypes were selected with a known percent of the population resistant to a single application of 0.86 g ae/ha of glyphosate. The four biotype populations and percentages were A 0, B 28, C 44, and D 90%. Four-hundred plants from each of the four biotypes were subjected to four separate treatments of 0, 0.14, 0.28, and 0.56 kg ae/ha. Plants were evaluated as alive or dead at 14 days after application. Two-hundred or all surviving plants were then transplanted into 15x15x15cm pots and allowed to grow until in a reproductive stage. The total number of male and female plants for each treatment and biotype were recorded at that time. Male:female ratios of the 0 rate across biotypes were not different from 1:1, thus ratios for all rates were compared to 1:1. Biotypes A and B had no plants survive the 0.28 and 0.56 kg ae/ha rates of glyphosate. Biotype A had 185 and 32 plants survive 0 and 0.14 kg ae/ha respectively. Male:female ratio of biotype A was not influenced by these two glyphosate rates. Biotype B had 144 and 69 plants survive 0 and 0.14 kg ae/ha respectively. Male:female ratio of biotype B was not influenced by these two glyphosate rates. Biotype C had 200, 129, 111, and 77 plants survive 0, 0.14, 0.28, and 0.56 kg ae/ha respectively. Male:female ratio of biotype C was influenced by 0.14 and 0.28 kg ae/ha, with an increase in male plants at both rates. Ratios were not influenced by 0 and 0.56 kg ae/ha rates. Biotype D had 167, 134, 176, and 147 survive 0, 0.14, 0.28, and 0.56 kg ae/ha respectively. Male:female ratio of biotype D was influenced by 0.14 ae/ha, with an increase in female plants. Ratios were not influenced by 0, 0.25 or 0.56 kg ae/ha rates. Male:female ratios can be influenced by glyphosate, but this study suggests that factors other than, or in addition to, glyphosate may cause a shift toward more male plants in a population.

INCREASING WINTER RYE (*SECALE CEREALE*) AND ITALIAN RYEGRASS (*LOLIUM PERENNE* SSP. *MULTIFLORUM*) CONTROL OPTIONS WITH CROP ROTATION. J.A. Bushong*, T.F. Peeper; Plant and Soil Sciences, Oklahoma State University, Stillwater, OK

ABSTRACT

Winter rye (*Secale cereale*) and Italian ryegrass (*Lolium multiforum*) are major winter annual weed problems in winter wheat production in Oklahoma. Both species are well established across the state and are becoming more difficult to control. Italian ryegrass has quickly spread into wheat fields due to its use as a winter forage in neighboring fields. Improperly cleaned equipment such as combines, grain drills, fertilizer spreaders, and trucks contribute to spreading these two grasses. Controlling Italian ryegrass has recently become more difficult due to herbicide resistance and limited herbicide mode-of-action options. A crop rotation with winter canola would improve options for controlling these species. Field experiments are underway to evaluate herbicide programs and a wheat -canola rotation for management of these species. An experiment was established in the fall of 2007 at four sites, three in north central and one in south central Oklahoma. The experimental design at each site is a randomized block with a factorial arrangement of treatment. Factors include herbicide treatment applied to wheat in year one, i.e. untreated, imaxamox, or pinoxaden and crop-herbicide combination for the second year. Crop herbicide combinations in year two include a second year of wheat with the same herbicide treatment as the first year or canola with eight herbicide treatments. Plot size was 1.2 by 7.6 m with four replicates. The plots were established in areas not infested with rye or ryegrass. These weeds were seeded at 16.8, and 11.2 kg ha-1 respectively. Clearfield wheat was seeded at all sites. Imaxamox and pinoxaden were applied and weed densities were determined in the spring of 2008. Plots were harvested in June 2008 and weed seed content determined. In the second crop year one treatment was applied PPI to canola and incorporated with a field cultivator. The seven postemergence treatments were applied at labeled rates in 187 L ha-1 of water carrier plus recommended adjuvants in the fall. All herbicide treatments were applied using a CO2- pressurized backpack sprayer. The first growing season pinoxaden treatments reduced ryegrass but not rye. In contrast imazamox treatments reduced both species. Wheat yields were highest in the imazamox treatments. Visual ratings the second year indicate that all canola herbicide treatments are reducing ryegrass. Weed seed content of harvested grain will be obtained again in June 2009 to identify the most effective control strategies for these species.

SITE SPECIFIC WEED MANAGEMENT (SSWM) - SOUTHERN AUSTRALIAN POTENTIAL WITH ANNUAL RYEGRASS (*LOLIUM RIGIDUM*). S.P. Trengove*,[1] C. Preston,[1] J. Heap,[2] A.H. Mayfield[3]; [1]School of Agriculture, Food & Wine, University of Adelaide, Adelaide, Australia, [2]South Australian Research and Development Institute, Adelaide, Australia, [3]Allan Mayfield Consulting, Clare, Australia

ABSTRACT

Weeds often grow in patches within a paddock. Spraying the whole paddock is the current practice, but there are potential economic and environmental benefits to be gained from SSWM, targeting herbicide control measures only to weed patches. Weed patches of many species have been mapped with varying success in studies worldwide. Interest in SSWM is increasing in Australia and overseas as GPS and Precision Agriculture adoption grows. This paper reports recent Australian field research with SSWM of annual ryegrass. Research in this study has focused on the detection and mapping of ryegrass patches in crops using commercially available crop sensors (CropCircle, GreenSeeker and Yara N-Sensor), and the herbicide treatment decisions for high and low-density ryegrass populations. The commercially available crop sensors measure light reflectance in the red and NIR wavebands. Red light reflectance is sensitive to changes in plant chlorophyll content and NIR light reflectance is sensitive to changes in plant biomass. In cropping situations, variation in plant biomass is a result of two variables - the crop and weeds. At early crop growth stages crop biomass tends to be relatively uniform (with uniform crop densities) with little expression of any underlying soil or landscape variability. Weed biomass at early growth stages varies according to variations in weed plant populations. Therefore, variability in plant biomass mapped with these sensors at early crop growth stages can often be associated with variable weed densities. Ryegrass patches have been successfully mapped in lentil, pea and canola crops at early growth stages in South Australia before crop variability becomes large. As crop growth progresses through the season, variability in crop biomass increases, complicating the detection of weed patches by biomass variation. Herbicide trials conducted in South Australia showed significant advantages in using SSWM for the control of annual ryegrass. At a high density annual ryegrass site trifluralin applied alone at 480 g ai ha^{-1} pre-sowing provided 12% control, while trifularin + triallate (480+500 g ai ha^{-1}) pre-sowing increased control to 72%. However, at a low-density annual ryegrass site mean control was 82% and there was no difference between herbicide treatments. In another trial in lentils, clethodim applied at 60 g ai ha^{-1} post-emergence controlled 99% and 97% of annual ryegrass in both high and low density populations respectively. However, 12 ryegrass plants m^{-2} remained at the high density site compared with 2.3 ryegrass plants m^{-2} at the low density site. Ryegrass head numbers in spring were 83 and 33 heads m^{-2} for the high and low density sites respectively, indicating influence of initial seedling density on seed production potential. Clethodim rates needed to be increased to 84 g ha^{-1} at the high-density site to achieve the level of control provided by 60 g ha^{-1} at the low-density site. To progress these results, further research needs to be conducted into weed detection systems that can map ryegrass in crops at lower densities than is currently being achieved with commercially available crop sensors. Scanning only in the inter-rows is more challenging, but more accurate. More complex systems use both reflectance and image shapes to identify plant type. The more advanced research systems can identify up to 25 weed species.

RYEGRASS TOLERANCE TO HERBICIDES UNDER FIELD CONDITIONS. R.G. Haxton*, T.F. Peeper, A.E. Stone; Plant and Soil Sciences, Oklahoma State University, Stillwater, OK

ABSTRACT

Italian ryegrass (*Lolium multiflorum* L.) infestations continue to increase in winter wheat across the state of Oklahoma. In replicated research conducted annually on various Oklahoma State Univ. Experiment Stations, herbicide resistant ryegrass has not been found. However, increasing grower complaints concerning difficulty in controlling ryegrass suggested that herbicide resistance could be hindering control efforts. Therefore, during May and June, 2008 ryegrass seed samples were collected from 23 Oklahoma counties. Of the 103 samples collected, 79 were randomly collected by the authors as they were encountered while driving, 16 were collected by growers and/or county Cooperative Extension personnel and 5 were collected by grain elevators as they recleaned wheat delivered to them in 2008. A few samples submitted were too immature to germinate, but 98 of the 103 were satisfactory for seeding. A single row of each sample was seeded 30.5 m long at the Cimarron Valley Research Station near Perkins, OK in a Norge loam soil on September 9, 2008. Row spacing was 0.8 m. Nine herbicide treatments were applied to 3 m segments of each row and one segment was left unsprayed. Activating rainfall was received soon after the two preemergence treatments were applied. Seven postemergence treatments were applied 29 days after planting at which time the ryegrass had begun to tiller. All herbicides were applied using a CO^2 backpack sprayer in 187 L ha^{-1} water carrier with appropriate additives at recommended rates. Control was visually estimated 34 days after the postemergence treatments were applied. To simplify presentation to growers, response was categorized as controlled, suppressed, or resistant corresponding to visual ratings of 90 to 100%, 50 to 89%, or less than 50% control, respectively. Using this classification, only 35% of the ryegrass samples were effectively controlled by Group 2 (ALS inhibiting) herbicides and over 50% were resistant. All of the ryegrass was controlled with glyphosate. None of the samples was resistant to the four Group 1 (ACCase inhibitor) herbicides, but diclofop-methyl only suppressed 20% of the samples, indicating that resistance to these herbicides may be developing. Growers often fail to apply herbicides in the fall as recommended because of concerns over later emergence of additional ryegrass plants. Thus, we are continuing to monitor the plots treated with glyphosate for late emerging plants. Some late emergence (emergence more than 63 days after seeding) is occurring in 88% of the lines. Seed of two locally purchased cultivars exhibited no herbicide resistance.

THE INFLUENCE OF APPLICATION VARIABLES ON THE FOLIAR EFFICACY OF SAFLUFENACIL ON HORSEWEED (*CONYZA CANADENSIS*). T.G. Mellendorf*, B.G. Young, J.L. Matthews; Plant, Soil and Agricultural Systems, Southern Illinois University, Carbondale, IL

ABSTRACT

Application variables can have a significant influence on the efficacy of foliar applied herbicides, therefore, greenhouse studies were conducted to evaluate the effects of light intensity, temperature and adjuvant on the foliar efficacy of saflufenacil on horseweed. To evaluate light intensity, horseweed were grown in the greenhouse and placed in a growth chamber with a light intensity of 300 or 1000 µmol/m^2/s for 24 hours prior to and following the herbicide application. Similar procedures were used to evaluate differences between 10 and 27 C. A dose-response of seven rates of saflufenacil (0.0781, 0.1563, 0.3125, 0.625, 1.25, 2.5, and 25 g ai/ha) was repeated with non-ionic surfactant (NIS) and crop oil concentrate (COC) to evaluate the effects of adjuvant on saflufenacil efficacy. For all three experiments visual evaluations of control were taken at 1, 3, 7, and 14 days after treatment (DAT) and plant shoots were harvested for dry weight determination at 21 DAT. Significant horseweed injury in the form of necrosis and stunting was visible within 1 DAT. Horseweed control from saflufenacil was similar for both light intensities at 1 DAT. Saflufenacil had up to 20% greater activity on horseweed plants under low light compared with high light at 3, 7, and 14 DAT. Saflufenacil applied under low light conditions resulted in plant growth reduction of 55% and under high light conditions plant growth reduction was only 44%. Initially, the activity of saflufenacil was greater under high temperature compared with low temperature at 1 and 3 DAT. However, at 7 and 14 DAT this trend was reversed as horseweed control was slightly greater from saflufenacil applied under low temperatures versus high temperatures. Dry weights indicated that temperature had no influence on horseweed control from saflufenacil by 21 DAT. Based on regression analysis and estimates for GR_{50} values, the sensitivity of horseweed was 36% greater when saflufenacil was applied with COC versus NIS.

SYNGENTA AND UNIVERSITY GENERATED DATA. J.C. Sanders*,[1] T.H. Beckett,[1] H.H. McLean,[2] B.W. Minton,[3] J.C. Holloway[4]; [1]Syngenta Crop Protection, Greensboro, NC, [2]Syngenta Crop Protection, Perry, GA, [3]Syngenta Crop Protection, Cypress, TX, [4]Syngenta Crop Protection, Jackson, TN

ABSTRACT

Data utilized by Syngenta are generated either by internal field scientists, private contract research organizations, or university scientists. Experiments are coordinated with university scientists by way of local Syngenta field scientists as a result of strategic planning. University scientists are typically selected for placement of experiments because of specialized expertise, access to herbicide-resistant weeds, or the need for familiarity with a new active ingredient or formulation prior to labeling and market launch. Other reasons that experiments are placed with particular university scientists include ability to provide unbiased comparisons, insight to grower practices or problems, crop expertise, weed expertise, geographical expertise, creative insight, or ability to conduct complex studies. Unless specified differently in a legal contract, Syngenta may not have exclusive ownership of data generated by universities. Consequently Syngenta strives to the best of its ability to respect the ownership of data generated by universities. Should Syngenta desire to include university generated data in sales and marketing related materials, permission is sought and received prior to this type of utilization. The data generated by university scientists commonly contribute to important business decisions made by Syngenta. Recognizing the importance of university generated data, Syngenta takes great care and diligence in obtaining, processing, protecting, and storing all data. Maintaining existing relationships and building new relationships with university scientists are vital to Syngenta's effort to access data from the public sector in the present and future.

INTRODUCTION TO WOLVERINE - A NEW HERBICIDE FOR GRASS AND BROADLEAF WEED CONTROL IN NORTHERN PLAINS CEREALS. M.D. Paulsgrove*, J. McGregor, D.W. Maruska, K.B. Thorsness, M.C. Smith; Product Development, Bayer CropScience, RTP, NC

ABSTRACT

Wolverine™ herbicide is a new postemergence grass and broadleaf herbicide developed by Bayer CropScience for use in spring wheat, durum, winter wheat, and barley. Wolverine is formulated as an emulsifiable concentrate containing pyrasulfotole, bromoxynil, fenoxaprop p-ethyl and herbicide cereal safener, mefenpyr-diethyl. This unique combination of active ingredients provides consistent broad spectrum grass and broadleaf weed control with excellent crop tolerance. Rapid microbial degradation is the primary degradation pathway for pyrasulfotole in the soil environment, with no appreciable soil activity from fenoxaprop or bromoxynil. The crop rotation profile allows re-cropping nine months after application to all of the major crops grown in the northern cereal production area. Wolverine will be labeled on 63 different weed species with many of them common in the northern cereal production area of the United States. Wolverine provides control of key grass and broadleaf weeds such as wild oat (*Avena sativa*), yellow foxtail (*Setaria pumila),* green foxtail (*Setaria viridis),* kochia (*Kochia scoparia),* pigweed sp. (*Amaranthus sp.),* wild buckwheat (*Polygonum convolvulus),* common lambsquarters (*Chenopodium album),* mustard sp.(*Brassica sp.),* Russian thistle (*Salsola kali),* field pennycress (*Thlaspi arvense),* prickly lettuce (*Lactuca serriola),* tall waterhemp (*Amaranthus tuberculatos),* white cockle (*Melandrium noctiflorum),* and nightshade sp (*Solanum sp.).* Trial results from 2007 and 2008 show 2 liters of Wolverine ha-1, delivering a dose of 272 g ai ha-1 applied to grass weeds between the 1 leaf and 2 tiller stage of growth or broadleaf weeds between the 1 - 8 leaf stage of growth (depending on weed species) controlled kochia, Russian thistle, wild buckwheat, common lambsquarters, redroot pigweed (*Amaranthus retroflexus),* common sunflower (*Helianthus annuus),* wild mustard (*Sinapis arvensis),* green foxtail, yellow foxtail and wild oat equal to or greater than 89%. Control of sulfonylurea resistant weeds such as kochia, prickly lettuce and Russian thistle biotypes was confirmed in field trials. Wolverine has been tested 24 different varieties of spring wheat, durum wheat, and barley. Crop tolerance at 1x and 2x rates was excellent with no negative yield impacts at 2x rates on varieties tested. Broad spectrum weed control across a wide range of grass and broadleaf weeds with excellent crop safety will make Wolverine a safe and easy to use tool for cereal grain farmers.

EARLY-SEASON APPLICATIONS OF CHLORIMURON FOR WEED CONTROL IN PEANUT: ARE THE BENEFITS WORTH THE RISK? W.C. Johnson, III*; Crop Protection and Management Research Unit, USDA-ARS, Tifton, GA

ABSTRACT

Chlorimuron is applied mid-season to control Florida beggarweed in peanut. Chlorimuron can be applied from 60 days after emergence (DAE) until 45 days prior to harvest. Applications are restricted to this time interval since peanut is more tolerant of chlorimuron applied mid-season than when applied early-season. However, Florida beggarweed are often too large for consistent control once peanut are old enough for treatment. Trials were conducted from 2006 to 2008 in Georgia to determine if the benefit of controlling smaller Florida beggarweed with chlorimuron applied earlier in the season compensates for the risk of significant peanut injury. Main plots were chlorimuron (9 g ai/ha) applied at 21, 35, 49, 63, 77, and 91 (DAE). Additionally, flumioxazin (0.094 kg ai/ha) PRE was included as a standard treatment for Florida beggarweed, along with a nontreated control. Main plots were split into subplots; weed-free and weeds present. Florida beggarweed was the predominant dicot weed in these trials. The only herbicide treatment that effectively controlled Florida beggarweed was flumioxazin PRE. While chlorimuron is registered on peanut specifically for Florida beggarweed control, visual control ratings ranged from 38 to 67%. Chlorimuron applied at 21 and 35 DAE was more efficacious than chlorimuron applied at later dates. In plots with weeds present, peanut treated with chlorimuron at any time of application yielded less than peanut treated with the standard of flumioxazin PRE. In plots that were maintained weed free, peanut treated with chlorimuron at any of the times of application yielded less than peanut treated with the standard of flumioxazin PRE. These data indicate that chlorimuron can be applied earlier than 60 DAE and provide better Florida beggarweed control with greater peanut yields than when applied at the recommended time intervals. However, Florida beggarweed control and peanut yields from any of the chlorimuron treatments were consistently less than the standard of flumioxazin PRE.

EFFECT OF HAIRY NIGHTSHADE IN THE EPIDEMIOLOGY OF POTATO VIRUSES AND THE BIOLOGY OF APHID VECTORS IN IDAHO. J.M. Alvarez*; PSES, University of Idaho, Aberdeen, ID

ABSTRACT

Potato virus Y (Potyvirus: *Potyviridae*) (PVY) and *Potato leafroll virus* (PLRV) are the most economically important viruses affecting the potato production in the United States. Both viruses are vectored by aphids. The current Pacific Northwest management plan for these viruses is not always effective and calls for expensive and environmentally challenging control measures. Even the most intense aphid control may not prevent spread of the viruses unless measures are also taken to keep virus-source plants within and outside the crop at a minimum. Hairy nightshade, *Solanum sarrachoides* (Sendtner), a prevalent and difficult to control annual solanaceous weed in the Pacific Northwest, can be infected with the two viruses and is a preferred host for the most efficient aphid vectors. The role of hairy nightshade as potential inoculum source for PVY and PLRV into the potato crop was investigated with a series of laboratory and field experiments for three years. Aphid counts and disease progression were monitored in the field at weekly intervals. This research shows that the most efficient aphid vectors prefer nightshade over potatoes and reproduces up to 50 percent higher on the weed than on potatoes. Laboratory experiments confirmed that aphids can transmit PLRV to hairy nightshade and that non-viruliferous aphids can become viruliferous after feeding on infected nightshades. Transmission from hairy nightshade to potato is four times the rate of potato to potato or potato to hairy nightshade. Field results revealed that whenever nightshades are present in potato fields, there are higher densities of aphid vectors and consequently higher PLRV and PVY infection rates on potato. These findings thereby suggest that *S. sarrachoides* might play a major role in the epidemiology of potato viruses and the management of this weed should be included in the management plan of viruses in the potato ecosystem.

INPUT REDUCTION IMPACTS ON WEEDS AND CROP YIELDS IN BARLEY (*HORDEUM VULGARE*) AND CANOLA (*BRASSICA NAPUS*). N. Harker*,[1] S. Brandt,[2] E. Johnson,[2] J. O'Donovan,[1] R. Blackshaw,[3] K. Turkington,[1] R. Kutcher[4]; [1]Agriculture & Agri-Food Canada, Lacombe, AB, Canada, [2]Agriculture & Agri-Food Canada, Scott, SK, Canada, [3]Agriculture & Agri-Food Canada, Lethbridge, AB, Canada, [4]Agriculture & Agri-Food Canada, Melfort, SK, Canada

ABSTRACT

Inputs can play a key role in weed and crop yield outcomes as well as net returns. A study was conducted at six western Canada locations (Lacombe, AB; Lethbridge, AB; Beaverlodge, AB; Fort Vermilion, AB; Scott, SK; and Melfort, SK) to determine the impact of crop input levels on weed biomass and crop yields in a barley-canola rotation with each rotation phase present each year. Inputs and their respective levels were as follows: cultivar (barley - 'AC Metcalfe' or 'Harrington', canola - 'InVigor 5020' or '84S00LL'), seeding rate (barley - 150 or 300 seeds m^{-2}, canola - 75 or 150 seeds m^{-2}), fertilizer rate (0, 50, or 100% of recommended), and herbicide rate (0, 50, or 100% of recommended). Higher levels of individual inputs were added to the lowest input combination and lower levels of individual inputs were removed from the highest input combination in each crop. All possible treatment combinations were not employed. The same input levels were applied to the same plots for four consecutive years. Cultivar choice was more important for maximum yields in canola, where a hybrid cultivar was compared to an open pollinated cultivar, than in barley where both cultivars were non hybrids. Higher crop seeding rates did not always lead to higher crop yields but often improved weed management. At most sites, low fertilizer inputs did not influence crop yields in the first year, but were more detrimental in succeeding years. Crops without herbicides were severely compromised by weeds. However, in many cases, crops with 50% of the recommended herbicides had similar weed control and yields as those with full herbicide rates. High input levels were more necessary for high net returns in canola than in barley.

RESPONSE OF 98140 CORN (*ZEA MAYS*) WITH GAT4621 AND HRA TRANSGENES TO GLYPHOSATE AND ALS-INHIBITING HERBICIDES. J.M. Green*,[1] T. Hale,[1] M.A. Pagano,[1] J.L. Andreassi,[2] S.A. Gutteridge[2]; [1]Herbicide Trait Discovery and Gene Shuffling, Pioneer Hi-Bred International, Inc., Newark, DE, [2]Chemical Genomics, DuPont Crop Protection, Newark, DE

ABSTRACT

The transgenic corn line, 98140, has a high level of resistance to glyphosate and all five chemical classes of herbicides that inhibit acetolactate synthase (ALS). The dual herbicide resistance is due to a molecular stack of two constitutively expressed genes, *gat4621* that produces a glyphosate acetyltransferase that rapidly inactivates glyphosate and *hra* that produces a highly resistant ALS. On a rate basis, the positive 98140 isoline with a single copy of the *gat4621* gene is over 1000-fold more resistant to glyphosate than a negative isoline without the transgene. Similarly, the positive 98140 isoline with the *hra* gene is over 1000-fold more resistant to key ALS-inhibiting herbicides such as chlorimuron at the whole plant and enzyme level. The *gat4621* and *hra* genes do not change the natural tolerance of corn to selective herbicides so new corn hybrids based on 98140 will give growers more options to manage weeds and delay the evolution of herbicide-resistant weeds.

ALFALFA FORAGE AND SEED CROP TOLERANCE TO FLUMIOXAZIN. R. Boydston*; USDA-ARS, Prosser, WA

ABSTRACT

Weed control is an important component of producing high quality and high yielding alfalfa seed and forage. Flumioxazin was evaluated for weed control in alfalfa forage and seed production in 2007 and 2008 in Washington State. Flumioxazin applied at 0.14 and 0.28 kg ai/ha plus paraquat in February to dormant alfalfa planted the previous fall inhibited early growth of alfalfa and forage yields of the first cutting in 1 of 2 years. Early growth of alfalfa planted September 5 or later tended to be inhibited by flumioxazin more than alfalfa planted August 15 in both years. Alfalfa forage yield of the second cutting was not reduced by flumioxazin. Forage yield of established alfalfa treated with flumioxazin at 0.14 kg ai/ha plus paraquat at 0.56 kg ai/ha in February was similar to that treated with currently registered herbicides. Established alfalfa treated with flumioxazin at 0.14 kg ai/ha or 0.28 kg ai/ha plus paraquat in February produced seed yields similar to treating with other currently registered preemergence herbicides or paraquat alone.

BURNDOWN CONTROL OF FALL GERMINATING WEEDS WITH BAS 800H AS INFLUENCED BY THE TYPE OF ADJUVANT. S. Knezevic*,[1] J. Scott,[1] L. Charvat[2]; [1]UNL, Concord, NE, [2]BASF, Lincoln, NE

ABSTRACT

BAS 800H is a new herbicide under development for broadleaf weed control in various crops. Field studies were conducted in the Fall of 2005 and 2006 with the objective to describe dose-response curves of BAS 800H applied POST on 10-15 cm tall weeds. A total of six BAS-800H rates, ranging from 0 to 100 g ai/ha, were used alone or tank mixed with glyphosate (870 g ae/ha), NIS (0.25 % v/v), COC (1% v/v), or MSO (1% v/v). An effective dose (ED) that provided 90% control (e.g., ED90) was determined for each weed species using R software and drc package. In general, preliminary data suggested that MSO provided the most enhancement of BAS 800H. The ED90 values for common dandelion (*Taraxacum officinale*) at 14 DAT were 54, 96, 48, 40, and 99 g /ha of BAS 800H applied tank mixed with glyphosate, NIS, COC, or MSO, and BAS 800H applied alone, respectively. The ED90 values for henbit (*Lamium amplexicaule*) were 41, 87, 45, 32, and 95 g /ha of BAS 800H tank mixed with glyphosate, NIS, COC, MSO, and BAS 800H alone, respectively. Similar trends in ED90 values were observed for field bindweed (*Convolvulus arvensis*), prickly lettuce (*Lactuca serriola*), and shepherd's-purse (*Capsella bursa-pastoris*), suggesting potential use of this new compound for fall control of many broadleaf weeds. sknezevic2@unl.edu

RAPID HERBICIDE RESISTANCE EVOLUTION IN *LOLIUM* FROM FIELD RECURRENT SELECTION (WHEAT CROP) AT REDUCED RATE OF DICLOFOP-METHYL. S. Manalil Velayudhan*, R. Busi, S.B. Powles; Western Australian Herbicide Resistance Initiative, University of Western Australia, Perth-WA, Australia

ABSTRACT

Low herbicide rates can rapidly select for herbicide resistance. We have documented in controlled conditions by recurrent selection of a herbicide-susceptible population of *Lolium rigidum* the potential for a low rates of diclofop-methyl to lead to high level herbicide resistance. Here, we conducted two consecutive cycles of selection at sub-lethal rates of diclofop-methyl, contrasting field (wheat crop) versus controlled conditions (plants grown in pots). In this field study with a wheat crop, a dose corresponding to 75% of the recommended rate (281 g ha^{-1}) was applied to a herbicide-susceptible *Lolium* population. Survivors were allowed to cross-pollinate and the first seed generation was collected. Dose-response studies exhibited significant increase in resistance compared to the originator unselected population. A second cycle of selection was conducted at the recommended label rate on the once-selected progeny grown again on the same wheat field. The twice-selected wheat field progeny exhibited four-fold increase in survival, expressed as LD_{50} values ratio, when compared to the unselected population. When done in more controlled conditions (field-grown potted plants), selection was initially conducted at 50% of the label rate (188 g ha^{-1}) resulting in 10% survival. Survivors were bulk-crossed excluding foreign pollen introgression. The once-selected progeny showed a significant shift towards resistance. This selection, similarly to the wheat field experiment, was repeated at the recommended label rate of diclofop-methyl (375 g ha^{-1}), resulting in 12% survival. The twice-selected progeny exhibited a LD_{50} 17-fold greater than the original susceptible population. Cross-resistance profiling of both the twice-selected generations from the wheat field and pot studies revealed a substantial level of resistance to two other ACCase herbicides (haloxyfop and fluazifop-butyl) and cross-resistance to the dissimilar ALS herbicides chlorsulfuron and imazethapyr. Therefore, selection of high level of resistance to diclofop-methyl in the herbicide-susceptible population WALR1 is consistent with results we obtained earlier with another susceptible population (VLR1). Likely the selected resistance is polygenic due to accumulation of minor genes. However, due to the magnitude of the resistance level observed, our results suggest this is not a population-dependent phenomenon. Resistance was rapidly selected by sub-lethal rates of diclofop-methyl in both a crop environment or in field-placed potted plants. Despite the much higher number of individuals treated in the wheat field versus the pot experiment (100000 vs. 200) the evolutionary process in the field conditions was slower. This was expected and likely it may be due to the late emergence of susceptible unselected plants and subsequent introgression of susceptible pollen. A similar cross-resistance pattern to other ACCase and ALS herbicides was detected in the twice-selected lines of both wheat field and pot experiments. This may be due to enrichment and accumulation under diclofop-methyl selection of gene traits (suspected P450 genes) endowing resistance to different herbicides by enhanced rates of metabolism. Therefore, use of sub-lethal herbicide rates is risky and should be avoided by farmers. High level of resistance may be selected in only a few generations. Cross-resistance to other herbicides may have detrimental consequences on resistance management.

PERFORMANCE OF GLYTOL AND GLYTOL + LIBERTYLINK COTTON TECHNOLOGIES IN THE US.

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ABSTRACT

Bayer CropScience has developed in-house glyphosate tolerant, Glytol® cotton (event GHB614), expressing the 2*mepsps* gene and stacks of GlyTol® with LibertyLink® cotton (event LL25). Contingent upon regulatory approval, Glytol® cotton is planned for commercial release in 2009 and will provide US cotton growers with new cotton varieties with season-long tolerance to a number of commercial formulations of glyphosate herbicide. Glytol® + LibertyLink® cotton is planned for commercial release in 2010, pending regulatory approval, and will provide US cotton growers with new cotton varieties with season-long tolerance to a number of commercial glyphosate herbicide formulations as well as tolerance to Ignite® herbicide at levels producers are accustomed to in current commercial LibertyLink varieties. Extensive field testing of Glytol® cotton was conducted with University cotton specialists and weed scientists in 2006-2008 and with GlyTol + LibertyLink® in 2008. These trials have recorded no adverse effects on Glytol® or Glytol + LibertyLink cotton plant establishment, plant height, maturity, vigour, yield or quality following multiple applications at full rates of a number of commercial formulations of glyphosate. Results of replicated field trials conducted with Glytol® and Glytol + LibertyLink technology cotton across the United States cotton belt in 2007 and 2008 are presented here. Once approved and available in elite germplasm, Glytol® technology will provide US cotton growers with the ability of over the top applications of more than one formulation of glyphosate herbicide. Once approved and available in elite germplasm, Glytol® + LibertyLink® technology will provide US cotton growers with the option of over the top applications from more than one herbicide mode of action.

GROWER'S PERCEPTIONS ON HERBICIDE RESISTANCE MANAGEMENT STRATEGIES BASED ON EXPERIENCE WITH HERBICIDE RESISTANT WEEDS. W. Givens*,[1] D. Shaw,[1] M. Newman,[1] W. Johnson,[2] S. Weller,[2] B. Young,[3] R. Wilson,[4] M. Owen,[5] D. Jordan[6]; [1]Plant and Soil Sciences, Mississippi State University, Mississippi State, MS, [2]Purdue University, West Lafayette, IN, [3]Southern Illinois University, Carbondale, IL, [4]University of Nebraska, Scotts Bluff, NE, [5]Iowa State University, Ames, IA, [6]North Carolina State University, Raleigh, NC

ABSTRACT

A survey was conducted by phone to 1,195 growers in six states (Illinois, Indiana, Iowa, Mississippi, Nebraska, and North Carolina) during the winter of 2005-2006. The survey measured producers' cropping history, perception of glyphosate-resistant weeds, past and present weed pressure, tillage practices, and herbicide use as affected by the adoption of glyphosate-resistant (GR) crops. This paper describes grower perceptions of glyphosate-resistant weeds and glyphosate resistance management. The growers who participated in the survey were asked if they were aware of the potential for weeds to develop resistance to glyphosate herbicide. If a grower answered no, they proceeded to the end of the survey. If a grower answered yes, they proceeded on the next series of questions. Results from the survey show that only 24% of the growers answered "yes". Approximately 2% of the growers answered "no" and, 74% of growers did not answer the questions. Responses to subsequent questions were not logged for growers who did not respond or answered "no". The remaining results are reported based on the 24% of growers who were aware of the potential for weeds to develop resistance to glyphosate herbicide. Growers were then asked to rank how serious a problem resistant weeds were on a scale from 1-10 with 1=not serious to 10=very serious. Results from the survey indicate that 11% gave a ranking of 10, 13% gave a ranking of 8, 18% gave a ranking of 5, 11% gave a ranking of 3, and 13% gave a ranking of 1. When growers were asked if they were aware of documented cases of glyphosate weed resistance in their state, 42% of growers answered "yes", while 58% of growers answered "no". Responses to specific weed species in their state with documented glyphosate resistance include horseweed (39%), waterhemp (20%), and pigweed (14%). Growers were also asked to list seven sources used for obtaining information about weed resistance to glyphosate herbicide. Of the total responses, 39% listed farm publications, 19% listed dealers/resellers, 14% listed university/extension, and 11% listed other. Other responses included other farmers, Monsanto, experience, TV, radio, and Syngenta. Base on preliminary results, the majority of growers 76% are not aware on glyphosate resistance in weeds. Of the percentage of growers aware of glyphosate resistance in weeds, only 62% ranked a "5" or higher for how serious a problem they believed resistant weeds to be. These results are surprising, considering the weed species that have developed resistance to glyphosate. Growers listed farm publications, dealers/retailers, and university/extension as their 3 primary sources of information concerning weed resistance issues. Results from this survey suggest that researchers and extension weed scientists and agronomist must be more deligent and proactive when it comes to weed resistance to glyphosate. Further research needs to done to re-evaluate grower perceptions in light new species that have documented resistance to glyphosate.

CONTROL OF GLYPHOSATE RESISTANT WEEDS IN NO-TILL ROUNDUP READY SOYBEANS WITH IGNITE. J. Ellis*,[1] L. Steckel,[2] R.C. Scott,[3] A. Hopkins[4]; [1]Agricenter International, Memphis, TN, [2]University of Tennessee, Jackson, TN, [3]Division of Agriculture, University of Arkansas, Little Rock, AR, [4]Bayer CropScience, RTP, NC

ABSTRACT

Management of glyphosate-resistant horseweed has become one of the biggest challenges for growers throughout West Tennessee. The glyphosate-resistant biotype of horseweed has now ended the era of glyphosate only weed control for soybean fields. Recent research has found that horseweed will germinate from March through November. This information dictates that weed management programs must be constructed that utilize herbicides with different sites of action as well as herbicides that can provide residual and/or can be applied post or post-directed. Glufosinate has provided very good weed control in LibertyLink soybeans. A recent addition to the glufosinate label will be applications used as a burndown to control glyphosate resistant weeds for the following crops: soybean, corn, sugar beets, and canola. In the past if glufosinate was used as a burndown herbicide, a planting of LibertyLink crops was to follow in this system. The biggest market opportunity with this new use is utilizing glufosinate as a burndown herbicide in Roundup Ready soybeans. Other burndown herbicides tank-mixed with glyphosate, like dicamba and 2,4-D will result in a waiting period of least 7 days prior to planting soybeans. However, with glufosinate, a grower will be able to plant within the same day if needed. Studies were conducted in 2008 in Jackson, Tn, Memphis, Tn, and Lonoke, Ar to evaluate glufosinate application rates and tank-mix partners for complete burndown weed control. Glyphosate resistant horseweed was present at the two Tn locations, however the population at the Arkansas location was susceptible to glyphosate. Glufosinate was applied alone at 593, 740, and 880 g ai/ha. Regardless of application rate, glufosinate applied alone resulted in excellent horseweed control (~95%). The addition of 85 g ai/ha flumioxazin to the various rates of glufosinate tested, did not result in increased horseweed control. Also, the addition of 1.2 kg ai/ha + 266 g ai/ha metolachlor + fomesafen, 280 g ai/ha dicamba, 560 g ai/ha metribuzin, or 31.5 g ai/ha chlorimuron + 6.3 g ai/ha tribenuron to 740 g ai/ha glufosinate did not result in increased horseweed control. Glyphosate applied alone at 1060 g ai/ha provided approximately 73% control of horseweed 5-9 in height. The addition of 85 g ai/ha flumioxazin improved control of horseweed to only 80%, however the addition of either 280 g ai/ha dicamba or 1.2 kg ai/ha + 266 g ai/ha metolachlor + fomesafen resulted in at least 98% control.

FIRE RESPONSE OF *MELALEUCA QUINQUENERVIA* TRANSFORMED BY BIOLOGICAL CONTROL.

P.W. Tipping*,[1] M.R. Martin[2]; [1]ARS, USDA, Ft. Lauderdale, FL, [2]Department of Soil and Water Science, University of Florida, Gainesville, FL

ABSTRACT

Melaleuca quinquenervia ('melaleuca') is an exotic invasive tree from Australia that threatened natural areas of southern Florida. This species is fire-adapted and, prior to the deployment of biological control, its recruitment and spread were significantly enhanced following fires. We protected melaleuca trees in a West Everglades site with regular insecticide applications from 2003 through 2007 to evaluate the impact of two classical biological control agents. In May 2007, the entire area was burned in a naturally occurring fire. We resumed post-fire monitoring and found that melaleuca density had decreased 72.5% from pre-fire densities in those plots not protected from herbivory compared with a 38.9% decline in plots protected by insecticides. In addition, mean post-fire plant height declined 11.0% in unprotected plots while increasing 1.2% in protected plots. The recruitment pulse that followed the fire yielded an average of 5.5 melaleuca seedlings m^{-2}. This represents a 99% decline compared to the recruitment of 591 seedlings m^{-2} that occurred after a similar fire in 1998. It appears that sustained herbivory by the biological control agents increased the susceptibility of younger trees to fire while reducing the canopy seed bank of older trees, resulting in a population level decline in melaleuca density, height, and recruitment potential.

ORIGIN OF ARTICHOKE THISTLE (*CYNARA CARDUNCULUS*) IN THE US: EVIDENCE FOR A PARTICULARLY WEEDY GENOTYPE WITH IBERIAN ORIGINS. J.S. Holt*, J.A. Garcia; Botany & Plant Sciences, University of California, Riverside, CA

ABSTRACT

Cynara cardunculus var. *sylvestris,* or artichoke thistle, is a noxious weed in California, Australia and South America. California's populations exhibit varying degrees of morphological intermediacy between native Mediterranean artichoke thistle and the two cultivated varieties, globe artichoke (*C. cardunculus* var. *scolymus*) and cardoon (*C. cardunculus* var. *altilis*). Despite a range of morphotypes and apparent variation in invasiveness among them, self-sustaining populations of *Cynara cardunculus* in California are almost exclusively identified as the weedy form. Differences stemming from source-derived pedigrees may explain variation in aggression among introduced populations. Seeds collected from 14 populations in California and 17 potential progenitor populations in Spain and Italy were grown in three common gardens representing inland and coastal environments. Microsatellite (SSR) analysis was performed to determine specific taxonomic variety and country of origin. Although circumstantial evidence points to Italian origins, California's artichoke thistle is a combination of feral and wild populations closely resembling that of southern Spain, indicating a potentially aggressive genotype. While invasive organisms are generally regarded as a species level phenomenon, this research focuses on the population level and understanding how source population contributes to invasion potential.

INTEGRATED MANAGEMENT OF COGONGRASS (*IMPERATA CYLINDRICA*) FOR BAHIAGRASS PASTURES. G. MacDonald*,[1] J.A. Ferrell,[1] K. A. Langeland,[1] B.A. Sellers[2]; [1]Agronomy, University of Florida, Gainesville, FL, [2]Range Cattle Research and Education Center, Ona, FL

ABSTRACT

Cogongrass, Imperata cylindrica, is a serious weed problem throughout the southeastern United States. This species is a problem along roadsides, pine (Pinus spp.) plantations, and natural areas and is also becoming extremely problematic in pasture and native rangeland settings. Cogongrass control in bahiagrass pastures was evaluated utilizing an integrated approach including tillage, herbicides, fertility inputs, and overseeding with desirable forage. In an area with greater than 90% cogongrass infestation, management factors including tillage (disking or plowing), herbicides (imazapyr or glyphosate), fertilizer inputs and overseeding with bahiagrass (Paspalum notatum) were evaluated. The herbicides glyphosate or imazapyr were applied in the fall months at 4.5 or 1.1 kg-ai/ha respectively, followed by tillage, overseeding and fertility inputs (1100 kg-ai/kg lime + 110 kg-ai/ha nitrogen or nitrogen alone) the following spring. A second study was conducted in an area with 30-60% cogongrass infestation within an established P. notatum pasture. Tillage was not utilized in this study. Low and high rates (kg-ai/ha) of the herbicides imazapyr (0.26 or 0.82), glyphosate (1.65 or 3.3), fluazifop (0.14 or 0.28) or imazapic (0.25 or 0.5) were applied in the fall months, followed by fertility and overseeding the following spring. In the study utilizing tillage, >90% cogongrass control was achieved with imazapyr at 1.1 kg-ai/ha, regardless of tillage operation. Glyphosate followed by the plowing tillage regime resulted in >90% control, while considerably lower control was observed in conjunction with disking. Overseeding and fertility inputs had little impact on recovery of P. notatum. In the second study, imazapyr selectively controlled cogongrass with minimal P. notatum injury at rates of 0.26 kg-ai/ha. However, selectivity could not be achieved with glyphosate, as both species were severely affected. Imazapic or fluazifop did not severely injury P. notatum, both also did not provide acceptable cogongrass control. Fertility and overseeding had little impact on P. notatum levels in this study. These studies indicate the potential for selective cogongrass control within P. notatum, but this is dependent on the levels of infestation prior to initial treatment. In areas with <30% cogongrass, selective control with herbicides can be effective, but in areas with >30% infestation, additional inputs such as tillage, must be employed. This further demonstrates the need for an integrated approach, including chemical, mechanical and cultural control methods for cogongrass management.

USING ENDOTHALL IN IRRIGATION CANALS FOR SAGO PONDWEED (*STUCKENIA PECTINATA*) CONTROL. C.J. Gray*,[1] G. Adrian,[2] K.J. Walz[2]; [1]United Phosphorus, Inc., Peyton, CO, [2]United Phosphorus, Inc., King Of Prussia, PA

ABSTRACT

The task of controlling aquatic vegetation in irrigation canals is an extremely important venture, especially in the western United States. The waters supplied by these canals are the primary, and in some locations the only, source of water for irrigating agronomic crops. In other locations, these waters supply industrial water users as well. Therefore, the control of aquatic weeds in irrigation canals becomes extremely critical; however, the tools available to canal managers for weed control are limited. Grass carp are used in some locations, but the task of keeping the carp in the desired location is difficult, and they do not provide adequate control of some aquatic weeds. Dredging and chaining canals can be employed for weed removal; however, these tactics are dangerous, very labor intensive, expensive, and offer only a temporary solution to the problem. The final option is the use of herbicides for weed control. Herbicides currently labeled for use in irrigation canals are acrolein, xylene, and copper formulations. The copper formulations are effective in removing problematic algae infestations, but provide minimal control of vascular plants. Acrolein and xylene have label restrictions that do not allow their use in some canal locations, and they are not labeled in all states. In addition, these products are extremely hazardous to applicators and handlers. At recommended labeled rates, these products are toxic to fish and other aquatic organisms. Endothall has been used since the 1960's for controlling aquatic vegetation in ponds, lakes, and streams. In recent months, residue trials (EPA Guidelines, OPPTS 860.1500 Crop Residue Trials) have been conducted for endothall as required for an EPA approved unrestricted FIFRA Section 3 label to allow treated water to be used on irrigated crops during herbicide applications. Sago pondweed [*Stuckenia pectinatus* (L.) Börner] is a native aquatic perennial that forms dense troublesome infestations in irrigation canals and drainage ditches; thereby, not allowing for proper water delivery or flow. In 2007 and 2008, experimental trials were conducted to evaluate endothall efficacy for sago pondweed control in irrigation canals. Treatments resulted in greater than 95% sago pondweed control for up to 16 weeks after treatment. Additional trials resulted in endothall residues traveling up to 20 miles from the initial injection site providing extended downstream sago pondweed control. Results from these trials indicate endothall will provide a safer, more effective tool for controlling aquatic weeds in irrigation canals compared to other alternative control methods.

LOCAL-SCALE GIS MODELING OF EURASIAN WATERMILFOIL. J.M. Prince*,[1] D.R. Shaw,[1] J.D. Madsen,[1] J.L. Harvill,[2] G.E. Ervin,[1] S.A. Samson,[1] J.L. Martin[1]; [1]Mississippi State University, Mississippi State, MS, [2]Baylor University, Waco, TX

ABSTRACT

A spatial analysis using generalized linear mixed models was conducted to estimate the predictive probability for the presence of Eurasian watermilfoil (*Myriophyllum spicatum* L.) in Pend Oreille Lake and outflowing river (Idaho). Predictor variables included water depth, fetch length, and distance from nearest *M. spicatum* population. Water depth was interpolated from NOAA sounding data using simple kriging with ArcGIS Geostatistical Analyst. Fetch length was determined using methods outlined in the Shoreline Protection Manual. These methods were automated using python scripts obtained from USGS. Input wind speed and direction data were taken from a U.S. Navy buoy on Pend Oreille Lake. Distance from nearest population was a 0/1 variable which identified if the point was within a reasonable distance to expect asexual spread from the nearest population. Presence/absence data were obtained by field surveys conducted in summer 2007. Data were interpolated and re-sampled to a 250-meter point grid for analysis in SAS. Re-sampling and grid generation were done with Hawth's tools in ArcGIS. Only points where water depth was less than 20 m were considered for model use, representing 2 times the maximum preferred depth of growth for *M. spicatum* reported in literature. Model parameters estimates were obtained using Proc GLIMMIX in SAS. Using data on Pend Oreille Lake and separately on data from the river flowing out of the Lake, five statistical models were considered for estimating the predictive probability of the presence of *M. spicatum* in terms of the three predictors. The first was a traditional logistic regression model. This model did not include a spatial autocorrelation structure, but did include the Boolean distance variable. The remaining four models incorporated spatial autocorrelation via a spherical spatial covariance function, and so did not require the Boolean distance variable. Specifically the four spatial models considered in this study were a (1) binomial regression model with over-dispersion, (2) random effects model, (3) conditional spatial generalized linear mixed model (GLMM), and (4) marginal spatial GLMM. Depth and fetch were highly significant in every model considered. All four of the spatial models had a lower predictive probability error variance than the logistic regression model. However, the additional complexity of spatial models requires advanced computing algorithms for parameter estimation. For this study, this additional complexity resulted in a lack of convergence in some cases. When it was possible to estimate all the parameters in the model, the four spatial models performed equally well. Depending upon the desired interpretation of the model and covariance parameters, and the ability to estimate those parameters, one of these four models may be preferred over the other three. Based on this study, in terms of predictive probability error variance, all spatial models are preferred over the traditional logistic regression model. Model outputs indicate predictive probabilities for the presence of *M. spicatum* at each point in the lake and river. A spatial view of these probabilities created in ArcGIS illustrates areas where *M. spicatum* is likely to occur based on existing depth and fetch.

RESPONSES OF SELECTED AQUATIC WEEDS TO CARFENTRAZONE AND FLUMIOXAZIN. R.J. Richardson*, A.P. Gardner, R.L. Roten, S.T. Hoyle; Crop Science, North Carolina State Univ., Raleigh, NC

ABSTRACT

Two greenhouse trials were conducted to determine the response of selected aquatic weed species to foliar applications of flumioxazin and carfentrazone-ethyl. In trial one, flumioxazin and carfentrazone-ethyl were evaluated on the emergent species alligatorweed [*Alternanthera philoxeroides* (Martius) Grisebach], creeping water primrose [*Ludwigia grandiflora* (M. Micheli) Greuter & Burdet ssp. *hexapetala* (Hook. & Arn.) Nesom & Kartesz], and parrotfeather (*Myriophyllum aquaticum* (Vell.) Verdc.). In trial two, flumioxazin was evaluated on the floating species giant salvinia (*Salvinia molesta* D.S. Mitchell) and water lettuce (*Pistia stratiotes* L.). In both trials flumioxazin was applied at 0, 34, 168, 302, and 437 g ai/ha, while carfentrazone-ethyl was applied only in the first trial at 0, 56, 112, and 224 g ai/ha. At 4 weeks after treatment (WAT), flumioxazin controlled alligatorweed, giant salvinia, and water lettuce at least 91% with rates of 168 g/ha or higher. Creeping water primrose and parrotfeather were controlled 73 to 81% with 437 g/ha. Calculated EC_{90} flumioxazin values were 35.6 g/ha for alligatorweed and 70.3 g/ha for water lettuce. Creeping water primrose, giant salvinia, and parrotfeather EC_{70} values were 120, 256, and 164 g/ha, respectively. Carfentrazone-ethyl did not control alligatorweed, creeping water primrose, or parrotfeather greater than 64% at the rates evaluated.

DIFFERENTIAL ABSORPTION AND METABOLISM OF IMAZAMOX AND IMAZAPYR IN *HYDRILLA VERTICILLATA*. A. Puri*,[1] M. Royuela,[2] W.T. Haller,[1] G.E. MacDonald[3]; [1]Center for Aquatic and Invasive Plants, University of Florida, Gainesville, FL, [2]Universidad Pública de Navarra, Pamplona, Spain, [3]Department of Agronomy, University of Florida, Gainesville, FL

ABSTRACT

Several of the herbicides that are used on crops are being developed as herbicides for aquatic vascular weed control. Imazapyr is a systemic herbicide that has been labeled for aquatic use, and recently, a new systemic herbicide (imazamox) was approved by the US Environmental Protection Agency for use in aquatic environments. Both herbicides belong to the imidazolinone herbicide family with the same mechanism of action, the inhibition of Acetolactate synthase (ALS) activity. Preliminary studies showed that the exotic submersed aquatic weed hydrilla (*Hydrilla verticillata*) had different sensitivity to both herbicides. A comparative study of effects of imazapyr and imazamox herbicides on hydrilla growth was conducted under greenhouse conditions. A complementary study of the sensitivity was conducted in the laboratory by extracting the ALS enzyme from control plants and applying the herbicides *in vitro*. The concentration required to inhibit ALS activity by 50% was determined for both herbicides and the I_{50} for ALS inhibition for both herbicides was 0.6 ppm. The imazamox I_{50} for growth was established as 43 ppb. In contrast, imazapyr did not show any effect on hydrilla growth even at 2 ppm. ^{14}C studies on absorption and translocation of herbicides (imazapyr and imazamox) in hydrilla to determine the mechanism of imazapyr tolerance in hydrilla. It was determined that absorption of imazapyr in hydrilla was higher compared to imazamox. However, there were two metabolites of imazapyr observed in the plant extracts at 6h to 7d after the herbicide application. On the contrary, for imazamox, more than 90% of ^{14}C recovery was still parental compound (imazamox) after the study period of 7 days. Studies are being conducted to identify the metabolites of imazapyr in hydrilla.

EVALUATION OF FLUMIOXAZIN AND BISPYRIBAC COMBINATIONS FOR CONTROL OF HYDRILLA (*HYDRILLA VERTICILLATA*). C.R. Mudge*, L.S. Nelson, H.J. Theel; US Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS

ABSTRACT

Flumioxazin and bispyribac-sodium are herbicides being developed and evaluated for control of hydrilla and other invasive aquatic plants. Flumioxazin degrades rapidly when applied to water with a pH >8.0 and fails to provide long-term hydrilla control. Hydrilla control with bispyribac-sodium is dependent on long exposure periods (ca. >60 d) at concentrations $\geq$15 µg active ingredient (a.i.) L^{-1}. Although both products have shown promise for hydrilla control, efficacy may be enhanced if they are applied in combination. Aquatic herbicide combinations have been used to enhance efficacy or mitigate herbicide resistance. An indoor environmental growth chamber study was conducted to determine the effective concentration of each herbicide, applied alone, and in combination for control of hydrilla. Flumioxazin (F) and bispyribac-sodium (B) were applied as subsurface treatments as follows: 50 (F), 100 (F), 50 (F) + 5 (B), 50 (F) + 10 (B), 50 (F) + 20 (B), 100 (F) + 5 (B), 100 (F) + 10 (B), 100 (F) + 20 (B), 20 (B), 10 (B), and 5 (B) µg a.i. L^{-1}. Flumioxazin and bispyribac-sodium were applied in sequence to the experimental aquaria. Untreated reference aquaria were also used to compare plant growth in the absence of herbicide. All shoot and root biomass were harvested 16 weeks after treatment (WAT). All treatments, except B5, resulted in a 50 to 97% decrease in shoot biomass 16 WAT. The B5, B10, and B20 treatments failed to reduce mean hydrilla shoot biomass below pretreatment level. No differences between treated and untreated root biomass were detected 16 WAT. All flumioxazin and flumioxazin + bispyribac-sodium combinations provided $\geq$85% control of hydrilla. Based upon this research, the lowest concentration combination evaluated (F50 + B5) should be further tested in mesocosm or field settings. This combination may be cost effective and help prevent development of acetolactate synthase (ALS) resistance in hydrilla.

INTRA-SPECIES VARIATION OF SUBMERSED AQUATIC PLANTS TO HERBICIDE TREATMENTS.

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ABSTRACT

The variation in response of target and non-target aquatic plant species to herbicides has been well documented in the literature and these inter-species differences are the basis for the selective use patterns of herbicides registered for use in aquatic systems. Of recent interest, intra-species response differences to herbicides have been documented for some submersed aquatic plants. This presentation will focus on laboratory and mesocosm studies that have evaluated potential response differences noted for genotypes of hydrilla (*Hydrilla verticillata* L.f. Roye), hybrids between the parental strains of the invasive Eurasian watermilfoil (*Myriophyllum spicatum* L.) and the native northern watermilfoil (*Myriophyllum sibiricum* L.), and phenotypes of cabomba (*Cabomba caroliniana* Gray), variable watermilfoil (*Myriophyllum heterophyllum* Michx.), and vallisneria (*Vallisneria americana* Michx*)*. Molecular characterization of the hydrilla genotypes and watermilfoil hybrids was necessary prior to initiating the herbicide efficacy work. Results from laboratory studies indicated that various genotypes of hydrilla that are resistant to the bleaching herbicide fluridone (1-methyl-3-phenyl-5-[trifluoromethyl) phenyl]-4(1*H*)-pyridinone) remain dominant in many of the large public lakes in Central Florida. Hydrilla plants with the same mutation in the phytoene desaturase gene demonstrate significant differences in response to fluridone and this observation remains largely unexplained. Comparisons of a native and invasive phenotype of cabomba show distinct response differences to numerous herbicides. Moreover, the complete lack of a physiological or herbicidal response of a green phenotype of this dicotyledon to 2,4-D ((2,4-dichlorophenoxy)acetic acid) and triclopyr [3,5,6-trichloro-2-pyridinyl)oxy]acetic acid) is also difficult to explain. Recent studies have evaluated the response of two phenotypes of the native plant vallisneria to the herbicide endothall (7-oxabicyclo [2.2.1heptane-2,3-dicarboxylic acid) and initial results suggest a notable difference in the response of the phenotypes. Current hydrilla control efforts in Florida rely very heavily on endothall, and one of the main objectives of these treatments is promotion of vallisneria expansion. Therefore differences in response by vallisneria phenotypes need to be better understood when project objectives include preservation or expansion of vallisneria. Hybrid milfoil accessions have been shown to vary in susceptibility to low use rates of triclopyr and 2,4-D; however, no evidence of a different response to operational use rates of these herbicides has been determined. It is important to note that the hybrid milfoil has acquired a parental trait from the non-invasive parent that allows the plant to produce axillary turions. The ecological importance of turion formation and the role of these propagules in tolerating herbicide applications remains largely unexplored. While most of the intra-species differences described may ultimately be subtle variations or changes that will not have major impacts on management or invasiveness, the example of the rapid spread of fluridone resistant hydrilla suggests that an intra-species change can have major and lasting impacts on our approach to aquatic plant management.

MONOECIOUS HYDRILLA PHENOLOGY AND TUBER DYNAMICS IN NORTH CAROLINA. J.J. Nawrocki*, R.J. Richardson, S. Hoyle, A.P. Gardner, R.L. Roten; Crop Science, North Carolina State Univ., Raleigh, NC

ABSTRACT

Hydrilla [*Hydrilla verticillata* (L.f.) Royle] is the most economically damaging aquatic weed in the United States. Long term control of hydrilla is complicated by persistent subterranean turions (tubers) that the plant forms each year. Elimination of the tuber bank is essential for control and eradication. Research was conducted in North Carolina to evaluate monoecious hydrilla tuber dynamics. Tuber surveys were initiated on three North Carolina lakes to determine the effects of specific management techniques on monoecious hydrilla tuber numbers over time. Sampled lakes in North Carolina included Lake Gaston, Lake Tillery, and the Tar River Reservoir. Tuber counts were conducted in spring and late fall of 2007 and 2008 on each lake using a four-inch core sampler. Additional samples were collected on certain lakes during the summer. Sampling was also initiated in 2008 on Shearon Harris Reservoir in North Carolina. Sample points were selected based upon the presence of an established tuber population. GPS coordinates of sample points were marked to ensure that repeated sampling would occur within a limited area. Management practices on the lakes included fluridone treatment or no treatment on Lake Gaston, fluridone treatment on Lake Tillery, a combination of fluridone application and drought-induced summer drawdown on the Tar River Reservoir, and no management on Shearon Harris Reservoir. De-watering or fluridone application in 2007 and 2008 resulted in a 53 and 67% annual decrease in tuber numbers in Lake Gaston and the Tar River Reservoir, respectively, with little variation in mortality rate each year. Tuber densities in Tar River declined from 697 per m^2 in spring 2007 to 78 per m^2 in fall 2008. On Lake Gaston, tuber densities declined in areas treated both years from 329 to 82 per m^2. If these rates remain steady over time, seven to ten years would be required to achieve 99.5% reductions in tuber numbers. In contrast, areas of Lake Gaston that were fluridone treated in 2007 but not in 2008, had new tuber formation in 2008 to recover density levels to 74% of those in spring 2007. Densities in these areas were 361 tubers per m^2 in spring 2007, 139 per m^2 in spring 2008, and 268 per m^2 in fall 2008. On the unmanaged Shearon Harris Reservoir, densities averaged 1,700 tubers per m^2 in fall 2008.

INTEGRATING BIOLOGICAL CONTROL WITH HERBICIDES FOR DALMATIAN TOADFLAX CONTROL: DO "MANY LITTLE HAMMERS" REALLY WORK? S. Enloe*,[1] A. Norton,[2] P. Meiman,[2] T. Collier[3]; [1]Auburn University, Auburn, AL, [2]Colorado State University, Fort Collins, CO, [3]University of Wyoming, Laramie, WY

ABSTRACT

The conceptual basis for using integrated strategies to manage invasive plants has been well established. However, the myriad of potential combinations of integrated methods across a large number of invasive plants has resulted in piecemeal evidence of IWM success at best. Furthermore, evaluations of IWM non-target impacts have been done to an even lesser degree. Dalmatian toadflax is an aggressive Eurasian forb that spreads by seed and creeping roots and is very difficult to control. Using the approach of multiple and temporally variable stresses (many little hammers), we tested the integration of the biological control agent *Mecinus janthinus* Germar and the herbicides picloram and imazapic for Dalamatian toadflax control. Studies were conducted near Boulder, CO, Cheyenne, WY, and Centennial, WY from 2006 to 2008. Treatments included all combinations of biocontrol (yes or no) with picloram at commercial (0.56) and reduced (0.28 kg/ha) rates and imazapic at commercial (0.21) and reduced (0.11 kg/ha) rates. For the biocontrol treatments, 30 adult *Mecinus* weevils were released in each biocontrol plot in May 2006. A systemic insecticide was applied annually each spring to non-biocontrol plots and was successful in preventing or minimizing weevil encroachment. Herbicide treatments were broadcast applied in October 2006 when prostrate toadflax stems had emerged. Data collected 18 months after herbicide treatment included individual species cover, biomass by functional group, and Dalmatian toadflax density. While we did find considerable variation in treatment impacts across sites, we did not find consistent evidence that biocontrol, herbicides or the integration of both was effective for Dalmatian toadflax control 18 MAT. Herbicide efficacy was better at sites with initial high grass cover and low forb cover than high forb cover. Non-target vegetation impacts varied among herbicides and were most pronounced for picloram, which strongly negatively impacted native perennial forbs, subshrubs, and shrubs but increased grasses 18 MAT. Imazapic also increased grass cover but was less injurious to native dicots. Neither herbicide directly impacted *Mecinus* survival. However, *Mecinus* population size was correlated with the amount of toadflax present in a plot, and treatments that reduced toadflax cover also reduced *Mecinus* by a similar amount. While it is positive that the treatments did not directly negatively impact *Mecinus*, the reduction in density the following year did not allow for a buildup in the *Mecinus* population. While a longer time frame might have resulted in a greater *Mecinus* buildup and possibly better results, these data suggest site specific conditions may play a key role in treatment outcomes for Dalmatian toadflax management.

EXTENSION RESPONSE TO CONTAMINATED 2,4-DB/PEANUT PROBLEMS IN 2007. E.P. Prostko*,[1] J.T. Flanders,[2] S.N. Brown[3]; [1]Department of Crop & Soil Sciences, The University of Georgia, Tifton, GA, [2]Berrien County Cooperative Extension, Nashville, GA, [3]Colquitt County Cooperative Extension, Moultrie, GA

ABSTRACT

2,4-DB is one of the most widely used herbicides in southeastern peanut production systems. In Georgia, approximately 50% of the peanut acres are treated annually with 2,4-DB to control various weeds including morningglory (*Ipomoea* sp.), pigweed (*Amaranthus* sp.), and sicklepod (*Senna obtusifolia*). In 2007, unusual crop injury symptoms were observed after applications of 2,4-DB in some locations. Laboratory tests conducted by the Georgia Department of Agriculture indicated that certain lots of 2,4-DB were contaminated with low levels of 2,4-D (0.104-0.294%) and dicamba (0.170-0.198%). Limited information about the response of peanut to 2,4-D and dicamba at these levels was available. Observational data collected from several field locations indicated that potential yield effects were minimal. However, the manufacturer agreed to compensate growers for yield losses based upon historical comparisons. A field trial conducted in 2008 with a contaminated lot of 2,4-DB indicated that peanut yields and pod weights were not reduced by applications of the product. This situation has also stimulated research to address the potential effects of low rates of dicamba on peanut since dicamba-resistant cotton and soybean technologies are on the horizon and drift/sprayer contamination problems are likely.

WHAT TO LEARN FROM THIRTY YEARS OF RESEARCH ON HERBICIDE RESISTANT WEEDS?

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ABSTRACT

Since its start in the late 1970's, research on herbicide resistant weeds at the Weed Science Unit has been dealing with a wide variety of weed species, crops, herbicides, and environments (long-term experiments versus daily practice). Closely related species may display a differential response to a given herbicide; therefore, when resistance is suspected in a weed population, correct species identification is a prerequisite prior to further action. This need is illustrated by experiences with poor bittercress (*Cardamine*) control in container grown ornamentals. First, in the 1990's, hairy bittercress (*C. hirsuta*) was alleged to have developed resistance to isoxaben while, in reality, flexuous bittercress (*C. flexuosa*), a related species with lower intrinsic sensitivity to this herbicide, was responsible for the control failures. Recently, growers became confronted with unsatisfactory control of a third species, New Zealand bittercress (*C. corymbosa*). So, growers currently may be confronted with a complex of three different species rather than an isoxaben resistant biotype of one of these species... In long-term field experiments with herbicides being applied repeatedly on the same strips, waiting for the appearance of the first resistant biotypes may require a lot of patience. In an orchard experiment initiated in 1958, it took about 20 years before the start of the successive appearance of triazine-resistant biotypes of birdseye pearlwort (*Sagina procumbens*), fringed willowherb (*Epilobium ciliatum*) and annual bluegrass (*Poa annua*) respectively could be recorded. In another experiment in a pear orchard with application of paraquat (1 kg a.i./ha) three to four times a year on the same strips starting in 1970, not until 1982 there was the sudden appearance of a paraquat resistant biotype of fringed willowherb (*Epilobium ciliatum*), a species previously unrecorded in the experiment. This happened at a time when this species was reported to be "on the move" in Western Europe. Even some three decades after the first reports on the now "classical" target site resistance to the photosystem II inhibiting triazines in common lambsquarters (*Chenopodium album*), it continues to be a fascinating story. Towards the 1980's, in Belgium like in many other European countries, it was one of the first major maize weeds with biotypes having target site resistance to s-triazines. Like in numerous other weed species, the molecular basis of this type of resistance was found to be a point mutation on the chloroplast *psbA* gene resulting in a substitution of serine to glycine at position 264 of the D1 protein. Despite the fact that these triazine resistant biotypes selected in maize were found to have target site cross resistance to the triazinones, metamitron (a key herbicide in European sugar beet) and metribuzin (selective to a wider variety of crops), their control did not cause major problems in the rotational crops where these herbicides are used. However, in recent years sugar beet growers in several European countries are experiencing problems with the control of common lambsquarters. Greenhouse bioassays revealed resistance to metamitron in "suspected" populations from Belgium, France and Sweden. As Belgian and French populations were found to be also resistant to metribuzin and atrazine, their resistance profile is similar to that of the triazine resistant biotypes known from maize. DNA sequence analysis of the *psbA gene* showed the previously known Ser 264 to Gly substitution in the Belgian biotypes. However, the Swedish population highly resistant to metamitron and metribuzin is only slightly less sensitive to the 2-chloro-triazines atrazine and terbuthylazine. In this biotype originating from an environment having no history of s-triazine use and displaying the aberrant resistance profile, an other *psbA* point mutation (Ala251 to Val) was identified. These results demonstrate that target site resistance to the triazinone herbicides in common lambsquarters may be due to two different *psbA* mutations and it may evolve under selection pressure exerted by these herbicides themselves in an environment having no history of s-triazine use.

NEW FUNCTIONALITY IN WEEDSOFT TO DEMONSTRATE PRINCIPLES OF WEED MANAGEMENT. M. Bernards*, L. Sandell, R. Eubanks; Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE

ABSTRACT

WeedSOFT is a bio-economic model developed for cropping systems in the North Central Region of the United States. It has recently been converted from a CD based format to an internet based format. During the conversion the functionality of the program was changed to 1) include weed emergence, 2)incorporate residual activity of herbicides on weed control, and 3) account for potential yield late-emerging weeds. The new format and new functionality will enhance the usefulness of WeedSOFT in teaching principles of crop competitiveness, weed competition, and herbicide function. In addition, a new online lesson has been developed for the Plant and Soils eLibrary that features WeedSOFT in teaching principles of weed management.

CHANGE IN CROP MANAGEMENT IN NEBRASKA'S LOWER BIG BLUE WATERSHED, 1996-2006.

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ABSTRACT

Survey's were conducted of grower practices in the Lower Big Blue Watershed in Southeastern Nebraska in 1996 and 2006. Data from 2006 showed large changes in tillage, conservation practices, herbicide application timing, and herbicide active ingredients.

GLYPHOSATE RESISTANCE - A WORLDWIDE PHENOMENON. R.L. Nichols*; Cotton Incorporated, Cary, NC

ABSTRACT

Glyphosate (N-(phosphonomethyl) glycine) is an exceptionally broad-spectrum herbicide that was originally used for non-crop weed control, renovation of turf or timber, and for general weed management in perennial crops such as orchards and plantations. Use of glyphosate for the pre-plant management of weeds in sod and fallow ground greatly facilitated the development of reduced-tillage planting. In 1996 soybean (*Glycine max*.) cultivars, transgenically modified for resistance to glyphosate, were deregulated in the United States (U. S.). Subsequently glyphosate-resistant cultivars of cotton (*Gossypium hirsutum*) and corn (*Zea maize*) also were commercialized in the U. S. and many other countries, and glyphosate became the most commonly used means of weed management for agronomic row-crops in the world. Glyphosate was first used commercially in 1974. No resistance was found until 1996. Unfortunately, the discovery of new weed species exhibiting resistance to glyphosate in developed agricultural countries has accelerated in recent years. Presently there are 15 weed species with documented resistance to glyphosate, including 7 grasses, 4 composites, 2 amaranths, and one species each in the Plantaginaceae and the Euphorbiaceae. The distribution of glyphosate-resistant species is worldwide with 7, 6, 4, 3, 3, and 1 weed species, documented in North America, South America, Europe, Africa, Australia, and Asia, respectively. The incidence of glyphosate-resistant species is concentrated in botanical families with species that are common, prolifically-reproducing weeds in agronomic crops, and secondarily in weeds that are found in perennial crops and that also are found frequently in habitats disturbed by human activities. Glyphosate-resistant *Amaranthus palmeri* and *A. rudis* are significant threats to cotton and soybean production in the U. S. *Lolium rigidum* is a threat to wheat (*Triticum aestivum*) culture in Australia. The recent emergence of glyphosate-resistance in the extremely competitive and difficult to control weed, *Sorghum halepense*, in both North and South America is especially troubling.

GLYPHOSATE RESISTANCE IN THE UNITED STATES. M.D. Owen*; Iowa State University, Ames, IA

ABSTRACT

Two of the main benefits growers ascribe to crop production systems based on herbicide-resistant crops (HRC) are the convenience and simplicity of weed control. These presumed benefits are, in part, the driving force for the unprecedented grower adoption of glyphosate resistant (GR) soybean, cotton, canola and corn. Since the commercialization of GR soybean in 1996, growers in the United States are now planting approximately 100,000,000+ acres of GR crops per year and the number of acres continues to increase. Growers use glyphosate as the primary, if not sole, tactic to control weeds and repeated glyphosate applications within the growing season are the norm rather than the exception. However, these presumptions of convenience and simplicity have negative consequences, notably ecological. The ecological consequences of the current glyphosate-based crop systems are demonstrated in the evolution of GR weed populations. In the United States, currently nine weed species are documented to have evolved GR populations and most of these species have been identified since 2000. Two new species (*Ambrosia artemisiifolia* and *A. trifida*) were documented in 2004 and three new species (*Amaranthus palmeri*, *A. rudis* and *Sorghum halepense*) were documented in 2005. It is important to recognize that unless weed scientists follow a specific protocol (www.weedscience.com), weeds cannot be listed as "officially glyphosate resistant". It is the contention of the author that many populations of GR weeds go unreported and the number of locations with GR weeds is much greater than currently documented. For example, while GR *A. rudis* was reported in two Iowa fields in 1998, the fields had only scattered resistant plants and the locations were not added to the list. There are currently no GR weed populations documented in Iowa and listed on the website. However, an Iowa survey of 6588 growers and 568 agchem professionals suggests that the situation in Iowa is becoming increasingly problematic. Twenty-six percent of the growers indicated that fields with GR crops are becoming more weedy and 45% reported that increased glyphosate rates and frequency of application is now required for weed control. The same questions were answered by the agchem professionals who reported a higher concern for weedy fields (40%) and more glyphosate needed (57%). Given the rapid evolution of GR weeds in cotton and soybean production systems based on GR crops, it is not difficult to understand why the concern expressed by weed scientists about GR weed populations continues to grow. Unfortunately growers continue base weed control on a single herbicide tactic and HRC technology. Thus, it is difficult to envision that the trend of GR weed populations increasing at an increasing rate can be stopped. However, weed scientists must continue to provide objective, science-based recommendations to growers and work effectively with the industry in order to maintain the sustainability of HRC technology. Stewardship must be given due consideration by growers when they develop weed management tactics and integrated weed management is the core of stewardship.

GLYPHOSATE-RESISTANT PALMER AMARANTH IN THE SOUTHEAST. A.S. Culpepper*,[1] A.C. York,[2] M.W. Marshall[3]; [1]University of Georgia, Tifton, GA, [2]N.C. State University, Raleigh, NC, [3]Clemson University, Blackville, SC

ABSTRACT

Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) has been confirmed to infest 24 counties in Georgia, 22 counties in North Carolina, and 9 counties in South Carolina with a total estimated infestation of 600,000 acres. Populations from two counties in Alabama are currently being studied with expected confirmation of resistance during 2009. Glyphosate-resistant Palmer amaranth populations in Georgia have also been confirmed to be highly resistant to ALS-herbicides. Multiple resistance to both glyphosate and ALS inhibitors is also being studied in North and South Carolina. Glyphosate resistance in Palmer amaranth poses serious ramifications for weed management in numerous agronomic crops, especially cotton and soybean. And, Palmer amaranth with multiple resistance to both glyphosate and ALS inhibitors is especially devastating to cotton producers as there are no other topically applied herbicides available for use in Roundup Ready cotton. Preventative management programs relying heavily on residual herbicides with multiple modes of action have proven effective in slowing the spread of resistance and managing light infestations of this resistant pest. However, in fields with severe infestations, weed management programs relying exclusively on herbicides are often not effective, especially in dryland production areas. Cotton growers with severe infestations are being forced to utilize hand removal, cultivation, incorporated dinitroanline herbicides, deep turning land, growing cultivars with tolerance to glufosinate, or growing other crops that provide greater weed management options. Several management tactics, especially in cotton, have forced some growers to abandon conservation tillage. In fact, during 2004 when glyphosate-resistant Palmer amaranth was first found in Macon County, Georgia, growers utilized conservation tillage production practices to produce 60% of the cotton in the county. By 2008, conservation tillage production was reduced to a mere 10% of the acreage. Extension throughout the Southeast has conducted thousands of educational programs to increase growers' awareness of the problem and to encourage proactive management programs. Although resistant Palmer amaranth continues to spread at an alarming rate, growers have become more aggressive in their management programs. It is hopeful that these aggressive programs will reduce the rate of spread and begin to slowly reduce the number of resistant seeds currently present in soil seedbanks of heavily infested fields.

GLYPHOSATE RESISTANT PALMER AMARANTH IN THE MID-SOUTH. L. Steckel*,[1] K. Smith,[2] B. Scott,[3] D. Stephenson,[4] T. Koger,[5] J. Bond,[5] D. Miller,[6] S. Stewart,[4] D. Dodd[7]; [1]University of Tennessee, Jackson, TN, [2]University of Arkansas, Monticello, AR, [3]University of Arkansas, Loneoak, AR, [4]Louisiana State University, Alexandria, LA, [5]Mississippi State University, Stoneville, MS, [6]Louisiana State University, St. Joseph, LA, [7]Mississippi State University, Starkville, MS

ABSTRACT

We now have glyphosate-resistant (GR) Palmer amaranth becoming established in many fields in the Mid-South. We have found GR Palmer amaranth in 30 counties to date in Arkansas, Mississippi and Tennessee with several counties in Louisiana with suspect populations. Fortunately, in most cases the GR Palmer has been isolated small pockets or scattered plants that will not be a big drawback on yield this year. On the other hand, GR Palmer has come close to completely over running a couple of fields this spring in Shelby and Tipton counties. The level of glyphosate resistance in some of these Palmer amaranths is very concerning. In previous years, we have seen glyphosate resistance levels of about 2 - 3x. The Palmer in those fields would at least show some symptoms from a 0.75 lb ae/A (22 oz/A Roundup WeatherMax) application. Some Palmer amaranth in fields we have observed this past spring are showing no symptoms at all even after being sprayed with rates ranging from 1.5 - 5.38 lb ae/A (44 - 158 oz/A Roundup WeatherMax) of glyphosate. In research conducted in the mid-south along with research from the south east would indicate that PRE applied herbicides before cotton or soybean emergence offer the best chance for successful Palmer amaranth control without relying on glyphosate. The herbicides that in the latest research appear to show the most value in controlling GR Palmer in cotton are Caparol, Cotoran, Direx, Dual, Reflex and Valor. There are no post emergence options in Roundup Ready cotton. In soybeans there are a few more options to control this weed Pre emergence and include Authority, Dual, Sencor, Boundary, Prefix, Reflex, Intrro etc. There are several PPO herbicides that can provide good control post emergence in soybeans if applied to Palmer amaranth less than 4" tall. In the Liberty Link soybean or cotton systems Ignite can provide control of Palmer amaranth as long as Palmer is no larger than 3 to 4" tall at time of application. In summary we now have GR Palmer amaranth in many fields in the mid-south. Management of this pest will make weed control much more complex than what cotton and soybean producers have been accustomed.

GLYPHOSATE RESISTANT PALMER AMARANTH- A THREAT TO CONSERVATION TILLAGE.
A.J. Price*,[1] D.W. Reeves,[2] D.A. Lamm[3]; [1]USDA-ARS-NSDL, Auburn, AL, [2]USDA-ARS-JPC, Watkinsville, GA, [3]USDA-NRCS-ENTSC, Greensboro, NC

ABSTRACT

Since the mid 1980's, conservation tillage has been recognized as a beneficial alternative to conventional tillage practices. With definite advantages over traditional tillage practices, conservation tillage adoption remained sluggish through the 80's and mid 90's due, in large part, to poor weed control and weed control options available for these systems. A turning point for conservation tillage was reached when, in 1996, Monsanto introduced Roundup Ready® soybean and subsequent glyphosate-resistant crops offered a successful alternative to conventional weed management that could be incorporated into conservation agriculture systems. Glyphosate resistant Palmer amaranth is now present in Alabama, Arkansas, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee. Hundreds of thousands of conservation tillage cotton acres, some currently under USDA Natural Resources Conservation Service (NRCS) conservation program contracts, are at risk of being converted to higher-intensity tillage systems. The shift to higher intensity tillage facilitates seed burial as well as preplant incorporated and preemergence herbicide control of this problematic weed, especially in dry-land cotton production. NRCS defines conservation agriculture as cropping systems that maintain a minimum 30% residue on the soil surface. Recent NRCS programs such as EQIP, the Conservation Security Program and the recently enacted 2008 Farm Bill Conservation Stewardship Program offer incentive contracts rewarding conservation. Cropping systems with higher resource conservation receive higher payments; in many states, use of high residue cover crops increase payments. Due to the threat of glyphosate resistant pigweed to conservation agriculture, a USDA-ARS/Cotton Inc. sponsored workshop involving southeastern stakeholders was held in Athens, GA on Aug. 11th, 2008. The following is an abbreviated list of the solutions offered: 1) Crop rotation intensification (including pasture-based rotations, 2) Improve residual herbicide performance in dry-land conservation systems, 3) Weed management intensification (scouting, timely applications, ect.), 4)Integration of cultural solutions (high residue cover crops, delayed cotton planting, etc., 5) High residue cultivators, 6)Deep tillage to bury seed bank followed by a continuous high residue conservation system, 7) Alternative herbicide chemistries, 8) New cotton herbicide paradigm for Coastal Plain /Uplands/ Delta regions: site-specific, 9) Use of fall residuals on harvested fallow fields to reduce weed seedbank. Depending on the severity of glyphosate Palmer amaranth infestation, multiple strategies involving integration of cultural as well as chemical weed control will be needed to overcome this threat. Integrating high-residue cover crop systems may help facilitate Palmer control in row middles; however, Palmer emerging in the crop row remains a threat to cotton performance, especially in dryland cotton. Much research is needed to solve this threat to conservation tillage cotton production.

EXAMINING GLYPHOSATE RESISTANCE MECHANISMS IN PALMER AMARANTH. R.D. Sammons*, A. Herr, K.A. Kretzmer, A. Norris, E. Ostrander, B. Duncan, D. Wang; Monsanto, St. Louis, MO

ABSTRACT

The mechanisms of glyphosate resistance are typically considered to be; target site, metabolism or exclusion. The characterization of glyphosate-resistant weeds by mechanism type provides some understanding of the potential for selection of resistance and how durable or endemic that resistance might become in a particular species. Our studies confirm that glyphosate is not restricted in its phloem translocation in *Amaranthus palmeri* (Palmer amaranth). This result dictates then a new set of models to explain resistance if restricted phloem translocation is to be a mechanism of resistance. We are also able to confirm the results of Westra and Gaines (this symposium) that EPSPS is dramatically upregulated in glyphosate resistant Palmer. We will present studies on metabolism and cellular uptake of glyphosate resistant Palmer to aide in the classification relative to which mechanism of resistance is the major contributor.

A NOVEL MECHANISM OF RESISTANCE TO GLYPHOSATE IN PALMER AMARANTH (*AMARANTHUS PALMERI*). T. Gaines*,[1] C. Preston,[2] D. Shaner,[3] J. Leach,[1] S. Chisholm,[1] B. Bukun,[1] S. Ward,[1] A.S. Culpepper,[4] P. Tranel,[5] P. Westra[1]; [1]Colorado State University, Fort Collins, CO, [2]University of Adelaide, Adelaide, Australia, [3]USDA-ARS, Fort Collins, CO, [4]University of Georgia, Tifton, GA, [5]University of Illinois, Urbana, IL

ABSTRACT

Glyphosate resistant Palmer amaranth populations were identified in Georgia. The molecular basis of resistance is unknown. No target site mutations known to confer resistance were identified in resistant alleles of the 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) gene, the target of glyphosate. Glyphosate selection in cell culture results in EPSPS gene amplification, so copy number and expression level were compared. DNA blot analysis of Palmer amaranth gDNA suggested more copies of EPSPS in resistant than susceptible plants. Estimation of gene copy numbers of EPSPS relative to acetolactate synthase (ALS) in gDNA by quantitative PCR (qPCR) revealed the same threshold cycle (Ct) for ALS and EPSPS in gDNA from susceptible plants and the same Ct for ALS in both resistant and susceptible plant gDNA. In contrast, the Ct for EPSPS in gDNA from resistant plants was six to seven cycles earlier than the Ct for ALS, suggesting that resistant plant genomes contain 64 to 128 times more copies of EPSPS than ALS. qPCR on cDNA revealed that EPSPS was expressed at 30 to 40 times higher levels in resistant plants. Elevated EPSPS copy number is heritable and correlates with expression level and resistance in F_2 populations. The molecular basis of resistance is likely due to increased production of EPSPS due to gene amplification. The possibility exists that one or a few genomic copies have higher expression due to promoter changes, or have a target-site mutation that has not been detected. This is the first documented occurrence of EPSPS gene amplification in a weed population under glyphosate selection pressure.

EFFECTS OF HERBICIDES AND CULTURAL PRACTICES ON RATE OF GLYPHOSATE RESISTANCE DEVELOPMENT IN PALMER AMARANTH. J.K. Norsworthy*,[1] P. Neve,[2] K. Smith,[3] C. Foresman,[4] I. Zelaya[5]; [1]University of Arkansas, Fayetteville, AR, [2]University of Warwick, Wellesbourne, United Kingdom, [3]University of Arkansas, Monticello, AR, [4]Syngenta Crop Protection, Raleigh, NC, [5]Syngenta Crop Protection, Bracknell, United Kingdom

ABSTRACT

Palmer amaranth (*Amaranthus palmeri*) is one of the most troublesome weeds of crops in the southern United States because of its biological characteristics and resistance to herbicides, particularly acetolactate synthase-inhibiting herbicides and glyphosate. The evolution of glyphosate resistance continues to increase across the southern United States as a result of almost sole reliance on glyphosate for weed control in glyphosate-resistant cotton and other crops. Recent modeling efforts by our group have shown a high risk of rapid evolution of glyphosate-resistant Palmer amaranth after 5 years of monoculture cotton treated with five in-crop applications of glyphosate. Our present efforts focus on the risks of glyphosate resistance under current management regimes in rotation with cotton where the weed management programs in cotton are either (a) a sole glyphosate program involving five glyphosate applications or (b) optimum timing and use of residual herbicides in combination with glyphosate. Both of these scenarios are evaluated in a monoculture system and in yearly rotation with various weed management programs for corn including glyphosate-resistant, glufosinate-resistant, and non-transgenic hybrids, conventional (non-transgenic) cotton where cultivation is integrated as part of the weed control program, and programs in glufosinate-resistant cotton. Biological, genetic, and operational assumptions for the model were presented previously (Neve et al. 2008). The model was run 250 times for a 30-year period, with each run representing a 60-ha production field. Resistance was assumed in the population when 25% of the plants in the field were resistant to glyphosate. It was assumed that independent selection occurred within each production field (runs of the model); hence, no gene flow occurred among fields. Continuous sole reliance on five glyphosate applications per year led to rapid increase in the risk of resistance evolution after four years of glyphosate use, with the risks of resistance being 67% after only 11 years in a glyphosate-only system. Timely use of residual herbicides or alternate modes of action delayed resistance evolution 1 to 2 years and reduced the risks of resistance to no more than 10% in monoculture cotton for 30 years. Residual herbicides applied early in the growing season were more effective than later timings in reducing the risk of glyphosate resistance because Palmer amaranth emergence mainly occurs shortly after cotton establishment. Rotation of glyphosate-resistant cotton treated with residual herbicides with a weed management program similar to one used in non-transgenic cotton in the mid-1990's (involving cultivation) reduced the risks of glyphosate resistance to less than 3%. Rotation of glyphosate-resistant cotton with glyphosate-resistant, glufosinate-resistant, or non-transgenic corn often delayed the onset of resistance by 2 to 3 years and reduced the risks of resistance by approximately 50% over a 30-year period. Various management scenarios will continue to be modeled and used as part of our educational efforts to make producers aware of the managerial factors that contribute to glyphosate resistance and to encourage the use of proactive strategies to reduce the risks of glyphosate-resistant Palmer amaranth evolving on their farms.

PRACTICING HERBICIDE RESISTANCE MANAGEMENT. A.C. York*,[1] A.S. Culpepper[2]; [1]North Carolina State University, Raleigh, NC, [2]University of Georgia, Tifton, GA

ABSTRACT

Herbicide resistance is an increasingly serious problem facing growers and those who advise growers. Much of the emphasis is currently focused on glyphosate resistance because of conservation tillage and wide-spread adoption of Roundup Ready technology. However, resistance is not unique to glyphosate; resistance in the United States has been reported with 19 modes of action and 122 species/mode of action combinations. In the past, growers had less reason to worry about resistance as new herbicides were being introduced regularly. When resistance to one herbicide became a problem, they could simply switch to another herbicide. That is no longer an option as commercialization of new chemistry, specifically new modes of action, has essentially stopped. Without new chemistry, it is critical that growers attempt to manage to avoid multiple resistance; otherwise, multiple resistance will greatly reduce control options. It is generally accepted that herbicides do not cause resistance per se, but rather they select for resistant biotypes naturally present at very low frequencies in native populations. Resistance will evolve only if selection pressure is put on those few resistant biotypes that may be present in a population. To manage resistance, specifically to avoid resistance or at least delay its evolution, one must focus on reducing selection pressure. This is accomplished by integrating multiple modes of action into a cropping system; crop rotation, which allows a greater opportunity to incorporate other modes of action; and non-chemical options where they are feasible and can fit into a grower's program. Additionally, it is important to minimize seed banks to the extent practical. Current programs for management of glyphosate-resistant Palmer amaranth in the southeastern US will be discussed as examples.

NEW HERBICIDE RESISTANCE TRAITS AND THEIR MANAGEMENT. C.H. Koger*,[1] D.M. Dodds[2]; [1]Mississippi State University, Stoneville, MS, [2]Mississippi State University, Starkville, MS

ABSTRACT

Glyphosate has been the backbone of practically all weed control programs in corn, cotton, and soybean production systems over the past ten years. With the introduction of Roundup Ready soybean, cotton, and corn in 1995, 1996, and 1997, respectively, the percent of the U.S. crop planted to these Roundup Ready crops has increased to 97, 72, and 91, respectively in 2008. Adoption of Roundup Ready crops in the U.S. has led to several widespread accomplishments and challenges. Accomplishments have included reduction in herbicide cost inputs, flexibility of the glyphosate weed control system, and the allowance of more time to focus on other important crop management components such as disease and insect management, irrigation management, and marketing of crops. The main challenge has been the development of glyphosate-resistant weeds. New technologies incorporating herbicide-resistant or tolerance traits into crops are on the horizon. Liberty link soybean (resistant to glufosinate) will be commercialized in 2009. Dicamba resistant soybean and cotton are currently in the research phase and are scheduled to be commercialized in two to five years. Traits enabling applications of 2,4-D and other phenoxy type herbicides over-the-top of soybean and potentially cotton are in the research phases will likely be commercialized in upcoming years. The introduction of soybean and corn that can be treated with glyphosate and ALS-herbicides, that before were not tolerant to specific ALS-herbicides, will be commercialized through Optimum GAT technology in the near future. Technology allowing co-application of glyphosate and glufosinate has already been commercialized in corn and is close to being commercialized in soybean and cotton. These new herbicide resistant or tolerance traits will provide growers with new tools, researchers with job security, and all of us a new set of weed control options as well as challenges in the near future. All of these technologies will help us to continue to develop safe, economical, practical, and effective weed control programs into the future for our row-crop production systems.

THE IMPORTANCE OF ETHICS IN RESEARCH. G. Comstock*; North Carolina State University, Raleigh, NC

ABSTRACT

When the National Institutes of Health (NIH) began requiring training in responsible conduct of research (RCR) decades ago, it did not provide benchmarks by which the success of efforts could be evaluated. Consequently, it is disquietingly unclear what works and does not work in this critical area. The number of RCR training programs overall is increasing, as is the absolute number of graduate students so trained. A reasonable assumption is that the number of research misconduct reports would be decreasing. To the contrary, the number of institutions reporting misconduct cases to the NIH's Office of Research Integrity continues to increase. Something is deeply wrong with RCR education. The OpenSeminar in Research Ethics (OSRE) is predicated on the idea that students are more likely to follow regulations if they are fully acculturated into their professional groups. OSRE, therefore, aims not at inculcating compliance with rules but rather at *welcoming junior researchers into the research community*, supporting and empowering them as they are integrated into various face-to-face and virtual communities of scholars. Supported by the National Science Foundation, OSRE is a free online inter-institutional collaborative effort. The main outcome of the Model Curriculum in Land Grant University Research Ethics (LANGURE) project, OSRE results from the efforts of 150 faculty and graduate students across three dozen disciplines at a diverse set of land grant and historically-minority serving universities (Wisconsin, NC State, NC A&T, NC Central, Fayetteville State, Purdue, Iowa State, and Hawaii). Drawing on research in educational psychology, evolutionary biology, and the moral development literature OSRE begins with the students' own, usually unspoken but deeply felt, question: "Who cares?" To answer this challenge, OSRE starts off discussing narratives of students harmed by misconduct, appealing directly to students' own self-interests. OSRE provides a set of readings students may complete in 14 contact hours, the equivalent of one graduate level course. Our software allows each instructor to modify the readings to suit their students' needs. We cordially invite you to join us by visiting the site and opening your own section.

PUBLISH OR PERISH: AUTHORSHIP AND PEER REVIEW. M.E. Foley*; USDA-ARS, Fargo, ND

ABSTRACT

Publish or perish is defined in Wikipedia as the pressure to publish work constantly to further or sustain one's career in academia. This is an apt description given that refereed scientific publications are the currency of science and the primary means for broad dissemination of knowledge. Professional scientists holding publically funded academic, not-for-profit, and government positions have an obligation to participate honestly and ethically in the various facets of publication, such as authorship, reviewing, and editing of scientific articles. Inexperienced authors should seek mentors to provide perspective on what, when, where, and how to publish and who can provide feedback on scientific writing. Authors should concentrate on what they publish and its quality more so than where they publish. Publishing fashions change, but important, high quality research will be sought out, cited, and has a more durable impact on society and science. Nevertheless, advancement in the form of promotion, tenure, and funding may depend on current fashion; therefore, it is prudent to understand institutional values as they relate to quantity, quality, journal impact factor, and/or impact of the research. Scholarly publication requires committed, impartial, and knowledgeable reviews that logically and clearly advise editors. Reviewers must be capable of identifying and evaluating what is new, making constructive and respectful criticisms, distinguishing between style and content, and justifying statements with references or logical arguments. Reviewers highlight the strengths and weaknesses of a paper; they are not responsible for rewriting poorly crafted papers. As an author's publication skills increase, so does their visibility. Eventually, authors may be asked to serve in an editorial capacity, which can enhance a career, hone writing and reviewing skills, and provide a satisfying way to give back to the profession. Finally, if authors realize that science advances in incremental stages, they have self-confidence, and a support system, there should be little temptation to succumb to the pressures to publish by abandoning ethical standards. Indeed, scientific fabrication, falsification, and plagiarism are rare and far less prevalent than sometimes portrayed in the media. Research papers are an author's legacy to science; strive to write them well and with integrity.

DIVERSITY AND INCLUSION: WHY ALL THE FUSS? T.M. Sterling*; New Mexico State University, Las Cruces, NM

ABSTRACT

A large body of research findings over the past 25 years has documented the need for increased diversity of the U.S. science, technology, engineering, and mathematics (STEM) academic workforce to strengthen this nation's competitiveness. The movement of women and minorities into STEM fields has been uneven within the various STEM disciplines as well as among the various levels of the STEM workforce. Since the 1970s, women have moved into social, life, and agricultural science degree programs at a greater rate than into the physics-based sciences, computer science or engineering; however, women's representation at faculty and administrative levels has not kept pace with degree representation. In addition, Hispanics, African Americans, and American Indians are still highly underrepresented in all STEM fields when compared to their proportion of the U.S. population. The presentation will include a historical view of the data, the major reasons behind these differences, why diversity is important, and strategies for improving the inclusion of underrepresented groups in STEM fields. The model for Institutional Transformation at New Mexico State University, which has increased female representation in STEM faculty through recruitment and retention initiatives, including a formal mentoring program, will be highlighted.

GRADUATE STUDENT ETHICS- LAYING THE GROUNDWORK FOR THE FUTURE. D. Refsell*; University of Illinois, Urbana, IL

ABSTRACT

Graduate students are faced with ethical decisions throughout the conduct of their research and classroom education. They are held to the utmost levels of academic integrity because it is not only the student being judged, but also the advisor, committee, research program, and University they are a part of. As a student, your decisions and actions are reflective of those around you. Struggles typically surface when there is an imbalance due to status, experience, and power when a decision is to be made. Ethics may take many facets in graduate college from instruction to examination and interpretation. Ethical dilemmas in graduate education can arise when there is favoritism towards certain students, plagiarism, or unauthorized collaboration. Improper ethics as applied to research typically coincide with falsification, fabrication, and plagiarism. In addition, awareness of data ownership and the rights for publication of the research you have conducted or aided in can be misunderstood. Issues regarding bias and conflict of interest may also develop for many graduate students with projects that are funded by industry or other visible funding sources. As the graduate student, we must rely on a combination of our advisor, committee members, additional faculty, staff, and other experienced students to mentor us in our ethical decisions as we are learning scientific methods and practice. After all, it will be us doing the leading and mentoring in the future.

PURPLE NUTSEDGE CONTROL WITH DISMISS (SULFENTRAZON) YEAR 2. J.W. Marvin*, L.B. McCarty, A.G. Estes; Horticulture, Clemson University, Clemson, SC

ABSTRACT

Purple Nutsedge (*Cyperus rotundus*) is considered the world's worst weed in fine turf. Purple Nutsedge is predominantly a problem in temperate and tropical regions. The purpose of this study was to evaluate effectiveness of Dismiss (Sulfentrazone) for postemergence control of Purple Nutsedge. Various timings and rates were applied and evaluated starting June 19, 2007. Single applications rates of 0.125, 0.188, 0.25 and 0.375 Lb ai/A were evaluated for their longer term control of Purple Nutsedge. Sequential applications of Dismiss at 0.125, 0.188 and 0.25 Lb ai/A were applied on 28 DAIT, 35 DAIT or 42 DAIT. A single application of Certainty (Sulfosulfuron) at 0.059 Lb ai/A was used for a comparison. The initial applications were made June 23, 2008. Ratings of the plots were taken on July 15, August 15, September 15, and October 15, 2008. Applications were made using a CO_2 powered sprayer calibrated at 20 GPA. Plots measured 2 x 3 meters. Three replications of each treatment were evaluated and compared to an untreated check. All applications received a non-ionic surfactant at 0.25 % V/V. Plots were evaluated for percent control of Purple Nutsedge, with 0% indicated no control while 100% indicated complete control. Single applications of Dismiss showed limited (≤ 50%) control of Purple Nutsedge. Higher applications rates provided better control, with 0.375 Lb ai/A providing a maximum control of ~50% at 53 days after treatment. Control steadily declined after 53 days. Split applications followed a similar trend with higher application rates providing the best control. Dismiss 0.25 Lb ai/A on a 28 day interval provided the best control for the group at slightly above 70% control on August 15, 2008. Split applications 35 days apart provided ~ 85% control using 0.25 Lb ai/A on August 15, 2008. Dismiss applied 42 days after initial treatment provided ~ 90% control at the 0.25 Lb ai/A rate on August 15, 2008. The best long term control was achieved using Dismiss at 0.25 Lb ai/A on a 42 day interval by providing ~ 80% control. Results of the study show that multiple applications of Dismiss (Sulfentrazone) provided the most effective control. Rates of 0.25 Lb ai/A at 35 and 42 day intervals provided the best control at ~ 85% and 90% respectively. Single applications provided a peak control at 49 days after initial treatment. Single Dismiss application at 0.375 Lb ai/A provided the best control at ~ 50%. However control steadily dropped afterwards to about 30% control on September 19, 2007. Certainty provided the best overall results ~90% on July 15, 2008 and continuing to provide around 90% control on October 5, 2008. Plots will continue to be evaluated for long term effects of the products. Repeat treatments and additional screening of products will be continued for timing and control of Purple Nutsedge.

YELLOW NUTSEDGE AND FALSE GREEN KYLLINGA CONTROL IN TURF WITH AMICARBAZONE, METSULFURON, AND PYRITHIOBAC SODIUM. T.L. Mittlesteadt*,[1] J.B. Willis,[2] M.J. Goddard,[1] S.D. Askew[1]; [1]Turfgrass weed science, Virginia Tech, Blacksburg, VA, [2]Turfgrass Weed Science, Virginia Tech, Blacksburg, VA

ABSTRACT

Yellow nutsedge (*Cyperus esculentus* L.) and false green kyllinga (*Kyllinga gracillima* L.) are perennial weeds that are found in all species of turfgrass and are typically found in moist areas. They are found in the south and as far north as Connecticut. These weeds constitute management options that fall outside of normal weed control efforts in turfgrass. Typically, special herbicides are marketed for sedge control and are used in addition to normal broadleaf and grass weed control efforts. A combination product that includes multiple herbicide active ingredients and provides a broad spectrum of weed control that includes sedges, broadleaves, and grasses is needed. Amicarbazone and pyrithiobac sodium are experimental herbicides that could offer sedge, broadleaf, and grass control in turfgrass. Our objectives are: 1.) evaluate amicarbazone, metsulfuron, and pyrithiobac sodium when applied alone and under various tank mixes for the control of yellow nutsedge and false green kyllinga. 2.) Evaluate tall fescue (*Festuca arundinacea* L.) tolerance to amicarbazone, metsulfuron, and pyrithiobac sodium when applied alone and under various tank mixes. Studies were conducted at Brookemeade Sod Farm in Doswell, VA on tall fescue and at Chatmoss Country Club in Martinsville, VA on Kentucky bluegrass. A randomized complete block design was used at both locations. Treatments were applied June 21 and July 14, respectively. Treatments included metsulfuron, amicarbazone, pyrithiobac sodium, metsulfuron+amicarbazone, metsulfuron+pyritiobac sodium, amicarbazone+pyrithiobac sodium, metsulfuron+amicarbazone+pyrithiobac sodium, and a nontreated check. A nonionic surfactant was added to all treatments at 0.25 % v/v. Herbicide rates were as follows, metsulfuron (58 g ai/ha), amicarbazone (244 g ai/ha), and pyrithiobac sodium (106 g ai/ha). Cover, control, and injury data were collected and means were separated using Fisher's LSD. No treatments effectively controlled yellow nutsedge ($\geq$ 50%) 1 MAT. All treatments effectively controlled false green kyllinga ($\geq$ 50%) with the exception of metsulfuron, amicarbazone, and metsulfuron+amicarbazone 1 MAT. Pyrithiobac sodium controls false green kyllinga better than metsulfuron and amicarbazone. Furthermore, pyrithiobac sodium must be present in tank mix to effectively control false green kyllinga ($\geq$ 50%). All treatments significantly injured tall fescue ($\geq$ 15%) with the exception of amicarbazone and pyrithiobac sodium applied alone.

THE INFLUENCE OF AMICARBAZONE ON CREEPING BENTGRASS (*AGROSTIS STOLONIFERA*) PHOTOCHEMICAL EFFICIENCY. H. Perry*, S. McElroy, R.H. Walker; Auburn Univ., Auburn, AL

ABSTRACT

Annual bluegrass (*Poa annua* L.) is a problematic cool-season weed on creeping bentgrass putting greens. Both species are C3 grasses and control has proven to be difficult. Putting and aesthetic quality can be compromised due to differences in texture and seed head production posed by *P. annua*. Amicarbazone is a new triazolinone herbicide which is currently being evaluated for *P. annua* control on creeping bentgrass putting greens. Amicarbazone is a photosystem II inhibiting herbicide which reportedly has controlled numerous monocots and dicots in sugarcane. Root and foliar absorption by target species is possible; however, root absorption is predominant. Research was conducted to evaluate creeping bentgrass phytotoxicity and physiological response to increasing rates of amicarbazone compared to standard rates of paclobutrazol. This study was conducted in the fall of 2007 at the East Tennessee Research and Education Center in Knoxville, TN and repeated in the spring of 2008 at the Auburn University Turfgrass Research Unit in Auburn, AL. The 2007 study was conducted on a Crenshaw creeping bentgrass putting green. Amicarbazone (0.1, 0.2, 0.3, and 0.4 kg ai/ha) and paclobutrazol (0.6 and 1.2 kg ai/ha) was applied once on October 11. All treatments were applied with 0.25% v/v non-ionic surfactant and a non-treated control was included. Treatments were applied to 1 x 1 m plots with a CO_2-pressurized backpack sprayer calibrated to deliver 280 L/ha at 138 kPa with 8002VS nozzles. The study was organized in a randomized complete block design with four replications for each treatment. Creeping bentgrass injury was rated on a scale of 0-100% with 0 indicating healthy turf. Ratings were recording weekly for six weeks after treatment (WAT). Photochemical efficiency (Fv/Fm) was measured weekly utilizing a pulse-modulated chlorophyll fluorometer and measurements were standardized relative to the control. Fluorescence measurements were on a scale of 0 to 1 with 1 being optimal. Three readings were recorded for each plot. The 2008 study was initiated on April 2 on G2 creeping bentgrass which was mown daily at 3.2 mm and received 0.18 kg N/93 m^2 each month. Both study areas were irrigated to maintain adequate soil moisture. Data for creeping bentgrass injury and photochemical efficiency was subjected to ANOVA ($P = 0.05$). Means were separated using Fisher's protected LSD test ($P = 0.05$). In 2007, amicarbazone at 0.4 kg/ha injured creeping bentgrass 54% at 2 WAT. Amicarbazone at 0.3 and 0.4 kg/ha injured creeping bentgrass 16 and 36% 4WAT, respectively. All amicarbazone treatments except the 0.4 kg/ha rate were similar to the control 6 WAT. Paclobutrazol was similar to the non-treated at 2 and 4 WAT and injured creeping bentgrass ≤11% throughout the study. In 2008 similar results were observed at the Auburn, AL location. Amicarbazone injured creeping bentgrass 31 and 35% for the 0.3 and 0.4 kg/ha 2 WAT, and remained injured 26 and 48% 6 WAT. In 2007, amicarbazone decreased Fv/Fm 47, 71, 78, and 77% 1 WAT as rates increased from 0.1 to 0.4 kg/ha. At 0.1 kg/ha, amicarbazone was similar to both paclobutrazol treatments 4 WAT. Fv/Fm was similar among amicarbazone and paclobutrazol treatments 6 WAT. At 0.3 and 0.4 kg/ha, Fv/Fm was reduced ≤12% compared to the non-treated. Amicarbazone decreased Fv/Fm in the 2008 study 35, 51, 70, and 73% at 0.1, 0.2, 0.3, and 0.4 kg/ha 2 WAT, respectively. At 0.4 kg/ha, amicarbazone decreased photochemical efficiency ≥32% throughout the six-week study. Amicarbazone at 0.1 and 0.2 kg/ha did not decrease Fv/Fm 6 WAT. Further research is needed to investigate lower rates, repeat applications, and timing intervals to further quantify the potential use of amicarbazone.

THE EFFECT OF VARIOUS RATES AND TIMINGS OF AMICARBAZONE ON BENTGRASS CULTIVAR TOLERANCE AND ANNUAL BLUEGRASS CONTROL. L.S. Warren*, F.H. Yelverton, T.W. Gannon; North Carolina State University, Raleigh, NC

ABSTRACT

Annual bluegrass is a problematic weed in creeping bentgrass greens. Aesthetically, there are distinct texture and color differences between the grasses. Annual bluegrass seedheads produce an uneven putting surface. Annual bluegrass is highly susceptible to disease-causing pathogens which can infest creeping bentgrass. There are currently no postemergence herbicide options labeled in North Carolina for annual bluegrass control in creeping bentgrass greens. Research was conducted to evaluate single and sequential postemergence applications of amicarbazone treated in late summer, early fall and early spring for annual bluegrass control and creeping bentgrass tolerance. Tolerance trials in a putting green block consisting of 'A1', 'A4', 'Crenshaw' and 'L93' bentgrass cultivars were established at Lake Wheeler Road Turf Field Lab in Wake County and treated in 2007 - 08. A 'Penncross' bentgrass green infested with annual bluegrass was located at Sandhills Research Station in Montgomery County and treated in 2008. Plot sizes for all bentgrass trials were 1.2 x 1.8 m. An annual bluegrass-infested common bermudagrass fairway was treated in 2007 - 08 and located at Hidden Valley Golf Club in Wake County. Plot size was 1.5 x 3 m. All treatments were replicated 4 times and applied at 304 l/ha and 193 kPa with a 4-nozzle, 25.4 cm spacing boom containing XR 8002VS nozzles. Amicarbazone at 131 and 261 g ai/ha was applied at Lake Wheeler Road Turf Field Lab and Hidden Valley Golf Club. Applications were initiated in 2007 on Sep 5 with no sequential treatments, Oct 15 (Lake Wheeler) or 16 (Hidden Valley) with and without a sequential treatment on Nov 5 (Lake Wheeler) or 6 (Hidden Valley), and in 2008 on Apr 2 with and without a sequential treatment on Apr 24. Amicarbazone was applied at 123 and 246 g ai/ha at Sandhills Research Station with treatment dates in 2008 consisting of Apr 7, Apr 7 followed by Apr 29 and Apr 7 followed by May 12. Data presented are visual observations that include percent annual bluegrass control, bentgrass phytotoxicity and bentgrass stand reduction. At Hidden Valley Golf Club, single amicarbazone applications on Sep 5 and Oct 16 resulted in 0% annual bluegrass control when evaluated May 21, 2008. The historic drought in North Carolina during 2007 was the main factor for the lack of control. After rains in late Oct, partial annual bluegrass control was achieved with Nov 6 sequential amicarbazone treatments (45% with 131 g/ha, 80% with 261 g/ha). These data indicate that more annual bluegrass germinated after the Nov 6 application date. When treated Apr 2, 83% control occurred from 131 g/ha amicarbazone and 97% control occurred from 261 g/ha. Annual bluegrass at Sandhills Research Station was controlled 36% when treated Apr 7 with 123 g/ha amicarbazone and 95% with 246 g/ha. All Apr sequential treatments in both locations resulted in 99 to 100% annual bluegrass control. None of the bentgrass cultivars tested were injured by 123 to 131 g/ha amicarbazone when treated in Apr with a single application. 'Penncross' bentgrass stand was reduced 40% from 123 g/ha amicarbazone applied Apr 7 and May 12 and 84% when applied Apr 7 and Apr 29. Total 'Penncross' stand loss (100%) occurred from 246 g/ha amicarbazone applied Apr 7 and Apr 29 as well as Apr 7 and May 12. 'A1', 'A4', 'Crenshaw' and 'L93' bentgrass cultivars responded similarly to all treatments. A single Sep application of amicarbazone at 131 and 261 g/ha resulted in 70 to 85% and 93 to 96% phytotoxicity, respectively, 1 WAT, which resulted in 8 to 14% and 66 to 78% stand reduction, respectively, 7 WAT. A single Oct application of 131 and 261 g/ha produced 0 to 5% and 9 to 28% stand reduction, respectively, 4 WAT, which resulted in 0% and 0 to 4% stand reduction, respectively, 7 WAT. There was no initial phytotoxicity 1 WAT from the Oct or Apr applications. No bentgrass injury was observed from a single Apr amicarbazone application of 131 and 261 g/ha. 6 WA 261 g/ha sequential amicarbazone applications, 86 to 95% stand reduction was recorded in plots initiated in Oct and 37 to 51% reduction was recorded in plots initiated in Apr. 1 WA 131 g/ha sequential amicarbazone applications, 5 to 13% stand reduction occurred in Oct-applied treatments, and by 6 WA sequentials was 1% or less. There were no injury symptoms at any time from plots treated sequentially in Apr with amicarbazone at 131 g/ha. In conclusion, annual bluegrass was completely controlled postemergence in Apr with sequential applications of amicarbazone at 131 g/ha with no negative effects to 'A1', 'A4', 'Crenshaw' and 'L93' creeping bentgrass.

CONTROLLING ANNUAL BLUEGRASS ON GREENS AND FAIRWAYS WITH HM9930. S.D. Askew*, J.B. Willis, M.J. Goddard, T.L. Mittlesteadt; Virginia Tech, Blacksburg, VA

ABSTRACT

In the past 50 years, annual bluegrass (*Poa annua*) has been and remains the most troublesome weed of golf putting greens. Only three herbicides are registered for preemergence annual bluegrass control on creeping bentgrass putting greens with one, bensulide, receiving significant use. There aren't any herbicides registered for postemergence annual bluegrass control on creeping bentgrass golf putting greens. HM 9930 is an experimental herbicide under evaluation by Helena Chemical Company for possible use on golf putting greens and fairways. HM9930 controls annual bluegrass postemergence and preemergence without harming creeping bentgrass. In Japan, HM9930 has been marketed for use in turfgrass. Products for golf putting greens in Japan are typically applied at carrier volumes four to five times greater than in the US. Concerns were raised about the need for post application irrigation or adjuvants to improve activity of HM9930. In addition, herbicide rates are unknown for this new product on golf greens in the US. Our objectives were to evaluate effects of irrigation and adjuvant on three rates of HM9930 for annual bluegrass and creeping bentgrass response on sand-based putting greens and native soil fairways in Virginia. Studies were arranged as randomized complete block designs with 3 replications. Plots were 2 x 2 m. Experiments were conducted on a USGA-specification sand-based putting green at the Turfgrass Research Center in Blacksburg, VA, and on golf fairways at Blacksburg Country Club and The Glade Road Research Facility in Blacksburg. At Virginia Tech, both fairway and green trials consisted of L93 creeping bentgrass mown at 13 and 3 mm mowing heights, respectively. Penncross bentgrass was maintained at 15 mm at Blacksburg Country Club. HM9930 was applied at 109, 220, and 328 ml product per ha on the putting green and 220, 328, and 440 ml product per ha on fairways. Treatments were applied April 2 and August 2, 2007 on the green and fairway at Virginia Tech and on March 22 and September 4, 2007 at Blacksburg Country Club. Nonionic surfactant was applied at 0.25% v/v on appropriate treatments. The treatment design was a three by three factorial with a nontreated check as comparison. The first factor was HM9930 rate and the second factor was three levels of additive including none, nonionic surfactant, and post-treatment irrigation at 3 mm 4 hours after treatment. Trials were evaluated for percent annual bluegrass cover and control and creeping bentgrass injury at regular intervals for 1 year. Irrigation and adjuvant did not significantly influence annual bluegrass or creeping bentgrass response to HM9930 at any evaluation date. Normal putting green irrigation probably incorporates the herbicide appreciably negating the need for additional inputs. HM9930 has been reported to be relatively stable in the environment. Rate responses were not significant on golf fairways but all rates reduced annual bluegrass cover 67 to 89% at the golf course fairway and 35 to 65% at the Virginia Tech fairway with no significant differences between rates. On the putting green, increasing rate increased annual bluegrass reduction at 1 year after study initiation. High rates reduced annual bluegrass cover 74 to 84%. HM9930 did not injure creeping bentgrass or cause noticeable symptoms on annual bluegrass at any time during the study.

LOW RATE VELOCITY COMBINATIONS FOR *POA* CONTROL IN BENTGRASS. J.B. Willis*, M.J. Goddard, S.D. Askew; Turfgrass Weed Science, Virginia Tech, Blacksburg, VA

ABSTRACT

Annual bluegrass (*Poa annua* L.) is a troublesome weed in creeping bentgrass (*Agrostis stolonifera* L.) on golf course fairways. Bispyribac-sodium (Velocity Herbicide) can be used to control annual bluegrass. Several practitioners have observed excessive injury and reduction in turf color and quality during annual bluegrass control with bispyribac sodium. Herbicide rate and environmental conditions at application time has been shown to influence both annual bluegrass and creeping bentgrass response. Our objective is to evaluate low bispyribac sodium rates at 2 application scenarios in combination with products that have potential to reduce creeping bentgrass injury and improve turfgrass quality during annual bluegrass control. This field trial was established on a 'Penncross'creeping bentgrass fairway at Blacksburg Country Club near Blacksburg, Virginia maintained at 13 mm. Plot size was 2 by 2 m and experimental design was randomized complete block with treatments replicated 4 times. Treatment arrangement was a 2 by 5 factorial. Two application scenarios were 4 applications at monthly intervals or 2 applications at a 2 week interval followed 2 months later with 2 applications at a 2 week interval. Five combinations with bispyribac sodium (Velocity 80SP) at 25 g ai/ha were none, chelated iron (Sprint 330) at 610 g/ha, V-10142 at 325 g ai/ha, flurprimidol (Cutless 50 WP) at 280 g ai/ha, and trinexapac ethyl (Primo Maxx) at 97 g ai/ha. Initial application was made on July 9, 2008. Data collected included percent cover, control/injury of annual bluegrass and/or creeping bentgrass and turfgrass color. Overall, bispyribac sodium was not significantly injurious to creeping bentgrass. Only one application date lead to injury levels above 30%, all other applications did not lead to unacceptable injury. Injury peaked 1 week after treatment and completely recovered by 2 weeks after treatment. None of the tank-mixtures alleviated injury to creeping bentgrass consistently over the course of the trial regardless of application scenario. Annual bluegrass control was not significantly affected by any of the tank-mixture partners. Short-term annual bluegrass control was positively influenced by mixing bispyribac sodium with flurprimidol, however the differences were not statistically significant at $p = 0.05$. Additionally, analysis of annual bluegrass cover 3 months after the last application did not reveal statistical separation for bispyribac sodium containing treatments regardless of tank-mix partner or application scenario. All treatments containing bispyribac sodium did significantly reduce annual bluegrass population. Data from this trial indicate that bispyribac sodium applied 4 times throughout the summer significantly reduces annual bluegrass populations. Significant injury to 'Penncross' creeping bentgrass was not consistently eliminated by tank-mixture with any of the tested products. Turf managers should remain aware that environment drastically influences creeping bentgrass injury with bispyribac sodium.

ANNUAL BLUEGRASS CONTROL IN OVERSEEDED BERMUDAGRASS FAIRWAYS. A.G. Estes*, L. McCarty; Clemson University, CLEMSON, SC

ABSTRACT

Annual Bluegrass (*Poa annua*) a widely distributed prolific seed producer, with a tufted growth habit and non-uniform color makes for an unsightly appearance in highly maintained turf areas. Traditionally controlling annual bluegrass both pre and post-emergently has been obscure. The purpose of this research is to investigate the efficacy of Barricade, Monument, Prograss, and Velocity combinations for annual bluegrass control in overseeded perennial ryegrass fairways. In the Fall, of 2007 two studies were conducted by Clemson University, evaluating annual bluegrass control with combinations of Barricade, Monument, Prograss, and Velocity. The first study, which was located in Pendleton, SC at "Boscobel Golf Club," was conducted on bermudagrass fairways overseeded with perennial ryegrass at 300 lbs/A maintained at 0.5 inches. The second study was conducted at "Old Taby Links" in Beaufort, SC on bermudagrass fairways overseeded with perennial ryegrass at 300 lbs/A maintained at 0.5 inches. Plot size for each treatment measured 2.0 m by 3.0 m, replicated three times. Treatments were applied using a CO2 backpack sprayer calibrated at 20 GPA, at 30 p.s.i., with 8003 flat fan spray tips. Treatments for both studies included: Barricade 4 L at 0.75 lb ai/A 60 days before overseeding, Monument 75 WG at 0.01 lb ai/A 1 week before overseeding, Prograss 1.5 EC at 1 lb ai/A 8 weeks after overseeding (WAO)and 12 WAO, Velocity 17.6 WDG at .066 lb ai/A twice 3 weeks apart following annual bluegrass seedhead emergence. Treatment combinations of these included: Barricade followed by Monument, Barricade followed by Prograss, Barricade followed by Velocity, Monument followed by Prograss, Monument followed by Velocity, Prograss followed by Velocity, Barricade followed by Monument followed by Prograss, Barricade followed by Prograss followed by velocity, Monument followed by Prograss followed by Velocity and Barricade followed by Monument followed by Prograss followed by Velocity. Annual Bluegrass control on April 30, 2008 from the Pendleton study resulted in > 90 percent control from Barricade followed by Prograss, Barricade followed by Monument followed by Prograss, Barricade followed by Prograss followed by Velocity, and Barricade followed by Monument followed by Prograss followed by Velocity. Annual Bluegrass control of April 9, 2008 from the Beaufort study resulted in > 85 percent control from all treatments. Future research at Clemson University will be to investigate new and existing herbicides for annual bluegrass control including adjusting rates and timings of treatments. In addition, we will evaluate various herbicide combinations and programs for annual bluegrass control

DORMANT APPLICATIONS OF FLUMIOXAZINE ON CONTAINER GROWN ORNAMENTALS. A. F. Senesac*; Cornell Cooperative Extension, Riverhead, NY

ABSTRACT

The objective of this study was to determine if selected container-grown woody shrub species could tolerate over-the top applications of flumioxazin (Sureguard 51WDG) when applied at the beginning of the dormant season. In late November 2007, after at least one hard frost, a variety of commonly grown shrubs were treated with over the top applications of three rates of flumioxazin (.25, .375 and .75 Lbs/a 51 WDG or .375 lbs/a Broadstar 0.25%G). The species treated were being grown in 1 or 2-gallon containers in commercial nursery media. The species evaluated were: Hydrangea arborescens 'White Dome', Ilex crenata 'Beehive', Ligustrum vicaryi, Picea pungens, Spirea japonica 'Fire Light' and Viburnum x burkwoodii. The plants were irrigated overhead (0.5") five hours after treatment and moved into an unheated hoop-house covered with white poly film. Plant growth and injury were evaluated the following spring, starting in early April 2008 and continuing for the next two months. The results suggest the following: the two evergreen species that were evaluated (Ilex crenata 'Beehive' and Picea pungens) were not injured by any treatment. The deciduous Viburnum x burkwoodii was significantly injured by all treatments of flumioxazin, however, the level of injury was the same regardless of whether the formulation was applied as a spray or as a dry granule. This suggests root uptake rather than foliar or stem absorption as the means of entry into this species. However, the three other deciduous species: Hydrangea arborescens, Ligustrum vicaryi and Spirea japonica, while slightly injured by the granular formulation of flumioxazin, were more significantly and permanently injured by the sprayable formulation. In general, this injury manifested as delayed leaf-out and smaller discolored leaves. These results suggest that dormant spray applications may be a valuable tool for managing weeds in the overwintering house, however the choice of ornamental species is important. Further testing of other species is ongoing.

2008 REVIEW OF ORNAMENTAL USES FOR DIMETHENAMID-P GRANULAR AND LIQUID FORMULATIONS. R.J. Keese*, C.A. Judge, K.E. Kalmowitz, G. Oliver, L. Newsom; BASF Corp, Research Triangle Park, NC

ABSTRACT

Dimethenamid-P was registered in 2008 as a preemergence herbicide for ornamental uses including commercial field and container production and non-turfgrass landscape areas. Between 2006-2008 trials on woody ornamentals demonstrated tolerance to a liquid EC formulation (720 g/L) Tower™. The first labeled use for dimethenamid-P is for directed-applications only for field production and landscape. A dimethenamid-P + pendimethalin granular formulation (1.75%), FreeHand™, was registered for over-the-top applications in nursery production and landscape sites to both woody and herbaceous ornamental plants. Tower™ is registered at a rate of 1.1 and 1.7 kg ai/ha and FreeHand at 2, 3, and 3.9 kg ai/ha. A major objective of field testing in 2008 was plant tolerance to dimethenamid-P, to expand the label by adding ornamental crop species and gaining additional weed efficacy data. Strengths of dimethenamid-P include efficacy on difficult to control weeds such as bittercress, spurge, eclipta, sedges and doveweed. Higher herbicide rates provide greater residual and therefore length of control is increased. More than 80 plant materials were evaluated with Tower™ applied over-the-top. Ornamentals to be added to the FreeHand™ label include Jasmine, Loropetalum, Privet, Norway Spruce, Camellia, Vinca; a longer list is being compiled to add to the Tower™ label. Exploratory trials included evaluations on application timing and herbicide use during specific production practices. Both formulations were applied at two rates to perennial plugs and stuck directly from cell-trays into 3-L containers at transplant or at 1 and 2 weeks following transplant. Two-weeks after transplant was the safer application timing on most species. Ornamental grasses were also evaluated following treatments at transplant or 2-weeks after transplanting. Phytotoxicity was observed on some grasses, especially if herbicide was applied at transplanting. Greater tolerance was observed at 2-weeks after transplanting; further testing will be required for ornamental grasses. Commercial production of crops from tubers and corms was also of interest in screening for crop safety. *Caladium bicolor* and *Gladiolus spp*. were used as examples of field-produced flowering crops and were screened in container and field trials, respectively. Trials in 2007 and 2008 confirmed that *Caladium* tubers are very tolerant of dimethenamid-P applications at all timings evaluated. Gladiolus trials are still underway but initial indications are good.

PREEMERGENCE WEED CONTROL IN PANSY (*VIOLA* X *WITTROCKIANA*). J.F. Derr*; Hampton Roads AREC, Virginia Tech, Virginia Beach, VA

ABSTRACT

Pansy is an important bedding plant for color in winter and spring landscapes. Use of preemergence herbicides is one option for weed management. Additional data is needed on the impact of herbicide formulation on pansy tolerance. Experiments were conducted in 3.8 L containers with 100% pine bark as the growing medium. Herbicides were applied with a CO_2-pressurized backpack sprayer for sprayable formulations and a shaker jar for granular ones. Treatments included microencapsulated (ME), emulsifiable concentrate (EC), and granular (G) formulations of pendimethalin at 2.24 and 4.5 kg ai/ha, an EC and wettable powder (WP) forms of dithiopyr at 0.6 and 1.1 kg/ha, a dry flowable (DF) form of isoxaben at 1.1 and 2.2 kg/ha, and a granular form of isoxaben plus trifluralin at 2.8, 5.6, and 11.2 kg/ha. In the first trial, all treatments except the microencapsulated form of pendimethalin, the granular form of pendimethalin at 2.2 kg/ha, and isoxaben gave 90% or greater control of annual bluegrass (*Poa annua* L.). Pendimethalin EC and both forms of dithiopyr reduced total flower count in 'Universal Plus Beaconfield' pansy by at least 78%. Pendimethalin G at 4.5 kg/ha did not reduce pansy flower count while the microencapsulated form at that rate reduced flowering by 71%. Isoxaben at 2.2 kg/ha reduced pansy flower count by 56% while the three rates of isoxaben plus trifluralin all reduced flower counts by approximately 37%. In the second trial, the 2.2 kg/ha rate of microencapsulated and granular forms of pendimethalin and both rates of isoxaben gave poor control of annual bluegrass, while all other treatments controlled this weed 78% or greater. Only pendimethalin EC at 4.5 kg/ha and all rates of isoxaben and isoxaben plus trifluralin controlled common chickweed [*Stellaria media* (L.) Vill.] 78% or greater. The microencapsulated and granular forms of pendimethalin and the lowest rates of isoxaben and isoxaben plus trifluralin caused no reduction in total flower counts of 'Crystal Bowl Mixed' pansy. The two higher rates of isoxaben plus trifluralin reduced pansy flowering by 40 to 52%, while isoxaben at 2.2 kg/ha reduced flowering by 65%. All rates of pendimethalin EC and dithiopyr reduced total flower count in pansy by at least 77%. In the third trial two months after treatment, pendimethalin EC, both forms of dithiopyr, and the 2 higher rates of isoxaben plus trifluralin gave 86% or higher control of common chickweed and annual bluegrass. Isoxaben controlled common chickweed but not annual bluegrass. At the lower application rate, the microencapsulated and granular forms of pendimethalin gave unacceptable (less than 70%) control of both weed species. The EC form of pendimethalin, both forms of dithiopyr, and sprayable isoxaben reduced total flower count in 'Crystal Bowl Yellow' pansy by over 90%. The microencapsulated form of pendimethalin reduced pansy flower count at 4.5 but not at 2.2 kg/ha. Granular isoxaben plus trifluralin did not reduce pansy flowering. In summary, pendimethalin EC and wettable powder and EC forms of dithiopyr were too injurious to pansy. Microencapsulated pendimethalin was less injurious than the EC form but provided lower weed control. Granular formulations of pendimethalin in most cases did not reduce pansy flowering. Granular isoxaben plus trifluralin generally caused less reduction in pansy flowering than sprayable isoxaben.

INDAZIFLAM/BCS-AA10717-A NEW HERBICIDE FOR PRE-EMERGENT CONTROL OF GRASSES AND BROADLEAF WEEDS FOR TURF AND ORNAMENTALS. D.F. Myers*,[1] R. Hanrahan,[2] J. Michel,[3] B. Monke,[4] L. Mudge,[5] L. Norton,[6] C. Olsen,[7] A. Parker,[8] J. Smith,[9] D. Spak[10]; [1]Development & Tech Service, Bayer Environmental Science, RTP, NC, [2]Development & Tech Service, Bayer Environmental Science, Englewood, NJ, [3]Development & Tech Service, Bayer Environmental Science, Orlando, FL, [4]Development & Tech Service, Bayer Environmental Science, Overland Park, KS, [5]Development & Tech Service, Bayer Environmental Science, Clemson, SC, [6]Development & Tech Service, Bayer Environmental Science, Bethlehem, PA, [7]Development & Tech Service, Bayer Environmental Science, Wildomar, CA, [8]Development & Tech Service, Bayer Environmental Science, Clayton, NC, [9]Development & Tech Service, Bayer Environmental Science, Trafalgar, IN, [10]Development & Tech Service, Bayer Environmental Science, Cary, NC.

ABSTRACT

Indaziflam (BCS-AA10717, AE117437) is a pre emergent herbicide under development for the control of annual grasses and broadleaf weeds in turf, ornamentals, and vegetation management. Customers will include golf, lawn care, industrial vegetation management, and consumers. Indaziflam belongs to the chemical class "alkylazines." It inhibits cell wall biosynthesis and acts on meristematic cell growth. Indaziflam is a residual herbicide that affects germinating weed seeds. Tolerant warm season turf types include bermudagrass (non overseeded), zoysiagrass, St. Augustinegrass, centipedegrass, and seashore paspalum. Indaziflam at rates between 25 and 100 g ai/ha controls annual grasses such as crabgrass, goosegrass, and annual bluegrass as well as 65 other grasses and broadleaf weeds. Control of annual bluegrass is particularly effective and may be made pre emergent or early post. Indaziflam may be applied as a single or split application to turf in the spring, summer, or fall. It provides excellent flexibility to the customer as well as weed control comparable or superior to standards. The herbicide will be available initially as a wettable powder (WP) and fertilizer-based granule and later as a soluble concentrate (SC). Applications to ornamentals may be made as directed sprays beneath field grown, tolerant plants or as over-the-top sprays on dormant, woody deciduous plants and conifers. Initial uses for industrial vegetation management include forestry and hardscapes (e.g. patios and driveways). Indaziflam has favorable human health and ecological profiles.

SEASONAL HERBICIDE PROGRAMS FOR SELECTIVE BERMUDAGRASS CONTROL IN COOL-SEASON TURF. S.D. Askew*, J.B. Willis; Virginia Tech, Blacksburg, VA

ABSTRACT

In the transition climate zone, warm-season grasses and cool-season grasses overlap in growing regions. Problems arise when warm-season grasses like bermudagrass (*Cynodon dactylon*) invade cool-season turfgrasses like Kentucky bluegrass (*Poa pratensis*) and tall fescue (Festuca arundinacea). Recent research at Virginia Tech developed control programs for bermudagrass in tall fescue that consisted of mesotrione, fenoxaprop, and triclopyr combinations applied 3 times in spring and 3 times in fall. These programs were highly effective for selective bermudagrass control in Kentucky bluegrass, tall fescue, and perennial ryegrass (*Lolium perenne*). Unfortunately, this program exceeds EPA maximum use limits per year for mesotrione. There are five herbicides that can be used in either tall fescue or Kentucky bluegrass and that may suppress or control bermduagrass. These include mesotrione, triclopyr, fenoxaprop, siduron, and ethofumesate. Our objectives are to evaluate seasonal programs that include these five active ingredients to selectively control bermudagrass while adhering to annual use limits. Treatments were arranged in a randomized complete block design with 13 treatments and 3 replications. Comparison treatments included a nontreated control, a positive control that consisted of renovation with glyphosate applied twice at 5.6 kg ai/ha and seed, and a negative control that consisted of prodiamine applied at label rates for crabgrass control and a broadleaf herbicide (Speedzone by PBI Gordon) applied at label rates for broadleaf weed control. Bermudagrass control treatments consisted of various combinations of mesotrione at 0.14 kg ai/ha, triclopyr at 1.12 kg ai/ha, ethofumesate at 0.84 kg ai/ha, siduron at 13 kg ai/ha, and fenoxaprop at 0.14 kg ai/ha. The industry standard comparison was called the "Carolina program" and consisted of fenoxaprop plus triclopyr applied monthly for four treatments. The original Virginia Tech 3-way combination was also included as a comparison treatment. The best performing program was called "VT Modified I" and consisted of fenoxaprop plus triclopyr applied twice at 3 week intervals starting at 50% bermudagrass greenup and two more times just prior to bermudagrass dormancy in the fall. Two additional mesotrione treatments were applied mid summer. This program controlled bermudagrass 93% at season's end with minimal turf injury. By comparison, the Carolina program controlled bermudagrass 76% and less than VT Modified I and the original VT 3-way program controlled bermudagrass 87% and equivalent to VT Modified I. Programs that included triclopyr mid summer, including the Carolina program, were too injurious too Kentucky bluegrass. Siduron did not improve bermudagrass control. As with any bermudagrass control evaluation, next year's evaluations will become the basis of control evaluations as next year's recovery must be considered for program performance. These evaluations will be forthcoming in the 2009 season.

EFFECT OF MOWING HEIGHT ON BERMUDAGRASS (*CYNODON DACTYLON*) ENCROACHMENT IN TALL FESCUE (*LOLIUM ARUNDINACEUM*). J.A. Hoyle*, F.H. Yelverton, T.W. Gannon, L.S. Warren; North Carolina State Univ., Raleigh, NC

ABSTRACT

Common bermudagrass (*Cynodon dactylon*) is a commonly used turf species in North Carolina (NC) for home lawns, golf courses, commercial properties and athletic fields, among other use sites. Common bermudagrass can also be a very problematic troublesome weed when introduced into a tall fescue (*Lolium arundinaceum*) turf area. In 2007 and 2008 field trials were conducted at Lake Wheeler Field Labs in Raleigh, NC to determine the effect of mowing height on bermudagrass encroachment in tall fescue. Lake Wheeler Field Labs consist of an Appling fine sandy loam and trials were initiated on March 30, 2007 and March 28, 2008. A standard USGA cup cutter (10.8 cm) was used to harvest common bermudagrass plugs. Four plugs were installed into each plot (3.05 x 3.05 meters), 0.76 meters from the corner. Evaluated mowing heights included 2.5, 5.1, 7.6 and 10.2 cm in tall fescue, which were initiated once the bermudagrass plugs were installed. Line intersect analysis was used to determine the percent bermudagrass cover starting 12 weeks after initiation (WAI) continuing bi-weekly through 28 WAI (early/mid-October), when the bermudagrass entered dormancy. In 2007, at 28 WAI there were significant differences between mowing heights resulting in 1.9%, 3.2%, 7.4%, and 19.3% bermudagrass cover, respectively with mowing heights 2.5, 5.1, 7.6 and 10.2 cm. While in 2008, 28 WAI contained 1.7%, 2.7%, 6.3%, and 20.2% bermudagrass cover, respectively, with mowing heights 2.5, 5.1, 7.6 and 10.2 cm. Data was also collected on the 2007-initiated trial after one year of growth. 28 WAI of the second year there were also significant differences in mowing heights of 2.5, 5.1, 7.6 and 10.2 cm, resulting in 2.9% 12.2%, 39.9%, and 79.4% bermudagrass cover. These data indicate the growth habit of tall fescue may be used to help suppress bermudagrass encroachment by implementing the correct mowing height.

HERBICIDE COMBINATIONS WITH FLAZASULFURON FOR BROAD SPECTRUM WEED CONTROL IN CREEPING BENTGRASS. S.D. Askew*, M.J. Goddard, J.B. Willis; Virginia Tech, Blacksburg, VA

ABSTRACT

Flazasulfuron is a new herbicide under evaluation for use in warm-season turfgrass such as bermudagrass (*Cynodon dactylon*) and zoysiagrass (*Zoysia japonica*). Previous research at Virginia Tech indicates creeping bentgrass (*Agrostis Stolonifera*) is relatively tolerant of flazasulfuron compared to other competitor products with similar chemical structure and mode of action. Since flazasulfuron failed to control creeping bentgrass in evaluation trials, experiments were conducted to evaluate creeping bentgrass response to reduced rates of flazasulfuron when under commercial turfgrass management as golf fairways. Our objectives were to determine the effects of flazasulfuron rates in comparison to, applied alone, or in combination with other herbicides for improved weed control in creeping bentgrass. This trial was established at one location in 2008 on an L-93 creeping bentgrass fairway at Virginia Tech's Turfgrass Research Center in Blacksburg, VA. Treatments were arranged in a randomized complete block design with 15 treatments and 4 replications. Treatments included flazasulfuron applied alone at 2.2 and 4.4 g ai/ha, and flazasulfuron in combination or compared to sulfentrazone, carfentrazone, quinclorac, and flucarbazone applied at 140, 18, 307, and 59 g ai/ha, respectively. Significant injury (>30%) occurred in treatments containing flazasulfuron at 4.4 g ai/ha applied alone or in combination with sulfentrazone or flucarbazone, and flucarbazone alone 2 week after treatment (WAT). All plots recovered from this injury 4 WAT. Treatments containing quinclorac were the most effective resulting in greater than 50% control of smooth crabgrass in every treatment combination 2 WAT and 61-70% control 3 WAT. These trends remained 6 WAT. Quinclorac applied alone resulted in 92.5% control and in combination with low and high rates of flazasulfuron resulted in 80 and 73% control, respectively, and were not significantly different from quinclorac applied alone. By adding flazasulfuron at low rates in combination with other herbicides, a broad spectrum of weeds could be controlled in creeping bentgrass with out causing significant turfgrass injury.

FLAZASULFURON FOR WEED MANAGEMENT IN WARM-SEASON TURFGRASS. B.J. Brecke*, B. Unruh, D.P. Telenko; West Florida Research and Ed. Cent., University of Florida, Jay, FL

ABSTRACT

Studies were conducted at the University of Florida, West Florida Research and Education Center near Jay, FL to determine warm-season turfgrass tolerance and weed control following postemergence application of flazasulfuron. Eight turfgrass species/cultivars common in the southern U.S. were selected for study (Sea Isle 1 and Sea Isle 2000 Seashore Paspalum; Tifway, Tifeagle, Tifdwarf, bermudagrass; common centipedegrass; Raleigh St. Augustinegrass; and Emerald Zoysiagrass). Four rates of flazasulfuron (26 gm ha^{-1}, 40 g ha^{-1}, 53 g ha^{-1}, 105 g ha^{-1}) were applied to the various species/cultivars of turfgrass. Sea Isle 1 seashore paspalum showed significant injury early, but recovered quickly indicating moderate tolerance to flazasulfuron. Sea Isle 2000 seashore paspalum showed no injury at the 26 g ha^{-1} level, and showed little injury at other rates suggesting good tolerance. Tifway bermudagrass was not injured by any flazasulfuron rate tested. Tifeagle and Tifdwarf bermudagrass had significant damage early, but recovered well over time. Both varieties had moderate to good tolerance. Common centipedegrass showed significant injury early with little recovery over time. Raleigh St. Augustinegrass showed little injury early, but had severe damage over time and did not tolerate flazasulfuron. Emerald zoysiagrass showed little injury throughout the study and had good tolerance to this herbicide. Flazasulfuron (52 g ha^{-1}), applied to bermudagrass 4 wk prior to overseeding perennial ryegrass provided 80% annual bluegrass control 20 wk after application with no injury to the perennial ryegrass. Other studies were conducted to evaluate flazasulfuron for control of both annual and perennial weed species in bermudagrass. At 4 wk after initial treatment (WAIT), flazasulfuron (26 g ha^{-1}) controlled southern crabgrass equal to MSMA (85 to 90%). By 14 WAIT the rate needed to maintain 85% control increased to 35 g ha^{-1}. Flazasulfuron applied three times at 80 g ha^{-1} , with treatments spaced 3 wk apart, provided better torpedograss control (80%) than a single treatment at the same rate (60%). Torpedograss control with the sequential program was comparable to that observed with the standard quinclorac 21 WAIT. Bahiagrass control was less than 50% with a single application of flazasulfuron. A single application was also ineffective for control of Virginia buttonweed. However, two sequential applications improved Virginia buttonweed control to 70% while three applications provided 90% control 11 WAIT. Flazasulfuron provided more consistent control of purple nutsedge and cocks-comb kyllinga when applied twice compared with a single treatment. The sequential treatment controlled these species similar to the standard halosulfuron. Flazasulfuron was also effective for removing ryegrass overseeding in the spring and provided 90% control 3 WAT.

ALLEOPATHIC PROPERTIES OF OVERSEEDED RYEGRASS ON BERMUDAGRASS SPRING GREENUP. R. McCauley,[1] L.B. McCarty*,[1] H. Liu,[1] J. Toler[2]; [1]Horticulture, Clemson University, Clemson, SC, [2]Applied Economics and Statistics, Clemson University, Clemson, SC

ABSTRACT

Perennial ryegrass (*Lolium perenne* L.) is often overseeded into bermudagrass [*Cynodon dactylon* (L.) Pers.] in the fall to sustain acceptable turf quality through the spring months. However, perennial ryegrass aggressively competes with bermudagrass for resources in the spring and may release allelochemicals into the environment. Allelopathy could impact spring transition, impair the bermudagrass base, and result in unacceptable turf quality. Growth chamber studies were conducted to investigate potential ryegrass inhibitory effects on common bermudagrass seedlings. Bermudagrass germination and growth (root length density, root mass density, specific root length, root ash weight, dry shoot weight, bermudagrass shoot number, and bermudagrass tiller number) were examined. The first growth chamber experiment utilized pots seeded with bermudagrass that received irrigation water contaminated with varying concentrations (0, 5, 10, or 20 g L^{-1}) of perennial ryegrass roots or shoots. All detectable responses to ryegrass contaminated irrigation water were neutral or stimulatory to bermudagrass, and no allelopathic effects were observed. The second growth chamber experiment utilized pots containing bermudagrass seeded in soil amended with varying rates (0, 2, 12, or 23% per 25g soil) of perennial ryegrass roots or shoots. Minimal effects on bermudagrass germination and growth were detected when ryegrass root amended soil was used. However, ryegrass shoot amended soil greatly reduced bermudagrass germination, ash weight, root length density, and root mass density. These inhibitory effects suggest allelochemicals are potentially leaking from severed and decaying ryegrass shoots and impacting bermudagrass growth and development.

PLANT COUNTS, DIGITAL IMAGE ANALYSIS, AND VISUAL RATINGS FOR ESTIMATING WEED CONTROL IN TURF: ARE THEY CORRELATED? F.H. Yelverton*, J.A. Hoyle, T.W. Gannon, L.S. Warren; North Carolina State Univ., Raleigh, NC

ABSTRACT

Herbicide efficacy research trials in turfgrass commonly report data based on visual estimates. There has been much interest recently in determining how accurate and consistent visual estimates may be, relative to other techniques. Other evaluation methodology includes line intersect analysis (LIA) and digital imaging analysis (DIA), among others. Field experiments were conducted during 2007 and 2008 at two locations (Jackson Springs and Raleigh, NC) to determine if tall fescue (*Lolium arundinaceum*) mowing height could suppress large crabgrass (*Digitaria sanguinalis*) populations. The Raleigh location consisted of an Appling fine sandy loam and the Jackson Springs location consisted of a Candor sand. Large crabgrass was purchased from Okeen, Oklahoma and seeded in each experiment in early March. Evaluated tall fescue mowing heights included 2.5, 5.1, 7.6 or 10.2 cm, which were initiated once soil temperatures reached an optimum (13C) for crabgrass emergence. Visual rating (VR), DIA and LIA were used to determine percent crabgrass cover in mid-September at each location and statistics were completed to determine their correlation. In 2007, no significant differences were observed between VR and DIA (P-value = 0.131) and VR and LIA (P-value = 0.392). In 2008, there were no significant differences between VR and DIA (P-value = 0.725) and VR and LIA (P-value = 0.471). Regression analysis of VR values against DIA or LIA values were also conducted for 2007 and 2008. In 2007, VR versus DIA expressed a slope of 0.89 and R^2 value of 0.99, VR versus LIA $R^2 = 0.99$ with a slope of 0.84. In 2008, VR versus DIA expressed a slope of 0.84 and a R^2 value of 0.99, VR versus LIA $R^2 = 0.99$ with a slope of 0.83. These results demonstrate evaluated rating methods are highly correlated and may allow VR to become more widely accepted.

POSTEMERGENCE CONTROL OF KHAKIWEED (*ALTERNANTHERA PUNGENS* HBK.) IN A BERMUDAGRASS ROUGH. G.M. Henry*, T. Williams; Plant and Soil Science, Texas Tech University, Lubbock, TX

ABSTRACT

Khakiweed (*Alternanthera pungens* HBK.) is one of the most troublesome weed species in managed turfgrass, especially in the arid and semi-arid regions of the southern United States. Tolerance to heavy traffic and soil compaction make khakiweed a problem in home lawns, golf courses, and athletic fields. Field experiments were conducted at Meadowbrook Country Club in Lubbock, TX in the summer of 2008 to quantify the efficacy of several herbicides for the postemergence control of khakiweed. Studies were located on established infestations of khakiweed present in a common bermudagrass rough cut to a height of 5.0 cm. Plots measured 1.5 x 1.5 m and were arranged in a randomized complete block design with four replications of treatments. Treatments were applied using a CO_2 backpack sprayer equipped with XR8003VS nozzle tips and calibrated to deliver 304 L/ha at 276 kPa. Treatments were initiated on June 1, 2008 and consisted of sulfentrazone at 0.21 kg ai/ha, sulfentrazone at 0.28 kg ai/ha, sulfentrazone at 0.21 kg ai/ha followed by (fb) 0.07 kg ai/ha 5 weeks after initial treatment (WAIT), sulfentrazone at 0.28 kg ai/ha fb 0.14 kg ai/ha 5 WAIT, single or sequential (3 WAIT) applications of carfentrazone at 0.017 or 0.034 kg ai/ha, and single or sequential (5 WAIT) applications of metsulfuron at 0.036 or 0.072 kg ai/ha. Visual estimates of percent khakiweed control and bermudagrass phytotoxicity were taken 1, 2, 4, 6, 8, and 12 WAIT. Data were subjected to analysis of variance (ANOVA) and means were separated using Fisher's Protected LSD at the 0.05 significance level. No bermudagrass phytotoxicity was recorded and all sulfentrazone treatments exhibited ≤ 5% control throughout the duration of the trial. Sequential applications of carfentrazone at 0.034 kg ai/ha provided the highest level of control (93%) 1 WAIT. All other carfentrazone treatments exhibited ≥ 81% control 1 WAIT. Control with metsulfuron treatments was ≤ 19% 1 WAIT. Khakiweed control was reduced (≤ 9%) with all carfentrazone treatments 12 WAIT. Sequential applications of metsulfuron at 0.036 and 0.072 kg ai/ha provided the highest level of control 12 WAIT, 95 and 99%, respectively. Single applications of metsulfuron at 0.036 and 0.072 kg ai/ha exhibited 49 and 74% control 12 WAIT, respectively. This experiment will be replicated in time.

BROADLEAF WEED CONTROL WITH AMINOCYCLOPYRACHLOR (DPX-KJM44) IN FINE TURF.
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ABSTRACT

Aminocyclopyrachlor (DPX-KJM44) is a new active ingredient under development by DuPont for selective weed control in turf, among other use sites. DPX-KJM44 is a systemic herbicide which is absorbed by leaves and roots. DPX-KJM44 offers foliar and residual control of perennial and annual weeds. Field experiments were initiated to evaluate DPX-KJM44 (25 - 108 g ai/ha) for postemergent control of select broadleaf weed species including Virginia buttonweed (*Diodia virginiana*), common lespedeza (*Kummerowia striata*), henbit (*Lamium amplexicaule*), buckhorn plantain (*Plantago lanceolata*), and dandelion (*Taraxacum officinale*). These data indicate a single DPX-KJM44 application (50 g ai/ha) may provide excellent control of Virginia buttonweed, annual lespedeza, and dandelion. Additionally, DPX-KJM44 provided excellent buckhorn plantain and henbit control although increased rates (75 g ai/ha) were required. These data indicate DPX-KJM44 may offer excellent control of several common or troublesome broadleaf weed species in turf.

EVALUATION OF IODOMETHANE AS A METHYL BROMIDE ALTERNATIVE IN TURF SYSTEMS.
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ABSTRACT

Iodomethane (methyl iodide) received federal registration as a fumigant alternative to methyl bromide. However, limited data exists on its effectiveness in turf and sod preplant situations. Experiments were conducted in 2006 and 2007 to evaluate two iodomethane formulations: 98:2 and 50:50 (iodomethane:chloropicrin). The 98:2 formulation was tested at 112 and 269 kgs ha^{-1} in 2006 and at 112, 196, and 269 kgs ha^{-1} in 2007. The 50:50 formulation was tested at 224 and 392 kgs ha^{-1} in 2006 and 224, 280, 336, and 392 kgs ha^{-1} in 2007. A methyl bromide treatment (392 kgs ha^{-1}) was included for comparative purposes. The experiments were conducted at the University of Florida, West Florida Research and Education Center near Jay. Plots areas were cultivated prior to fumigant application. All fumigation treatments were applied by a commercial applicator and plots measured 9.1 m X 15.2 m. Two passes with the fumigation applicator were made through each plot and each plot was covered with a plastic tarp. Tarps were removed 7 days after treatment (DAT). 'Tifway 419' bermudagrass (*Cynodon dactylon* X *C. transvaalensis*) was sprigged on three different sprigging dates in 2006 (7, 14 and 21 DAT) and on two dates in 2007 (14 and 21 DAT). Sprigs were planted at 40 m^3 ha^{-1} using a tractor-pulled sprigger in 4.6 m wide strips for each plot. Sprigs were watered as needed for establishment and fertilized weekly when conditions were favorable for bermudagrass growth. Visual turfgrass and weed control data were collected throughout the studies. Little to no bermudagrass injury was observed for all treatments. Cocklebur (XANST) was effectively controlled by all rates of the 50:50 formulation but not the 98:2 formulation. Carpetweed (MOLVE), pigweed (AMARE), and wild radish (RAPRA) were not effectively controlled with either formulation. Control of sicklepod (CASOB) was good with the 50:50 formulation but poor with the 98:2 formulation of iodomethane. Only methyl bromide provided acceptable (≥70%) purple nutsedge (CYPRO) control in both years. All other treatments provided ≤60% purple nutsedge control in 2006. In 2007, the 98:2 iodomethane treatments provided only 65% control of purple nutsedge. The 50:50 formulations provided only 40% control of purple nutsedge.

SAFETY OF MESOTRIONE TO NEW SEEDINGS OF COOL-SEASON TURFGRASS. P.C. Bhowmik*,[1] D. Sarkar,[1] D. Lycan[2]; [1]Plant, Soil and Insect Sciences, University of Massachusetts, Amherst, MA, [2]Syngenta Crop Protection, Baldwinsville, NY

ABSTRACT

Mesotrione [2-(4-mesyl-2-nitrobenzoyl)-3-hydroxycyclohex-2-enone] is a pigment inhibitor herbicide that controls many common susceptible weed species by inhibiting the 4-HPPD enzyme. Recently, mesotrione received EPA registration for use on golf courses and sod farms. Our objectives were to establish use rate of mesotrione under various turfgrass environments and to identify any injury from mesotrione in newly seeded turfgrass species. Studies were conducted at the Turfgrass Research Center, MA as well as at various locations with Syngenta Crop Protection. In a new seeding trial in MA, the existing turfgrass was killed with glyphosate (1.12 kg ai ha^{-1}) and the area was prepared for seeding. Perennial ryegrass was seeded on June 3, 2008. Plots were 1 by 3 m. Treatments were replicated three times in a randomized block design. The PRE and POST treatments were applied on June 4 and June 20, 2008, respectively. In 2007, various university trials included PRE applications of mesotrione (480 SC) at 175 or 280 g ai ha^{-1}, siduron at 6700 g ai ha^{-1}, and mesotrione applied PRE followed by POST at 175 g ai ha^{-1}. In 2008, university trials including MA compared PRE followed by POST applications of mesotrione 480 SC, 240 SC, and 50 WG formulations at 175 or 280 g ai/ha. PRE applications of siduron were included in some 2008 trials. POST applications were typically made after the first mowing. Turfgrass species tested included Kentucky bluegrass, perennial ryegrass, tall fescue, and fine fescue. Most locations showed slight phytotoxicity from mesotrione in the form of bleaching within 1 to 3 weeks after an application. In some trials, phytotoxicity was more severe and was considered unacceptable, especially with the higher rate of 280 g ai ha^{-1} applied to more sensitive species such as perennial ryegrass. In MA, however, this rate of mesotrione was safe to perennial ryegrass. In MA trials, POST application of mesotrione treatments whether applied as a split treatment to PRE or POST alone exhibited slight foliar phytotoxicity (5 to 10%). Phytotoxicity typically dissipated within 1 to 2 weeks of first appearance of symptoms. Percent of turfgrass ground cover in mesotrione treated plots was similar to siduron or untreated plots in the majority of trials. The various formulations of mesotrione performed similarly across all 2008 trials. Mesotrione provided good to excellent control of various grass and broadleaf weeds common to cool-season turfgrass. Across all trials and turf species tested, mesotrione applied PRE followed by POST at 175 g ai ha^{-1} provided consistent weed control while minimizing the potential of phytotoxicity to newly established turfgrass.

EFFICACY OF SODIUM CHLORIDE SALT APPLICATIONS FOR POSTEMERGENCE GRASSY WEED CONTROL IN SEASHORE PASPALUM TURF. J.T. Brosnan*,[1] J. DeFrank,[2] M.S. Woods,[1] G.K. Breeden[1]; [1]Plant Sciences, University of Tennessee, Knoxville, TN, [2]Tropical Plant and Soil Sciences, University of Hawaii, Honolulu, HI

ABSTRACT

Seashore paspalum (*Paspalum vaginatum* Swartz.) is a prostrate, perennial turfgrass that is indigenous to tropical and coastal areas and is consequently used extensively on golf courses throughout Hawaii. Halophytic in nature, seashore paspalum can tolerate higher salinity levels than other plant species, which suggests that applications of sodium chloride could be used for postemergence grassy weed control on established stands; however, minimal efficacy data has been published on the subject. Field research was conducted in 2007 and 2008 to evaluate the efficacy of sodium chloride applications for control of sourgrass (*Pasapalum conjugatum* Berg.), a grassy weed commonly found infesting seashore paspalum golf course fairways in Hawaii. Studies were conducted on a 'Salam' seashore paspalum fairway at Koolau Golf Course (Kaneohe,HI). Three salt products were evaluated: fine salt (99% sodium chloride, 1% sodium silicoaluminate, 83% of particles 0.50-0.25 mm in diameter), coarse salt (100% sodium chloride, 75% of particles 2.0-1.0 mm in diameter), and a salt solution produced from dissolving fine salt in distilled water. Each of these products was applied singly at 1464 kg/ha and sequentially (three applications on a 7 d interval) at 488 kg/ha. The efficacy of these treatments was compared to single and sequential (14 d interval) applications of MSMA at 2.4 kg/ha and 1.12 kg/ha, respectively, as well as single and sequential (14 d interval) applications of MSMA + metribuzin, at rates of 2.4 kg/ha + 0.56 kg/ha and 1.12 kg/ha + 0.28 kg/ha, respectively. The fine salt and coarse salt treatments were applied granularly using a shaker jar. Salt solution, MSMA, and MSMA + metribuzin treatments were applied using a CO_2-powered boom sprayer calibrated to deliver 374 L/ha using a single flat-fan 8004E nozzle at 275 kPa configured to provide a 0.9-m spray swath. 'Salt solution' treatments were applied using the same boom sprayer and nozzle, calibrated to deliver 1487 L/ha and 4761 L/ha, respectively. Increased carrier volume was needed in order to create salt solutions delivering 488 and 1464 kg/ha. Sourgrass control was assessed visually on a 0 (no injury) to 100% (complete plant death) scale. Seashore paspalum and sourgrass injury were assessed quantitatively through measurements of relative chlorophyll index (R840/R700) using a hand held chlorophyll meter. Data were collected 1, 2, 3, and 6 weeks after initial treatment (WAIT). One soil core was also removed from each plot at 6 WAIT and analyzed for sodium adsorption ratio (SAR) and electrical conductivity (EC_e). A single granular application of fine salt at a rate of 1464 kg/ha provided 84% and 23% control of sourgrass 6 WAIT in 2007 and 2008, respectively. Sequential granular applications of fine salt at 488 kg/ha provided 92% and 96% control of sourgrass in 2007 and 2008, respectively, at 6 WAIT. Sequential applications of salt solution yielded a similar response in both 2007 and 2008. Granular applications of a coarse salt provided a lower level of control than fine salt at both the 1464 and 488 kg/ha rates on 3 out of 4 rating dates in 2008; a similar trend was observed in 2007, but no significant differences were observed between these treatments. All salt treatments measured higher in soil sodium adsorption ratio (SAR) and electrical conductivity (EC_e) than the untreated check; however, levels reported in this study were significantly lower than the threshold SAR and EC_e levels that have been associated with reduced seashore paspalum growth. Sequential applications of MSMA at 1.12 kg/ha and MSMA plus metribuzin at 1.12 kg/ha and 0.28 kg/ha, respectively, provided greater than 90% control in 2008, but less than 40% control in 2007. Greater seashore paspalum injury was observed following applications of MSMA and MSMA plus metribuzin than following salt applications. These data suggest that sequential applications of fine salt can be used to control sourgrass infesting seashore paspalum turf.

CELSIUS: A NEW THREE-WAY HERBICIDE FOR CONTROL OF BROADLEAF WEEDS IN WARM SEASON TURF. D.F. Myers*,[1] M. Bradley,[2] J. Michel,[3] B. Monke,[4] L. Mudge,[5] L. Norton,[6] C. Olsen,[7] A. Parker,[8] D. Spak[9]; [1]Development & Tech Service, Bayer Environmental Science, RTP, NC, [2]Marketing, Bayer Environmental Science, RTP, NC, [3]Development & Tech Service, Bayer Environmental Science, Orlando, FL, [4]Development & Tech Service, Bayer Environmental Science, Overland Park, KS, [5]Development & Tech Service, Bayer Environmental Science, Clemson, SC, [6]Development & Tech Service, Bayer Environmental Science, Bethlehem, PA, [7]Development & Tech Service, Bayer Environmental Science, Wildomar, CA, [8]Development & Tech Service, Bayer Environmental Science, Clayton, NC, [9]Development & Tech Service, Bayer Environmental Science, Cary, NC

ABSTRACT

Celsius is the trade name for a new 3-way post emergent herbicide for control of broadleaf weeds and some grasses in warm season turf. The herbicide is composed of thiencarbazone-methyl/iodosulfuron/dicamba sodium salt in the ratio of 30/6.7/186 and is formulated as a WG. Thiencarbazone methyl and iodosufuron are ALS inhibitors and dicamba sodium salt is a growth regulator. Warm season turf including St. Augustinegrass, bermudagrass, zoysiagrass, and centipedegrass are tolerant to Celsius. Bahiagrass and seashore paspalum show marginal tolerance. Cool season grasses are not tolerant to Celsius. Celsius controls a number of broadleaf weeds and grasses including chickweed, dollarweed, dandelion, Facelis sp., white clover, Virginia buttonweed, corn speedwell, chamberbitter, spotted spurge, swinecress, annual sowthistle, California burclover, curly dock, oxalis, hop clover, rabbit clover, purslane, bull paspalum, broadleaf signalgrass, barnyard grass, ragweed, foxtail, johnsongrass, quackgrass, large crabgrass, and Texas panicum. Celsius does not control smooth crabgrass, blanket crabgrass, or annual bluegrass. Celsius has significant benefits to the customer, demonstrating excellent turf safety and broad spectrum efficacy that is equal or better than current standards. Overall use rates are significantly lower than other 3-way standards. In the Florida turf market, the development of Celsius is an important advancement due to the season-long tolerance of St. Augustinegrass to the product. Celsius also shows potential as an atrazine replacement in turf.

PENOXSULAM - A NEW BROADLEAF HERBICIDE FOR USE IN TURF. A. Alexander*,[1] D. Loughner,[2] M. Melichar,[3] M. Lees[4]; [1]DowAgroSciences, Lawrenceville, GA, [2]DowAgroSciences, Huntington Valley, PA, [3]DowAgroSciences, Indianapolis, IN, [4]DowAgroSciences, Granite Bay, CA

ABSTRACT

Penoxsulam is a new broadleaf herbicide for use in cool and warm season turf. This new active is another member of the triazolopyrimidine sulfonamide chemical family developed by Dow AgroSciences, LLC. Penoxsulam is an ALS (acetolactate synthase) inhibitor accepted for evaluation under EPA's Reduced Risk Pesticide Program. The molecule has a favorable environmental and toxicological profile with water solubility of 408 ppm at pH 7; aerobic half-life in soil of 46 days, and half-life in water 25 days. Absorbed via leaves, shoots, and roots then transported to meristematic tissue, penoxsulam is effective at low use rates of 22 to 67 gai/ha (grams active ingredient per hectare). Penoxsulam is the active ingredient in both LockUp™ and Sapphire™ specialty herbicides registered for use in established turfgrass, including residential lawns, golf courses, parks, sports fields, sod farms and around commercial buildings. Penoxsulam products sold in turf provide post emergent control of key weeds such as white clover (*Trifolium repens*), dandelion (*Taraxacum officinale*), dollarweed (*Hydrocotyle umbellate*), chickweed (*Stellaria media*) and annual sedges. Sapphire™ is a 37.5 gai/L SC (soluble concentrate) marketed by Dow AgroSciences in California and the Pacific Northwest targeted for English lawn daisy (*Bellis perennis*) control. Research trials in California with penoxsulam applied post emergently, twice, 30 days apart at 11 gai/ha with 0.25% v/v non-ionic surfactant illustrated 100% English lawn daisy control 1 to 3 months after application (MAA), and greater than 80% control 1 year after application (YAA). This level of English lawn daisy control far exceeded that of the standard 5 way combination that contains 2,4-D, dicamba, carfentrazone, quinclorac and MCPP. Two applications of the 5 way standard, post applied in 1% v/v methylated seed oil provided 30% control of English lawn daisy 1 YAA as compared to greater than 80% control provided by penoxsulam applied twice. In addition to penoxsulam alone, granular product registrations held by Dow AgroSciences contain penoxsulam + dicamba, and penoxsulam + dicamba + 2,4-D acid. LockUp™ is the trade name for the granular products that will be manufactured and distributed by Dow AgroSciences channel partners. Penoxsulam alone at 22 or 45 gai/ha, or penoxsulam at 22 gai + dicamba at 112 gae/ha, provided white clover control that was significantly better than common 2 or 3 way granule standards containing 2,4-D, dicamba and MCPP when applied on a product/area basis. Dollarweed control 3 to 5, or 6 to 10 weeks after application (WAA) of granular penoxsulam at 67 gai/ha ranged from 55 to 85%. While this level of dollarweed control is not complete, it was significantly better than the 35 to 50% control provided by the standard granule application of 2240 gai/ha of atrazine. In summary, penoxsulam is a new active ingredient from Dow AgroSciences, for effective post emergent broadleaf weed control in cool and warm season turfgrass. ™ Trademark of Dow AgroSciences LLC. Always read and follow the label directions. State restrictions on the sale and use of LockUp and Sapphire apply. Consult the label prior to purchase or use for full details.

POST-EMERGENCE CONTROL ON PURPLE NUTSEDGE. J.R. Harrell*, A. Estes, B. McCarty; Clemson University, Clemson, SC

ABSTRACT

Purple nutsedge is a native of India and is widely distributed in temperate and tropical regions of the world. It is a perennial that produces tubers on rhizomes. Its leaves and flowering stalks generally die back in fall as temperatures decrease, but tubers and rhizomes survive in the soil and sprout the following spring when soil temperatures remain above 59°F. The majority of tubers can be found in the top 6 inches of soil where they can survive for 1 to 3 years. The purpose of this study was to evaluate traditional and new chemistry for postemergence nutsedge control. Treatments for both studies included: Dismiss 4 L at 12 oz/a, Certainty 75 DF at 0.75 oz/a, Certainty 75 DF 0.75 at oz/a + Dismiss 4 L at 12 oz/a, Certainty 75 DF at 1.25 oz/a, Monument 75 DF at 0.33 oz/a, Monument 75 DF at 0.33 oz/a + Dismiss 4 L at 12 oz/a, Monument 75 DF at 0.56 oz/a, Dismiss 4 L at 6 oz/a, Certainty 75 DF at 1.25 oz/a + Dismiss 4 L at 6 oz/a, and Monument 75 DF at 0.56 oz/a + Dismiss 4 L at 6 oz/a. All treatments included a non-ionic surfactant at 0.25% v/v. Ratings taken were for control on a scale of 0 to 100 percent, where 0 was no control and 100 was complete control and 80 percent was acceptable. The only application for both studies was made on July 24, 2006 and July 10, 2008, respectively. Purple nutsedge control rates were taken on Aug. 10, 2006 (17 DA-A), indicated no treatment provided over 80 percent. Dismiss 4 L at 12 oz/a had 72 percent control. On Aug. 18, 2006 (25 DA-A), Dismiss at 12 oz/a (92%), Certainty at 0.75 oz/a + Dismiss at 12 oz/a (93%), Monument at 0.33oz/a + Dismiss at 12 oz/a (88%), Certainty at 1.25 oz/a + Dismiss at 6 oz/a (85%), and Monument 0.56 oz/a + Dismiss at 6 oz/a (83%) all controlled the purple nutsedge greater than 80 percent. Ratings on Aug. 25, 2006 (32 DA-A) showed that Certainty at 0.75 oz/a (80%), Certainty at 0.75 oz/a + Dismiss at 12 oz/a (95%), Certainty at 1.25 oz/a (88%), Certainty at 1.25 oz/a + Dismiss at 6 oz/a (92%), and Monument 0.56 oz/a + Dismiss 6 oz/a (80%) all controlled purple nutsedge over 80 percent. On Sept. 11, 2006 (49 DA-A), only Certainty 1.25 oz/a (88%) and Certainty 1.25 oz/a + Dismiss at 6 oz/a (95%) controlled purple nutsedge over 80 percent. Finally on Oct. 9, 2006 (77 DA-A), only Certainty 1.25 oz/a (88%) had control over 80 percent. In the second study, on July 17, 2008 (7 DA-A), only Dismiss at 12 oz/a (83%) had 80 percent control. On July 31, 2008 (21 DA-A), no treatments provided control, however Dismiss at 12 oz/a (75%) was closest. On Aug, 7, 2008 (28 DA-A), only Certainty 0.75 oz/a + Dismiss at 12 oz/a (83%) and Certainty at 1.25 oz/a + Dismiss at 6 oz/a (80%) provided over 80 percent control. On Aug. 21, 2008 (42 DA-A), only Certainty at 1.25 oz/a (90%) and Certainty at 1.25 oz/a + Dismiss at 6 oz/a (93%) had control over 80 percent. Finally, on Sept. 11, 2008 (63 DA-A), only Certainty at 1.25 oz/a + Dismiss at 6 oz/a (88%) reached 80 percent control. Future research at Clemson University will include continuing to evaluate possible herbicides and rates for purple nutsedge control.

SHADE TOLERANCE OF 'DIAMOND' ZOYSIAGRASS MANAGED UNDER PUTTING GREEN CONDITIONS WITH THE USE OF TRINEXAPAC-ETHYL. J. Atkinson*, B. McCarty; Clemson University, Clemson, SC

ABSTRACT

Turf quality on a putting green is damaged when grown under shade stress. In the southeast the traditional use of bermudagrass on putting greens has a major characteristic of being less tolerant to shade stress. The plant growth regulator trinexapac-ethyl, can lessen negative responses of turfgrasses to shade. The purpose of this research was to determine the shade tolerance of 'Diamond' zoysiagrass (Zoysia matrella) when maintained under putting green conditions with and without the use of trinexapac-ethyl. The study included three levels of shade: none (0%), low (60%), and high (90%). The three levels of shade were applied continuously to all plots using a neutral density, poly-fiber black shade cloth. Two treatments were within each level of shade. One included the application of trinexapac-ethyl with a CO_2 backpack sprayer at a rate of 4.77 L ha $^{-1}$wk^{-1} (1.5 oz/ 1000ft^2 wk^{-1}) operating at 20 GPA with an 8003 flat flan nozzle. The second treatment was absent of trinexapac-ethyl application. Application of shade was initiated on 23 May 2008 and removed 30 October 2008. Plot size was 2m by 1.5m maintained at a height of 45cm above ground level to maintain proper airflow. Shade tents were removed 3 hours weekly to take measurements and perform maintenance. Visual turf quality ratings were taken bi-weekly beginning on 23 May 2008 and ending on 30 October 2008. Ratings were based on a 1-9 scale, with 1 representing dead turf and 9 representing flawless turf. A turf quality rating <7 was deemed unacceptable. In the final visual rating on October 30, 2008 acceptable turfgrass quality resulted from 0% shade with and without trinexapac-ethyl and 60% shade with and without trinexapac-ethyl. Unacceptable turfgrass quality resulted from 90% shade with trinexapac-ethyl. Dead turf resulted from 90% shade without trinexapac-ethyl.

ANNUAL BLUEGRASS CONTROL WITH AE 717. J.L. Jester*, J.B. Willis, M.J. Goddard, T.L. Mittlesteadt, S.D. Askew; Turfgrass Weed Science, Virginia Tech, Blacksburg, VA

ABSTRACT

Annual bluegrass (*Poa annua*) is a winter annual that reduces the quality of turfgrass by altering the texture of playing surfaces, produces unsightly seed heads, and lowers aesthetics by mottling turf with lighter green patches. Annual bluegrass tolerates low mowing heights and seeds are capable of germinating throughout the year. These factors not only reduce quality of the turf but also make annual bluegrass control difficult. Current methods of annual bluegrass control in bermudagrass include applications of PRE herbicides for example oxadiazon and prodiamine. Efficacy of PRE herbicides depends on optimized application strategy. The objectives of this study are to 1) determine how application timing influences indizaflam efficacy for annual bluegrass control and 2) evaluate phytotoxicity of indizaflam on 'Vamont' bermudagrass. A field trial was initiated at Virginia Tech's Turfgrass Research Center (TRC) in 2007 in Blacksburg, VA on October 28, 2007. Treatments were arranged in a randomized complete block design with 16 treatments and 3 replications. Herbicide rates included indizaflam at 20, 40, and 60 g ai/ha, oxadiazon at 3360 g ai/ha, and prodiamine at 1120 g ai/ha. Application timings were mid fall (MF) on October 28, late fall (LF) on November 14, and spring (SP) on April 11. Percent coverage of annual bluegrass was evaluated for performance of treatments. Percent annual bluegrass coverage 1 month after initial treatment (MAIT) was 3 to 9% regardless of treatment. When evaluated the following spring, indizaflam applied in MF or LF reduced annual bluegrass coverage 56 to 68%; while prodiamine applied MF reduced annual bluegrass coverage 23-42%. Spring applications of indizaflam, oxadiazon, and prodiamine did not control annual bluegrass. Both fall applications of indizaflam controlled annual bluegrass acceptably through July 11 of the following season. Prodiamine applied in fall controlled annual bluegrass acceptably through June 13. Indizaflam did not injure bermudagrass at any application time.

ETHOXYSULFURON FOR KYLLINGA BREVIFOLIA ROTTB. CONTROL IN SEASHORE PASPALUM. X. Guang*, K. Pan; East China Weed Technology Institute, Nanjing,, China

ABSTRACT

Field studies were conducted during 2006 and 2008 at 3 Golf Courses in Guangdong and Hainan province, China, to determine the *Kyllinga brevifolia* Rottb. control in Seashore Paspalum with ethoxysulfuron. Seashore Paspalum (cv. Salum) tolerance and *Kyllinga brevifolia* control with ethoxysulfuron was also evaluated. *Kyllinga brevifolia* control with ethoxysulfuron at 0.05, 0.1, 0.15, 0.3 and 0.6 kg ai ha^{-1} was 73%,81%,92%,99% and 98% 5 WAT in 2006, 77%,83%,93%,98% and 100% 5 WAT in 2007 at Hill view golf course, Guangdong was 72%,85%,89% 93% and 96% 5 WAT in 2006, 75%,81%,89%,100% and 100% 5 WAT in 2007 at Kangle golf club, Hainan respectively. *Kyllinga brevifolia* control with ethoxysulfuron at 0.1, 0.15, 0.2,0.4 and 0.8 kg ai ha^{-1} was 85%,93%,99%,100% and 100% 6 WAT in 2007, 86%,95%,100%,100%and 100% 6 WAT in 2008 at Red valley golf course, Hainan. No injuring to Seashore Paspalum (cv.Salum) occurred with ethoxysulfuron at less than 0.3 kg ai ha^{-1} from 1-4 WAT and slight injuring to turf was appeared 2 WAT and disappeared 3 WAT with ethoxysulfuron at 0.6 kg ai ha^{-1}. Visible tiny injuring to turf at 2 WAT, recovered at 4 WAT.

CONTROL OF MULTIFLORA ROSE. J.D. Byrd, Jr. and J.M. Taylor. Mississippi State University, Mississippi State, MS 39762.

ABSTRACT

Experiments were conducted to evaluate methods for control of multiflora rose. In all experiments where foliar treatments were applied, treatments were made to simulate a low volume backpack or small hand sprayer application. The spray pressure remained constant at 30 psi and treatments were applied through a single cone nozzle inside the dripline of individual plants and plants were sprayed until runoff. In experiment 1, treatments were applied at the labeled rate either once on June 7, 2007 or initial followed by a sequential at 24 HAIT (hours after the initial treatment), 1 WAIT (week after the initial treatment), or 1 MAIT (month after the initial treatment). At 104 DAIT (days after the initial treatment), all Surmount (2% V/V) treatments provided 100% control. Cimarron (1 oz/100 gal) provided 70% control with one application or the initial followed by the sequential 1 MAIT. When the initial Cimarron application was followed by a sequential treatment at 24 HAIT or 1 WAIT, control improved to 90%. Velpar 75 DF (4 ml of 2.6 lb ai/gal solution per 3 ft diameter of rose vegetation) gave 90% control either as a single or initial followed by another treatment at 24 HAIT). When the sequential was delayed until 1 WAIT or 1 MAIT control decreased to 80%. Grazon P+D (1.5% v/v solution) provided 90% multiflora rose control with one application and 100% with the sequentials. Treatments could not be evaluated the following spring for long term control because they were accidentally clipped by the landowner. In the second experiment, Velpar DF was applied according to the label as mentioned above and compared to an equivalent amount applied as a dry granular treatment. All treatments were applied to the base of the plants. No difference in control was observed at 103 or 406 DAIT with 85 to 90% control at 103 DAIT and 95 to 100% control at 406 DAIT. In a third experiment, labeled rates of herbicides and mowing treatments were applied to multiflora rose on dates listed in The Old Farmer's Almanac that correspond to the best times to either discourage or encourage plant growth in the months of June and September. Treatments made on dates to discourage growth were applied June 10 and September 27, 2007 while treatments made on dates to encourage growth were applied June 18 and September 18, 2007. The first evaluations were made in September to evaluate the June treatments. There was no difference in clipping or herbicide treatments applied in June when comparing each applied during the dates to encourage or discourage growth. All treatments were evaluated in July 2008. With clipping, Surmount, Grazon P+D, Velpar, Weedmaster and Arsenal there was no difference between the June and September treatments for control of multiflora rose when they were applied during times to encourage growth. The September treatment of Cimarron was better than the June treatment when applied during the date to encourage growth. When applied during times to discourage growth, the September treatments were better than June treatments with Surmount, Grazon P+D, and Arsenal. When treatment dates corresponding to best days to encourage or discourage growth were compared, Surmount or Grazon P+D applied on dates to discourage growth in September provided better control than Surmount applied in September at the time to encourage growth. Arsenal applied in June during the time to encourage growth had better control than Arsenal applied in June during the time to discourage growth.

TECHNICAL INTRODUCTION OF THE NEW DUPONT VEGETATION MANAGEMENT HERBICIDE AMINOCYCLOPYRACHLOR. R.G. Turner*,[1] J.S. Claus,[2] E. Hidalgo,[2] M.J. Holliday,[2] G.R. Armel[3]; [1]DuPont Crop Protection, Memphis, TN, [2]DuPont Crop Protection, Wilmington, DE, [3]University of Tennessee, Knoxville, TN

ABSTRACT

Aminocyclopyrachlor, a new active ingredient herbicide from DuPont, is currently under development for use in non-crop markets including rights-of-way, bareground, roadsides and invasive weed management. Aminocyclopyrachlor is a novel pyrimidine carboxylic acid herbicide which provides both postemergent and soil residual activity in controlling many annual and perennial broadleaf weeds and brush species. This low use rate auxin-type herbicide provides broad-spectrum control of many broadleaf weeds including Asteraceae, Fabaceae, Chenopodiaceae, Convolvulaceae, Solanaceae and Euphorbiaceae, and a number of woody plant species, such as, *Acer rubrum*, *Acer negundo*, *Celtis occidentalis*, *Salix alba*, *Nyssa sylvatica*, *Prosopis juliflora* and *Ulmus americana*. Aminocyclopyrachlor also controls important ALS, PPO, triazine and glyphosate resistant weeds such as, *Amaranthus spp.*, *Kochia scoparia*, *Conyza canadensis*, *Ambrosia* spp., and *Salsola iberica*. Aminocyclopyrachlor has a very favorable toxicological (*acute and subchronic toxicity testing complete*) and environmental safety profile. Both the acute oral and dermal mammalian toxicity levels have been determined to be at an LD_{50} of > 5000 mg/kg. In the mammalian subchronic testing, no adverse effects have been observed in the developmental, reproductive or immune system studies and no adverse effects have been observed in the neurotoxic, genotoxic or mutagenic studies. Environmental toxicity testing has provided very favorable end point results for aminocyclopyrachlor across all studies. Aminocyclopyrachlor will provide a new standard for broadleaf and woody plant weed control in the roadside, invasive weed management, rights-of-way and bareground markets.

EVALUATION OF KJM-44 FOR MARESTAIL (*CONYZA CANADENSIS*) AND TOTAL VEGETATION CONTROL. M. Blair* Plant and Soil Sciences, University of Kentucky, Lexington, KY; and Z. Lowe, Purdue University, West Lafayette, IN.

ABSTRACT

Aminocyclopyrachlor (DPX-MAT28 / KJM44) is a pyrimidine carboxylic acid herbicide currently in development for the noncrop and invasive plant market by DuPont. Noncrop vegetation management occasionally requires total vegetation management and problematic plant species, such as horseweed (*Conyza canadensis*), thrive in the microconditions created by total vegetation management. Glyphosate and ALS resistant horseweed plants frequently exist in these areas due to the repeated use of glyphosate and ALS inhibiting herbicides. KJM44 provides a tank mix partner for standard treatments to provide post and pre emergent control of horseweed and other species for total vegetation management. KJM44 (80% a.i. w/w) was screened in two locations, Lexington, Kentucky and West Lafayette, Indiana, in 2008 for horseweed and total vegetation control. Treatments included KJM44 alone and in a three-way mix including sulfometuron and chlorsulfuron or metsulfuron. All treatments included glyphosate and methylated seed oil as is standard for many total vegetation management programs across the region. The three KJM44 alone treatments (210 g, 277 g, and 346 g ai h^{-1}) resulted in marginally to completely unacceptable levels of total vegetation control at both locations (< 72 %) 120 DAT. The combination of KJM44 at 277 g ai ha^{-1}, sulfometuron at 156 g ai ha^{-1}, and chlorsulfuron at 78 g ai ha^{-1} resulted in higher levels of bareground (i.e total vegetation control) than KJM alone or sulfometuron plus chlorsulfuron at the same rates 120 DAT at both locations. The KJM44 plus either sulfometuron and chlorsulfuron or sulfometuron and metsulfuron treatments resulted in effective and statistically similar levels of total vegetation control as the standard, bromacil at 7 kg ai ha^{-1}. Horseweed control was excellent for every treatment at the Kentucky trial and for every treatment except the glyphosate alone treatment at the Indiana trial. The glyphosate alone treatment as well as the untreated check resulted in significantly lower control in the Indiana trial at both 45 and 120 DAT. All chemical treatments resulted in significantly higher horseweed control (>93%) at the Kentucky trial than the untreated check 120 DAT. KJM44 alone resulted in excellent horseweed control (> 93%) at all rates tested at both locations. Tank mixes of KJM44 tested performed equally as well as KJM44 alone for horseweed control. KJM44 is not a stand alone total vegetation control material; however, it does provide an option as a tank mix partner to lessen the potential for herbicide resistant species.

INVASIVE WEED MANAGEMENT WITH AMINOCYCLOPYRACHLOR IN THE CENTRAL GREAT PLAINS. P. Westra*,[1] S. Nissen,[1] D. Shaner,[2] B. Lindenmayer,[1] G. Brunk[1]; [1]BSPM, Colorado State University, Ft. Collins, CO, [2]BSPM, USDA/ARS, Ft. Collins, CO

ABSTRACT

Aminocyclopyrachlor is a new non-ALS herbicide under development by Dupont for initial use in non-cropland settings for invasive weed and tree control. Its mode of action is most likely that of a plant growth regulator (PGR). Plant responses can be seen in less than 24 hours but are often more subtle than what is seen with other PGR herbicides. Use rates to date in field research projects have ranged from 35 to 280 grams active ingredient per hectare. Most sensitive perennial weeds are well controlled at 70 - 100 grams per hectare. This new herbicide has both foliar and soil activity on susceptible species. Central great plains research shows that leafy spurge, Canada thistle, Scotch thistle, Russian knapweed, field bindweed, common milkweed, salt cedar, and Russian olive all exhibit excellent (> 90%) 1 year after treatment (YAT) control with aminocyclopyrachlor. Weeds in the mustard family are not well controlled by this herbicide. Soil binding is soil dependent; this herbicide shows good residual soil activity in different soils, but by 2 YAT most agronomic crops show no injury effects. Use of a good adjuvant enhances foliar activity of aminocyclopyrachlor; C14 research shows that MSO is most effective for aminocyclopyrachlor uptake. Three formulations of the herbicide are being evaluated; studies show some significant differences in the performance of these formulations. 2008 field research evaluated the pre and post response of 18 cool and warm season grasses to aminocyclopyrachlor.

CHAPARRAL: A NEW HERBICIDE FORMULATION FOR PASTURE WEED CONTROL. W.N. Kline*,[1] P.L. Burch,[2] E.S. Hagood,[3] N. Rhodes,[4] J. Ferrell,[5] S.F. Enloe[6]; [1]Dow AgroSciences, Duluth, GA, [2]Dow AgroSciences, Christiansburg, VA, [3]Virginia Tech, Blacksburg, VA, [4]University of Tennessee, Knoxville, TN, [5]University of Florida, Gainesville, FL, [6]Auburn University, Auburn, AL

ABSTRACT

Chaparral™ specialty herbicide is a new herbicide from Dow AgroSciences LLC for use in rangelands and pastures. It is a novel, water dispersible granule containing two active ingredients, aminopyralid (the active in Milestone® and Forefront® specialty herbicides) and metsulfuron. Extensive research over several years has demonstrated that this low use rate combination provides excellent broad spectrum weed control and in many situations is superior to either of the component herbicides. Chaparral is formulated as a 62% water dispersible granule containing 85% aminopyralid and 15% metsulfuron. Maximum labeled use rate for rangelands and pastures is 3.3 oz of product per acre and typical use rate for most broadleaf weed complexes will be about 2 oz product/acre. Several economically important brush species can be controlled with Chaparral typically at rates between 2 and 3 oz product/acre. Chaparral has several advantages over current commercial products available for use in rangelands and pastures. It is a, non-restricted use product that provides broad-spectrum control of key weeds in pastures and brush control of many important species in North America. Chaparral will be sold in a small package size making it very convenient for smaller land owners to purchase and use; more acres can be treated without needing large quantities and without large containers requiring disposal. It has an excellent fit for 2,4-D restricted counties (cotton). Also, Chaparral aligns very well with increasingly important IPM approaches to weed control, two actives with different modes of action in one container improve weed resistance management. Recent research has shown that Chaparral provides improved control of goldenrod (SOOSS), musk thistle (CRUNU), wild carrot (DAUCA), narrowleaf plantain (PLALA) and wild parsnip (PAVSA) when compared to current products such as ForeFront ®R&P, Grazon® P+D herbicide or Milestone®. Several important brush or low growing shrubby species that Chaparral will control at 3 oz product/A are western snowberry (SYPOC), common snowberry (SYPAL), buckbrush (SYPOR), honey locust (GLITR), honeysuckle (LONJA), kudzu (PUELO), black locust (ROBPS), mimosa (ALBJU), eastern redbud (CCSCA), Cherokee rose (ROSLA), multiflora rose (ROSMU), wisteria (WSTFL), yucca (UCCSS) (suppression), and blackberry sp (bush type) (RUBSS) . Additional research is needed on dewberry (RUBTV), but initial results are very promising. Chaparral can severely damage or kill certain grass species due to the metsulfuron component in the product. In bermudagrass pastures, Chaparral can effectively control or suppress Pensacola bahiagrass (PASNO). This product cannot be safely used in Pensacola bahiagrass pastures. Higher rates of Chaparral can damage tall fescue (FESAR) and should not be used unless some damage or suppression can be tolerated. Lower rates of Chaparral provide seedhead suppression and some growth suppression of tall fescue. The product label has more specific information on grass tolerance, control and suppression. ® ™ Trademark of Dow AgroSciences LLC; Always read and follow the label directions. State restrictions apply to the sale and use of Chapparral. Consult the label prior to purchase or use for full details. Grason P+D is a Federally Restricted Use Pesticide.

MANAGEMENT OF PASTURE WEEDS WITH CLEANWAVE (FLUROXYPYR + AMINOPYRALID).
J. Ferrell*, B. Sellers; University of Florida, Gainesville, FL

ABSTRACT

Cleanwave (fluroxypyr 1.2 lb/gal + aminopyralid 0.08 lb/gal) was recently registered for use in Florida pastures. The weed control spectrum of Cleanwave under Florida conditions was unknown. Therefore, experiments were conducted to document the control of various weed species with this herbicide combination. It was observed that Cleanwave provided excellent control of dogfennel. Cleanwave applied at 14 oz/A was effective on dogfennel that was less than 30 inches in height. For dogfennel greater than 30 inches, applications rates of 20 or 26 oz/A may be needed. It was observed that the addition of 2,4-D at 32 oz/A commonly improved control of perennial dogfennel over Cleanwave alone. Other experiments found that Cleanwave was highly effective on prickly pear cactus. Fall applications of Cleanwave at 50 oz/A provided near 100% control of prickly pear cactus at 1 year after application. Tank-mixing addition aminopyralid did not significantly improve control. Cleanwave was also found to provide little or no control of 6" Florida pusley. Conversely, aminopyralid (0.08 lb) + 2,4-D (0.66 lb) provided 90% control of Florida pusley at 8 weeks after treatment.

COMPARISONS OF THE EXPERIMENTAL HERBICIDE DPX-KJM44 WITH AMINOPYRALID FOR CONTROL OF KEY INVASIVE WEEDS IN TENNESSEE. G.R. Armel*,[1] W.E. Klingeman,[1] P.C. Flanagan,[1] G.K. Breeden,[1] M. Halcomb[2]; [1]Plant Sciences, University of Tennessee, Knoxville, TN, [2]Cooperative Extension, University of Tennessee, Knoxville, TN

ABSTRACT

Field and greenhouse studies were conducted in 2008 near Beersheba Springs, Newport, Knoxville, and Maryville, TN to evaluate the experimental auxin mimic herbicide DPX-KJM44 (aminocyclopyrachlor-methyl) in comparison to another auxin mimic herbicide aminopyralid for control of key invasive and native weed populations. The weed species evaluated in three field studies included trumpetcreeper (*Campsis radicans*), mugwort (*Artemisia vulgaris*), buckhorn plantain (*Plantago lanceolata*), common ragweed (*Ambrosia artemisiifolia*), horsenettle (*Solanum carolinense*), maypop passionflower (*Passiflora incarnata*), wild violet (*Viola papilionacea*), red clover (*Trifolium pretense*), daisy fleabane (*Erigeron annuus*), crownvetch (*Coronilla varia*), wingstem (*Verbesina alternifolia*), oxeye daisy (*Leucanthemum vulgare*), Japanese honeysuckle (*Lonicera japonica*), Canada goldenrod (*Solidago canadensis*), tall ironweed (*Vernonia gigantean*), sweet gum (*Liquidambar styraciflua*), sulphur cinquefoil (*Potentilla recta*), poison hemlock (*Conium maculatum*), and wild blackberry (*Rubus* spp.). The weeds American burnweed (*Erechtites hieraciifolia*), mulberry weed (*Fatoua villosa*), purple loosestrife (*Lythrum salicaria*), horsetail (*Equisetum arvense*), and chamberbitter (*Phyllanthus urinaria*) were evaluated in the greenhouse because field locations were unattainable for evaluation of these species. DPX-KJM44 was applied postemergence at rates of 35, 70, 140, and 280 g ai/ha compared to aminopyralid at rates of 70 and 140 g ai/ha. Both herbicides were also evaluated in mixtures with 2,4-D at 1080 g ai/ha, metsulfuron at 42 g ai/ha, and diflufenzopyr at 70 g ai/ha. All herbicide treatments contained methylated seed oil at 1% v/v. The most sensitive species to DPX-KJM44 were trumpetcreeper, horsenettle, wingstem, common ragweed, crownvetch, and red clover. DPX-KJM44 applied alone at 140 g ai/ha provided greater than 83% control trumpetcreeper, horsenettle, daisy fleabane, oxeye daisy, wingstem, tall ironweed, Japanese honeysuckle, poison hemlock, common ragweed, maypop passionflower, crownvetch, and red clover. Aminopyralid at 280 g ai/ha was more effective in controlling mugwort than an equal rate of DPX-KJM44 and this rate provided equal control of crownvetch, red clover, common ragweed, daisy fleabane, wild blackberry, and sulphur cinquefoil when compared to DPX-KJM44 at 140 g ai/ha. DPX-KJM44 at 70 g ai/ha plus 2,4-D provided similar weed control to DPX-KJM44 applied alone at 280 g ai/ha which provided the broadest spectrum control of any single active ingredient treatment. In the greenhouse, DPX-KJM44 and aminopyralid were effective in controlling chamberbitter, mulberry weed, American burnweed, and purple loosestrife when applied at rates of 70 g ai/ha or greater. No purple loosestrife regrowth occurred following any treatment of DPX-KJM44 or aminopyralid. No DPX-KJM44 or aminopyralid treatments were effective in the control of horsetail.

PASTURE WEED AND BRUSH CONTROL WITH HERBICIDE MIXTURES. P.L. Burch*,[1] W.W. Witt,[2] E.S. Hagood,[3] B.B. Sleugh[4]; [1]Dow AgroSciences, Christiansburg, VA, [2]University of Kentucky, Lexington, KY, [3]Virginia Tech, Blacksburg, VA, [4]Dow AgroSciences, Des Moines, IA

ABSTRACT

Aminopyralid is a new systemic herbicide developed by Dow AgroSciences specifically for use on rangeland, pasture, rights-of-way, such as roadsides for vegetation management, Conservation Reserve Program acres, non-cropland, and natural areas. Formulations include Milestone® and ForeFront® R&P herbicides. Milestone is formulated as a liquid containing, 2 lbs ae/gal of aminopyralid as a salt. ForeFront R&P is also formulated as a liquid containing 0.33 lbs ae aminopyralid + 2.67 lbs ae 2,4-D/gal. These herbicides provide postemergence control of broadleaf plants and residual control of susceptible plants that emerge after application. ForeFront R&P is a very effective broad spectrum herbicide for controlling weeds in pasture management programs. However, depending on the level of weed management for a given pasture, the complex of weeds and/or brush may require additional herbicides to renovate a pasture and get it back to a more productive condition. Once the pasture renovation process is underway, other options to manage encroaching brush species can be integrated into pasture management programs. The objective of this study was to evaluate the efficacy of herbicide mixes to control complexes of herbaceous weed and brush species in degraded pastures. Remedy® Ultra, PastureGard®, and Crossbow® herbicides are effective brush herbicides useful in pasture management programs. These herbicides were evaluated as tank-mix partners with ForeFront R&P and Milestone at five locations in Virginia, Ohio, Kentucky and Missouri. Weed control was evaluated at the end of the growing season of application and brush was evaluated one year after treatment. ForeFront R&P and Milestone effectively controlled all herbaceous weeds evaluated in the trials. Multiflora rose (ROSMU) was controlled by ForeFront R&P alone or in combinations. Blackberry (RUBSS) (tall growing) was controlled with combinations of ForeFront R&P and Remedy Ultra, PastureGard, or Crossbow. Milestone alone did not control honey locust (GLITR), multiflora rose (ROSMU), blackberry, or elm (ULMAM). When Remedy Ultra was applied with Milestone, all these brush species were effectively controlled except multiflora rose. Sites with a high level of neglect can effectively be brought back into full productive capacity by use of ForeFront R&P or Milestone in combination with Remedy® Ultra, Pasturegard®, and Crossbow® herbicides. Aminopyralid-containing products (Milestone or ForeFront R&P) provide an excellent foundation for herbaceous and woody plant control in pastures. ® ™ Trademark of Dow AgroSciences LLC; State restrictions apply to the sale and use of Remedy Ultra. Consult the label before purchase or use for full details. Always read and follow the label directions.

EVALUATION OF FOLIAR HERBICIDES FOR GREENBRIER MANAGEMENT IN RANGELAND. J. Locke*, E. Funderburg, J. Rogers; Agricultural Division, Samuel Roberts Noble Foundation, Ardmore, OK

ABSTRACT

Greenbrier (*Smilax bona-nox*) is native, woody vine armed with sharp prickles. It may form dense thickets in pastures, fencerows and woodland edges. Greenbrier distribution ranges from the southeastern states to east Texas and Oklahoma to southeast Nebraska. When new shoots are still young and tender, the fresh foliage provides excellent quality browse for both livestock and wildlife. When mature, birds and small mammals utilize greenbrier berries, but cattle do not graze the thickets or understory forage. In cattle grazing systems, the negatives far outweigh any positives. Cattle producers in the Noble Foundations service area of southern Oklahoma and north Texas report significant reductions in forage production and livestock utilization in infested areas. Control recommendations include herbicides alone and in combination with mowing, burning and intensive grazing. Herbicide recommendations vary widely and include Weedmaster (dicamba+2,4-D), Tordon 22K (picloram), Remedy (triclopyr), Remedy + Tordon 22K, PastureGard (triclopyr+fluroxypyr), Crossbow (triclopyr+2,4-D), and Spike (tebuthiuron). These are usually recommended as individual plant treatments. Cultural practices provide only temporary suppression. For each strategy, repetition is needed to maintain infestations at an acceptable level. In the spring of 2007, two field trials were initiated in southern Oklahoma to evaluate six herbicides for greenbrier control and were repeated again in 2008. Two additional trials were initiated on the same ranches in 2008 following the same protocol. Herbicides tested were 1% Tordon 22K, 1.5% PastureGard, 0.25% Remedy + 0.5% Tordon 22K, 0.75% Weedmaster, 1% Surmount and 0.5% Remedy. All treatments were prepared on a v/v basis with 0.25% SurfKing non-ionic surfactant included. An untreated control was included and treatments were replicated 3 times in a randomized complete block design. Applications were made with a CO_2 backpack sprayer using 11002XR flat fan spray tips and applied to simulate a foliar spot spray. The first location is on The Noble Foundation's Oswalt Road Ranch on a stand of mature greenbrier. The west half of each treatment was mowed early each spring and allowed to re-grow until approximately 12 inches tall prior to treatment. The unmowed east half of each treatment was 18-36 inches tall at treatment. The mowed and unmowed portions of each treatment were rated and analyzed separately. The second location is on a Johnston County ranch. The 2007 trial was on a stand of 20-30 inch tall re-growth greenbrier after a winter 2006 burn. The 2008 trial was on a stand of mature greenbrier 15-36 inches tall in new spring growth condition. Treatments were visually rated for percentage suppression as compared to the untreated control. Data were subjected to ANOVA and means separated by LSD at 5% level of significance. In the 2007 trial at the Oswalt Road Ranch property, PastureGard provided a maximum of 87% suppression in the unmowed and 67% in the mowed treatments after the first application. At the 1 YAT rating, the PastureGard provided 72% suppression in the unmowed treatment and 50% in the mowed treatment. During 2008 after the second application, PastureGard provided a maximum of 87% suppression in the unmowed and 70% in the mowed treatments. In the 2007 trial at the Johnston County ranch, PastureGard provided a maximum of 57% suppression after the first application. At the 1 YAT rating, the PastureGard provided 63% suppression. During 2008 after the second application, PastureGard provided a maximum of 88% suppression. In the 2008 trial at the Oswalt Road Ranch property, PastureGard provided a maximum of 70% suppression in the unmowed and 82% in the mowed treatments after the first application. At the Johnston County ranch, PastureGard provided a maximum of 80% suppression after the first application. For all trials and rating dates, the PastureGard treatments provided the statistically maximum and most consistent level greenbrier suppression. Other treatments showing promise were 1% Surmount and 0.5% Remedy providing suppression equal to the PastureGard treatments 60% and 57% of the time respectively.

MANAGEMENT OF GRASS AND BROADLEAF WEEDS IN BERMUDAGRASS WITH DUPONTTM PASTORATM HERBICIDE. E.P. Castner*,[1] R.N. Rupp,[2] C.F. Grymes,[3] J.H. Meredith,[4] C.M. Alford[5]; [1]DuPont Crop Protection, Weatherford, TX, [2]DuPont Crop Protection, Edmund, OK, [3]DuPont Crop Protection, Inez, TX, [4]DuPont Crop Protection, Memphis, TN, [5]DuPont Crop Protection, Lakewood, CO

ABSTRACT

DuPont™ and University trials trials were conducted from 2005-08 to evaluate the efficacy of DuPont™ Pastora™ herbicide for the control of troublesome grass and broadleaf weeds in bermudagrass pastures and hay meadows. Results demonstrated good control of johnsongrass (*Sorghum halapense),* field sandbur (*Cenchrus incertus*) and other summer annual grasses with Pastora™ at use rates of 1 to 1.5 ounces per acre. In some trials, chlorosis and stunting of bermudagrass was observed following applications of Pastora™; however, these symptoms were transient in nature and were rarely observed at later evaluations. Early season applications to dormant bermudagrass provided satisfactory control of winter annual grasses including little barley (*Hordeum pusillum*) and sixweeks fescue (*Vulpia octiflora*) while also providing good control of Italian ryegrass (*Lolium multiflorum*).

UTILITY OF SULFOSULFURON FOR GRASS FORAGE ESTABLISHMENT IN FLORIDA. B.A. Sellers*,[1] J. Ferrell[2]; [1]Range Cattle Research and Education Center and Dept. of Agronomy, University of Florida, Ona, FL, [2]Agronomy, University of Florida, Gainesville, FL

ABSTRACT

Annual and, to a lesser extent, perennial sedges are the most problematic weed species during the establishment of perennial grass forage cultivars in central and south Florida. Current recommendations for the control of sedge species at establishment include WeedMaster (2,4-D + dicamba) at 2 pt/A for bermudagrass (*Cynodon dactylon*) and stargrass (*Cynodon nlemfuensis*) cultivars or Banvel (dicamba) at 2 pt/A for limpograss (*Hemarthria altissima*). While these products provide nearly 100% control of seedling sedges, wet conditions can preclude application of either product within the required 10 - 14 day period after planting - after which control declines to near 0%. Therefore, experiments were conducted to determine if sulfosulfuron can be substituted for WeedMaster and Banvel when establishing stargrass and limpograss pastures. Treatments included Outrider (sulfosulfuron 75% WDG) at 1.33 and 2.66 oz/A, Outrider + Milestone (aminopyralid 2 lb/gal) at 1.33 + 3 oz/A and 2.66 + 3 oz/A, Grasp (penoxsulam 2 lb/gal) at 2.3 oz/A, Sandea (halosulfuron 75% WDG) at 0.67 oz/A, and the standard WeedMaster at 2 pt/A for stargrass or Banvel at 2 pt/A for limpograss. These treatments were applied within 14 days after planting. To simulate a rescue treatment, all treatments except for the WeedMaster and Banvel, were applied 28 days after planting. Plots were visually evaluated 30 and 60 days after treatment (DAT) for crop injury and sedge control. Biomass was harvested 60 DAT and was oven dried for 4 days at 60 C. Stargrass was injured by Outrider to a greater extent than limpograss. Stargrass injury was 26 and 14% 30 and 60 DAT, respectively, when Outrider was applied at 1.33 oz/A 14 days after planting (DAP). When 1.33 oz/A Outrider was applied 28 DAP, stargrass injury was 21 and 11% at 30 and 60 DAT, respectively. Increasing the application rate to 2.66 oz/A increased stargrass injury to 94% 30 DAT when applied 14 DAP. The addition of Milestone to Outrider resulted in a decrease in stargrass injury by as much as 30% when applied 14 DAP, but there was no decrease in injury when this treatment combination was applied 28 DAP. Grasp and Sandea resulted in no stargrass injury regardless of application timing. Compared to WeedMaster, Outrider at 1.33 oz/A caused at least a 36% reduction in yield when applied 14 DAP, but caused only a 22% reduction in yield when applied 28 DAP. Applications of Grasp and Sandea did not cause a significant reduction in yield, regardless of application timing. Limpograss injury ranged from 9 to 23% for both application rates of Outrider 30 DAT when applied 14 DAP, but there was no injury evident 60 DAT. When applied 28 DAP, injury from Outrider applications ranged from 5 to 8% 30 DAT, but no injury was evident 60 DAT. All other treatments did not cause injury to limpograss. There were no significant differences in limpograss yields among herbicide treatments. Sedge control in both studies was 100% in all treatments when applied 14 DAP. However, efficacy of Grasp and Sandea at 60 DAT was reduced when applications were applied 28 DAP to 68 and 84%, respectively, . These data suggest that the use of Outrider is possible regardless of application timing in limpograss. However, Outrider should only be used in stargrass when producers are unable to apply WeedMaster within the 10 - 14 day recommended period after planting.

EFFICACY AND PHYTOTOXICITY OF NICOSULFURON APPLIED IN COMBINATION WITH OTHER HERBICIDES IN FORAGE BERMUDAGRASS. G.N. Rhodes*,[1] M.A. Thompson[2]; [1]Plant Sciences, University of Tennessee, Knoxville, TN, [2]Plant Sciences, University of Tennessee, Jackson, TN

ABSTRACT

Tennessee's climate and soils make the state an excellent location for the production of high quality bermudagrass hay for the horse market. However, the lack of effective and labeled postemergence herbicides for the control of weedy grasses such as crabgrass (*Digitaria sanguinalis*), broadleaf signalgrass (*Urochloa platyphylla*), johnsongrass (*Sorghum halepense*) and barnyardgrass (*Echinochloa crus-galli*) results in reduced quality hay due to curing problems and reduced palatability. In 2005 we began evaluating nicosulfuron + metsulfuron methyl postemergence in bermudagrass hay fields. While excellent (greater than 90%) control of several troublesome grasses was observed, crop injury in the forms of discoloration and stunting was substantial. However, the addition of diuron at low rates alleviated most of the injury. Much effort was spent over the next three years evaluating various rates of nicosulfuron + diuron to identify optimum combinations for weed control and crop safety. In late 2008 the manufacturer decided to discontinue the registration process for diuron in bermudagrass but indicated that it would continue to proceed with the registration for the mixture of nicosulfuron + metsulfuron methyl. Research was conducted in 2007 and 2008 near Decatur and Lexington, TN to evaluate combinations of nicosulfuron + metsulfuron methyl for crop phytotoxicity and weed control in bermudagrass. All treatments, except where noted, were applied with nonionic surfactant (nis) at 0.5 % v/v, and all nicosulfuron treatments were mixed with metsulfuron methyl at a ratio of 3.75 to 1 (nicosulfuron to metsulfuron). All herbicde rates are expressed as active ingredient per acre. At Decatur, nicosulfuron at 0.56, 0.7, and 0.84 oz caused 21 to 28% stunting when plots were evaluated at 26 days after treatment (DAT). Barnyardgrass control was excellent (90% or greater) Substitution of methyated seed oil (1 % v/v) increased stunting to 43 percent. Sulfosulfuron (1 oz) + nis caused 27% bermudagrass shunting but gave only 59% barnyardgrass control. Sequential applications of nicosulfuron at 0.56 followed by (fb) 0.56 oz and 0.84 oz fb 0.84 oz caused 27 and 33% stunting, respectively and did not improve barnyardgrass control compared to single applications. An additional study at this location revealed that the addition of either 2,4-D ester or pendimethalin at 1 lb did not increase stunting caused by 0.844 oz nicosulfuron; conversely, the addition of a premixture of 2,4-D amine + dicamba (0.7 + 0.25 lb) tended to decrease stunting (22% compared to 32%). No injury symptoms were visible in either study at 74 DAT. At Lexington, all applications of nicosulfuron (0.62, 0.78, or 0.94 oz)caused substantial bermudagrass injury (40 to 50%) at 25 DAT; injury from sulfosulfuron (1 oz) was 23%. Dallisgrass control with nicosulfuron was excellent (90% or greater) but poor (50%) with sulfosulfuron. Fresh weight yields were reduced by all treatments of nicosulfuron or sulfosulfuron compared to the untreated check. Similarly, height was reduced by all herbicides when measured at 25 DAT; however, no height reduction was visible at 77 DAT. Dry conditions at this site appeared to exacerbate crop injury. Our data indicate that nicosulfuron is effective for control of certain weedy grasses in bermudagrass hayfields, but it can cause substantial crop injury. In view of the decision regarding diuron it is unclear if an alternative safener will be identified. Crop injury potential may limit producer acceptance and use of nicosulfuron in bermudagrass weed management programs.

EVALUATION OF KUDZU CONTROL PROGRAM IN PENNSYLVANIA. M.A. Bravo*; Weed Science Department, Penn State University/ Penn Dept of Agriculture, Harrisburg, PA

ABSTRACT

Pennsylvania began a pilot kudzu eradication program in 2005. Kudzu is a state noxious weed in Pennsylvania and all known sites in the state are surveyed and monitored. Kudzu is found in Zone 6 of the U.S. National Arboretum Plant Hardiness Zone Map in 13 counties in the state. PDA has confirmed kudzu on more than 114 individual properties. Since 2005, 52 of 89 populations have been enrolled in the 3 year treatment program. The majority of enrolled sites are less than a half an acre in size (small sites) but 3 sites greater than 2 acres (large sites) are also part of the pilot program. Enrolled sites are treated for 3 consecutive years by the Bureau of Plant Industry with the annual goal of limiting any significant above ground biomass production. Technical assistance and training is also provided to enable property owners to monitor and effectively manage the seed bank after the program ends. Three types of treatment applications are used in the program- that begins in the Spring and ends with the onset of frost: high volume foliar, low volume foliar and cut stump/basal bark. Herbicides used in the program since 2000 include aminopyralid, clopyralid, imazapyr, metsulfuron and triclopyr. Clopyralid (Transline) is the base program. With the exception of the treated sites, all known sites of kudzu in Pennsylvania are flowering and most are producing viable seed on an annual basis and seed production at many locations has been documented since the 1980's. Most, but not all of the kudzu sites in Pennsylvania are more than 30 years old if not decades older and were purposely planted for soil stabilization purposes. The program has successfully killed the crowns at all of the small sites and in the portions of the large sites that could be treated. Seed bank germination has occurred at all treated sites the year after treatment but all treated sites have significantly less seed bank germination by the 3rd year of the program.

RESPONSES OF SELECTED WOODY PLANTS TO DPX-KJM44. R.L. Roten*, R.J. Richardson, A.P. Gardner; Crop Science, North Carolina State Univ., Raleigh, NC

ABSTRACT

DPX-KJM44, proposed common name aminocyclopyrachlor, is currently under development for use on a variety of non-cropland sites. Research trials were conducted in North Carolina to evaluate the response of selected woody plant species to this herbicide. Two trials were conducted on cut-over loblolly pine (*Pinus taeda* L.) sites to evaluate control of yellow poplar (*Liriodendron tulipifera* L.**)** and oak species (*Quercus* spp.). DPX-KJM44 rates ranged from 168 to 860 g/ha and were applied in comparison to imazapyr and fosamine. Methylated seed oil at 1% v/v was included with each treatment and treatments were applied with 280 L/ha spray volume. Woody plant size ranged from 0.3 to 3 m in height and natural regeneration of loblolly seedlings were present at time of application. Loblolly pine was also transplanted into plots at approximately 3 months after treatment (MAT) by the property managers. At one year after treatment, yellow poplar was controlled at least 97% with all DPX-KJM44 rates. Red oak species were controlled 100% with rates above 336 g/ha but white oak species and wild grape (*Vitis* spp.) were generally not controlled. Volunteer loblolly pine seedlings were injured up to 80%, while loblolly transplanted after application were not injured more than 21%.

CONTROL OF SELECTED WOODY PLANTS WITH AMINOPYRALID AND AMINOPYRALID MIXTURES. A.P. Gardner*, R.J. Richardson, R.L. Roten, S.T. Hoyle; Crop Science, North Carolina State Univ., Raleigh, NC

ABSTRACT

Tree of heaven [*Ailanthus altissima* (Mill.) Swingle] and privet spp. are significant invasive plants in the southeastern United States. Another problematic invasive plant of more limited distribution is trifoliate orange [*Poncirus trifoliata* (L.) Raf.]. Trials were initiated in the summer of 2006 and fall of 2007 in North Carolina to evaluate the efficacy of aminopyralid on these species. Herbicide treatments included aminopyralid applied alone, triclopyr applied alone, and various mixtures of these active ingredients. Industry standards, such as imazapyr, were also included in selected treatments. Non-ionic surfactant at 0.25% v/v was included with each treatment. Trials were evaluated at one month and one year after treatment (YAT) to establish percent vegetative control. At 1 YAT in the first tree of heaven trial, control was at least 85% with all mixtures containing aminopyralid and triclopyr-ester. Control with aminopyralid (0.163 kg ae/ha) alone and triclopyr-ester (3.4 kg ae/ha) alone was 83 and 91%, respectively. In a second trial, tree of heaven was controlled at least 90% with all triclopyr treatments whether alone or in mixture. Control with aminopyralid (0.122 kg ae/ha) alone was only 48%. Privet control was 82% at 1 YAT with aminopyralid (0.17 kg ae/ha) plus triclopyr-ester (2.2 kg ae/ha), and 93 to 99% with mixtures containing both triclopyr-ester and imazapyr (0.28 kg ae/ha). Aminopyralid alone did not control privet and control with triclopyr-ester alone ranged 42 to 77% at rates of 1.1 to 2.2 kg ae/ha. In the repeated trifoliate orange trial, control was at least 88% in both years of the trial with imazapyr (1 kg ae/ha), metsulfuron (0.14 kg ai/ha), and imazapyr plus metsulfuron. Control of at least 82% was obtained in one repetition with aminopyralid (0.12 kg ae/ha), triclopyr-amine (1680 kg ae/ha) plus aminopyralid, and fosamine (13.5 kg ae/ha).

MUSK THISTLE CONTROL ON OKLAHOMA HIGHWAY RIGHTS-OF-WAY WITH DPX-KJM44. C.C. Evans*, D.P. Montgomery, D.L. Martin; Horticulture, Oklahoma State University, Stillwater, OK

ABSTRACT

A roadside musk thistle control study was conducted in the spring of 2008 to evaluate the postemergent effectiveness of aminocyclopyrachlor (DPX-KJM44), chlorsulfuron, aminocyclopyrachlor/chlorsulfuron tank-mixes, aminopyralid and the experimental herbicide DPX-MAT28 (DuPont) alone and in tank-mixes with chlorsulfuron. Aminocyclopyrachlor was applied alone at 17.5, 35, 70 and 140g ai ha^{-1} and these rates were also applied as combination mixed with 26.5g ai ha^{-1} chlorsulfuron, respectively. Included in the study were three rates of aminopyralid, 52.5, 70, and 122.5g ai ha^{-1} applied alone, three rates of DPX-MAT28 at 17.5, 35, 70g ai ha^{-1}, applied alone and a single rate of chlorsulfuron, 26.5g ai ha^{-1}. All treatments listed above included methylated seed oil 1.0% v v^{-1}. The study was initiated April 14 with herbicide application to musk thistle rosettes 10.16cm - 35.6cm in diameter prior to bolting. Treatments were applied to 1.5m x 4.5m plots using a CO_2 pressurized boom sprayer calibrated to deliver 224.6L ha^{-1} of spray solution. Treatments were replicated 3 times in a randomized complete block design. Postemergence weed control was visually rated on a 0-100% control scale. Three rating dates were utilized, 11 DAA (days-after-application), 30 DAA, and 60 DAA. At 11 DAA none of the treatments had attained a good (80-89%) - excellent (90-100%) control rating. The highest rates of aminocyclopyrachlor (applied alone at 70 and 140g ai ha^{-1}), aminocyclopyrachlor + chlorsulfuron (applied in combination at 26.5 + 140g ai ha^{-1}, respectively), aminopyralid (applied alone at 52.5, 70, and 122.5g ai ha^{-1}) and DPX-MAT28 (applied alone at 70g ai ha^{-1}) were at the 58-68% control rating. At 30 DAA four treatments were exhibiting good to excellent control (80-100%), aminocyclopyrachlor (applied alone at 70 and 140 g ai ha^{-1}), aminocyclopyrachlor + chlorsulfuron (applied in combination at 70g + 26.5g ai ha-^{1}, respectively), aminopyralid (applied alone at 52.5, 70, and 122.5g ai ha^{-1}), and DPX-MAT28 (applied alone at 70g ai ha^{-1}). At the last rating, 60 DAA, all treatments except aminocyclopyrachlor (applied alone at 17.5g ai ha^{-1}), aminocyclopyrachlor + chlorsulfuron (17.5 + 26.5g ai ha^{-1}, respectively), and chlorsulfuron (applied alone at 26.5g ai ha-^{1}) were receiving good to excellent control ratings.

THE USE OF AMINOCYCLOPARACHLOR FOR SITE PREPARATION IN FORESTRY. A.W. Ezell*,[1] J. Yeiser[2]; [1]Forestry, Miss. State Univ., Miss. State, MS, [2]Forestry, Stephen F. Austin State University, Nacogdoches, TX

ABSTRACT

Chemical site preparation in forestry is challenging due to the variety of species found on most areas. DuPont has introduced a new product for use in forestry site preparation areas. Aminocyclopyrachlor has potential for controlling undesirable species on these sites. Studies were installed in Mississippi and Texas on recently cutover areas. Variable rates of aminocyclopyrachlor were applied and the control of hardwoods was evaluated using pretreatment and one year after treatment measurements. Results from both studies will be presented.

ENHANCING THINNED SLASH PINE VOLUME PRODUCTION AND PRODUCT CLASS DISTRIBUTION WITH COMPETITION CONTROL AND FERTILIZATION ON FLATWOODS SPODOSOLS-SIX YEAR RESULTS. E.D. Dickens*,[1] D.J. Moorhead[2]; [1]Warnell School of Forestry and Natural Resources, UGA, Statesboro, GA, [2]Warnell School of Forestry and Natural Resources, UGA, Tifton, GA

ABSTRACT

The effects of mid-rotation mechanical (M) and chemical (H) competition control, fertilization (F), dolomite liming (L), and combinations of M+F, H+F, and L+F in thinned slash pine stands on common flatwoods soils are quantified over a six year period. Two randomized complete block designed study areas have been installed in thinned slash pine stands (4th or 5th row + select); one each in Wayne and Ware counties, Georgia. There are three replications per treatment at each site. The soils have been delineated by a NRCS soil mapper on site prior to plot establishment as primarily Mascotte and Ocilla. Slash pine mean d.b.h, total height, live crown ratio, volume $tree^{-1}$, volume ac^{-1}, and diameter distributions and product class distributions were determined for each treatment at each site over time in two year intervals. Each tree in each plot has been tagged, numbered, measured for d.b.h,, total height (Haglof Vertex III Laser Hypsometer), height to base of live crown, presence and height of stem canker, height to fork, and merchandised into a product class (based on d.b.h. and stem form). Initial and final product class distributions (volume and TPA) are being determined by treatment. Rate of return will be quantified based on treatment costs, resultant product class distribution ingrowth, and current stumpage prices for each product class @ year 6 of the study period.

INFLUENCE OF APPLICATION TIMING ON THE EFFICACY OF CHOPPER GEN2 IN FORESTRY SITE PREPARATION. A.W. Ezell*,[1] J. Yeiser[2]; [1]Forestry, Miss. State Univ., Miss. State, MS, [2]Forestry, Stephen F. Austin State University, Nacogdoches, TX

ABSTRACT

Chopper GEN2 is one of the newest formulation of imazapyr to be labeled for forestry site preparation. This formulation is not the same as Arsenal AC or Chopper and provides different results in field applications. As with any product, application timing can influence results, especially in site preparation scenarios. While short term results are important, the long term results are of greatest interest to most land managers. This study was installed to (1) evaluate the effect of application timing on the efficacy of Chopper GEN2 and (2) evaluate pine seedling growth in these areas treated at different times. A single treatment (32 oz/A of Chopper GEN2 + 1% v/v MSO) was applied at three timings (June, August, and October) in 2006. Study sites for the project were Appamattox, VA, Starkville, MS, and Allen, LA. Hardwoods on the sites were recorded at the time of application and again in September, 2007. Pine height and groundline diameter (GLD) were measured at the time of planting (January, 2007) and again in November, 2007. Hardwood coverage varied by site, but all applications provided excellent control at all sites. Pine survival was very good in all treatments. Pine height and GLD were generally significantly greater in treated plots than in control areas at all locations. Height and GLD generally were not significantly different among application dates at any location. Overall, pine stem volume was 5 times (VA and MS) or 10 times (LA) greater in treated plots as compared to untreated (control) plots.

POTENTIAL NEW HERBICIDES TO ADD TO MISSISSIPPI DEPARTMENT OF TRANSPORTATION'S APPROVED PRODUCT LIST. R.S. Wright*, J.D. Byrd; Plant and Soil Sciences, Mississippi State University, Mississippi State, MS

ABSTRACT

Aminocyclopyrachlor, saflufenacil, and flazasulfuron were evaluated as potential new herbicides and Stimupro, Dyne-A-Pak, or Perc Plus were evaluated as potential additives for Mississippi Department of Transportation's Approved Product List. Visual evaluations were made on a scale ranging from 0 to 90% (0% = no visual control; 90% = complete control visually). All applications were made with a CO_2 pressurized backpack sprayer with a four nozzle boom delivering 236 L/ha. The first experiment was initiated October 12, 2007, and the following treatments were applied to cogongrass: 1.0% V/V imazapyr 2L combined with 2.0% V/V Stimupro, 2.0% V/V Dyne-A-Pak, 2.33 L/ha Perc Plus, or a 0.25% V/V 90/10 non-ionic surfactant (NIS), 2.0% V/V glyphosate 3L combined with 2.0% V/V Stimupro, 2.0% V/V Dyne-A-Pak, 2.33 L/ha Perc Plus, or 1.0% V/V imazapyr 2L plus 2.0% V/V glyphosate 3L combined with 2.0% V/V Stimupro, 2.0% V/V Dyne-A-Pak, or 2.33 L/ha Perc Plus, or 0.18 or 0.35 kg ai/ha aminocyclopyrachlor 80WG applied with 1.0% V/V methylated seed oil (MSO). Cogongrass treated with 1.0% V/V imazapyr applied with 0.25% V/V NIS was 90%, and comparable control (83%) was observed with 0.35 kg ai/ha aminocyclopyrachlor 241 or 277 days after application (DAA). At 353 DAA, 1.0% V/V imazapyr applied with NIS or 0.35 kg ai/ha aminocyclopyrachlor provided 70 or 73% cogongrass control, respectively, and was comparable to 1.0% V/V imazapyr plus 2.0% V/V glyphosate. Applying 2.0% V/V glyphosate with no additive resulted in 20% cogongrass control, which was not significantly higher than other glyphosate treatments containing any of the additives evaluated 353 DAA. The addition of Stimupro, Dyne-A-Pak, or Perc Plus with imazapyr, glyphosate, or imazapyr plus glyphosate did not significantly improve cogongrass control compared to imazapyr in combination with a NIS, glyphosate, or imazapyr combined with glyphosate. The second experiment was initiated March 6, 2008, and treatments are as follows: 0.21 or 0.42 kg/ha flazasulfuron 25WG, 0.14 kg/ha flazasulfuron combined with 0.63 kg ae/ha glyphosate 3L, 0.19 kg/ha flazasulfuron combined with 0.84 kg/ha glyphosate, 0.21 kg/ha flazasulfuron combined with 0.42 kg/ha glyphosate, 0.28 kg/ha flazasulfuron combined with 1.13 kg/ha glyphosate, 0.42 kg/ha flazasulfuron combined with 0.42 kg/ha glyphosate, 0.03 kg/ha sulfometuron, or 0.03 kg/ha sulfometuron combined with 0.42 kg/ha glyphosate. Any treatment applied without glyphosate received a 0.25% V/V 90/10 NIS. No differences of control were observed between treatments for crimson clover, hop clover, or Italian ryegrass control 62 DAA. Large crabgrass was controlled 88% with 0.42 kg/ha flazasulfuron combined with 0.42 kg/ha glyphosate, and comparable control (80%) was observed with 0.42 kg/ha flazasulfuron alone 92 DAA. Large crabgrass control using 0.03 kg/ha sulfometuron alone or with 0.42 kg/ha glyphosate was 28 or 60%, respectively, 92 DAA. A similar trend was observed 123 DAA for large crabgrass control. All treatments provided 85 to 90% control of horseweed except, 0.03 kg/ha sulfometuron which provided 65% control 92 DAA. Canada goldenrod control was 90% with all treatments except 0.21 kg/ha flazasulfuron alone or 0.03 kg/ha sulfometuron alone 123 DAA. The third experiment was initiated June 11, 2008, and the treatments that were as follows: 0.10 or 0.20 kg ai/ha BAS 80001 (saflufenacil) 70WG, 0.10, 0.20, 0.30, or 0.40 kg ai/ha BAS 80003 (saflufenacil) 1L, 0.10, or 0.20 kg ai/ha BAS 80004 (saflufenacil) 2.9L, 3.7 kg ai/ha MSMA. All treatments were applied with a 1.0% V/V MSO. Illinois bundleflower control ranged from 75 to 90% with no significant differences between treatments 64 DAA. Giant ragweed control ranged from 75 to 90%, and no significant differences were observed 12, 29, 64, or 100 DAA. Although Stimupro, Dyne-A-Pak, or Perc Plus did not provide beneficial results comparatively, evaluations on other species should be made prior to any final decision regarding Mississippi Department of Transportation's Approved Product List. Aminocyclopyrachlor, saflufenacil, or flazasulfuron will be recommended for Mississippi Department of Transportation's Approved Product List upon availability of product.

BREEDING FOR WEED SUPPRESSIVENESS: AN INITIAL APPROACH TO SOYBEAN GENOTYPE SCREENING. G.T. Place*, T.E. Carter, S.C. Reberg-Horton; Crop Science, North Carolina State University, Raleigh, NC

ABSTRACT

The expansion of some organic soybean markets has led some producers to explore alternative weed management systems that utilize a variety of tactics to reduce weed competitiveness. The use of more competitive soybean varieties could be one such tactic in a more diverse weed management program. We grew 28 soybean lines in 2007 and 2008 at Plymouth and Kinston, NC, in a strip split plot design with weedy and weed free treatments stripped across tests with soybean line subplots. Measurements were made from 2 weeks after emergence (WAE) through 7 WAE to evaluate differences in early and late main stem height, leaf area estimates at 3 and 5 WAE, canopy light interception at 4 and 6 WAE, soy biomass at 7 WAE in weedy and weed free plots, and within row weed biomass at 7 WAE. Tests were conducted to allow correlations of early weed suppressiveness with traits such as: large vs. small seed (both within and between genotypes), long vs. normal petiole, tall vs. short main stem, and large vs. narrow leaf shape.

COMPARISON OF SUBSURFACE AND FOLIAR HERBICIDE APPLICATIONS FOR CONTROL OF PARROTFEATHER (*MYRIOPHYLLUM AQUATICUM* VELL. VERDC.). R.M. Wersal*, J.D. Madsen; GeoResources Institute, Mississippi State University, Mississippi State, MS

ABSTRACT

Parrotfeather is an invasive aquatic plant in the United States that is native to South America. Parrotfeather has caused major problems in water-bodies in the United States, where infestations have reduced access, use, and runoff in ditches, streams, ponds, and shallow lakes. Parrotfeather is difficult to control and thrives in a variety of environmental conditions in addition to deploying management techniques. Our objectives were to examine the efficacy of subsurface applications of seven herbicides labeled for aquatic use and to compare those applications to herbicides that can also be applied to emergent foliage. A replicated mesocosm study was conducted in 378 L tanks beginning in August 2007. The maximum and half maximum labeled rates of copper, diquat (6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide), endothall (7-oxabicyclo [2.2.1]heptane-2,3-decarboxylic acid), fluridone (1-methyl-3-phynyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone), triclopyr (3,5,6-trichloro-2-pyridinyloxyacetic acid), 2, 4-D (2,4-dichlorophenoxyacetic acid), and carfentrazone (a,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1*H*-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoic acid, ethyl ester) were applied to designated tanks allowing for a 48 hour exposure time. Fluridone was applied as a static exposure. The maximum labeled rate for foliar applications of diquat, triclopyr, and 2,4-D were used to compare treatment methods. Parrotfeather was rated weekly for percent control for six weeks. At six weeks after treatment (WAT), healthy plant material was harvested, dried, and weighed to determine plant mass. Analyses were conducted using a Kruskal-Wallis test and means separated by the Student-Newman-Keuls method at a $p=0.05$ level of significance. Six WAT, copper, endothall, fluridone, and cafentrazone were not efficacious in controlling parrotfeather. Diquat at all rates and treatment methods significantly ($p<0.01$) reduced parrotfeather mass. Triclopyr as a subsurface treatment at 2.5 mg ae L^{-1} and as a foliar treatment significantly ($p<0.01$) reduced parrotfeather mass. The foliar treatment of 2,4-D resulted in acceptable control of parrotfeather. Future work needs to identify possible herbicide combinations and or application timings that could maximize treatment efficacy; as regrowth occurred in all tanks regardless of herbicide or treatment method and a second application would be necessary for complete control.

MANAGEMENT OF CREEPING RIVERGRASS IN RICE PRODUCTION. S.L. Bottoms*, E.P. Webster, J.B. Hensley, T. P. Carlson; Agronomy and Environmental Management, Louisiana State University, Baton Rouge, LA

ABSTRACT

Creeping rivergrass [*Echinochloa polystachya* (Knuth) Hitch.], an invasive aquatic perennial grass native to South America, infests 6,000 to 10,000 A of rice (*Oryza sativa L.*) and crawfish production in south Louisiana. The climate of this region and management practices associated with rice and crawfish production are conducive to the spread of creeping rivergrass. Presently creeping rivergrass can not be controlled by herbicides alone. Herbicides must be used as part of and integrated weed management system. The integrated management system includes draining of previously flooded fields and multiple tillage operations. Two greenhouse studies were conducted to evaluate the activity of various rice herbicides on creeping rivergrass growth and reproduction. The first study evaluated three rice herbicides on creeping rivergrass plants grown from various length stolon segments containing 1, 2, 4, or 8 nodes. The herbicides treatments were as follows: glyphosate at 1 lb ai/A, cyhalofop at 0.28 lb ai/A, imazethapyr at 0.094 lb ai/A, and a nontreated (NT). Each treatment was applied at either 14 days after planting (DAP) or 28 DAP. The second test evaluated the same herbicides at the same timings except the treatments were applied to creeping rivergrass plants grown from either rhizomes or crowns. In both studies at 14 days after treatment (DAT), plants in each treatment were measured, weighed and divided into single node stolon segments and were replanted. Emergence of the replanted nodes was recorded at 14 days. Results from the first study indicate that fresh weight, stolon length, node production, and germination were all reduced compared with the NT. All inferences were made compared with the NT. Cyhalofop, imazethapyr and glyphosate decreased length by 80 to 85% and fresh weight by 75 to 85%. Reinfestation potential was also impacted by decreasing overall node production 77 to 80% and germination of the replanted nodes was reduced 70 to 93%. In the second study a herbicide by root type interaction with fresh weight, stolon length, and germination occurred. All inferences were made compared with the NT. All herbicide treatments reduced creeping rivergrass fresh weight 35 to 50% when plants were grown from crowns. Fresh weight was reduced 55 to 65% when plants were grown from rhizomes. Stolon length was reduced 60% by cyhalofop and imazethapyr when plants were grown from crowns and 80% when plants were grown from rhizomes. Glyphosate reduced stolon length 80% in plants grown from either crowns or rhizomes. There was no interaction associated with node production. Imazethapyr, cyhalofop, and glyphosate reduced node production 78, 91, and 96%, respectively. Imazethapyr reduced germination of nodes from plants grown from crowns by 30% and germination of nodes from plants grown from rhizomes by 65%. Cyhalofop and glyphosate reduced germination of nodes from plants grown from crowns by 80% and germination of nodes from plants grown from rhizomes by 94 and 100%, respectively. The results from these and previous studies suggest that the use of glyphosate as a burndown herbicide in a Clearfield rice production system along with applications of imazethapyr and cyhalofop may be an integral part of an integrated management approach for creeping rivergrass in rice production. Based on previous research the use of this herbicide program should follow a fallow period of 1 to 2 years with multiple tillage operations under dry conditions to break the growth and reproductive cycle of creeping rivergrass. Research also indicates that increasing rice seeding rates can reduce creeping rivergrass biomass and reproductive potential. Other research has shown that creeping rivergrass is temperature dependent. Planting rice early in the recommended planting window will allow rice a competitive growth advantage over the weed. With an integrated management program, creeping rivergrass can be managed to allow for profitable rice production.

INFLUENCE OF HENBIT (*LAMIUM AMPLEXICAULE*) AND OTHER WINTER WEEDS ON OVERWINTERING AND EARLY-SEASON BUILDUP OF TWOSPOTTED SPIDER MITE (*TETRANYCHUS URTICAE*) IN COTTON. J.F. Smith*, A.L. Catchot, F.R. Musser; Department of Entomology and Plant Pathology, Mississippi State University, Starkville, MS

ABSTRACT

Spider mites have traditionally been considered occasional late-season pests of cotton across the mid-south cotton belt. However, the percentage of Mississippi cotton acres requiring treatment for twospotted spider mite, *Tetranychus urticae* Koch, has increased by at least two-fold over the past four years. One difference is that a small percentage of seedling cotton in Mississippi is now infested. It has been reported in Australia and North Carolina that twospotted spider mite populations remained active throughout winter months on winter annual weeds, despite the fact that most populations enter diapause and overwinter in ground debris. Our first objective in this study was to determine if mites remained active during winter months in Mississippi, and if so, which weed species were utilized as hosts. This was investigated by artificially infesting mites into late-planted cotton during October 2007, and then sampling winter annual weeds throughout winter. Also, when mite outbreaks in seedling cotton were discovered around the state, all weeds around the area were sampled for the presence or absence of mites in 2007 and 2008. A second objective was to determine if spring tillage or selected herbicide burndown could be used to eliminate in-field mite populations and reduce infestation of seedling cotton. Multiple reports have indicated that glufosinate was used in apple orchards to control both weeds and twospotted spider mites. One manuscript reported 100% mortality of mites when treated with field rates of glufosinate as compared to 0% mortality when treated with paraquat or glyphosate. Both field and laboratory tests were conducted. In the field test, mites were artificially infested into a field carpeted with henbit, *Lamium amplexicaule* L., on 17 March. Multiple herbicide treatments, at different timings with and without glufosinate, and tillage were initiated in April and May. Efficacy of glufosinate against mites was also measured in field and lab trials. Throughout the course of these studies, it was determined that henbit was a major host of twospotted spider mite during winter and spring months. Multiple other weed species were also identified as hosts of mites during spring and early-summer. Eliminating in-field weeds with herbicide and tillage proved to reduce mite infestations on seedling cotton. Yield was reduced by 40-50% in plots where mites were not controlled. Timing of applications was not critical, provided all weeds were killed before cotton was planted. In lab trials, glufosinate, Ignite 280 SL, at 580 g AI/ha killed 100% of mites. Control in field studies was comparable to Kelthane. These studies reinforce recommendations to eliminate the ‘green bridge’ that allows insects to move in succession from weeds to cultivated crops. It also identifies various weed species that could be targeted and killed around field borders to reduce the risk of mite migration into cotton. Additionally, these data indicate that weeds and mites can be controlled with one material.

ALLYL ISOTHIOCYANATE AS A METHYL BROMIDE ALTERNATIVE IN TOMATO. S.K. Bangarwa*, J.K. Norsworthy, J. Still, G.M. Griffith, L.E. Estorninos; Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville, AR

ABSTRACT

Methyl bromide, a preplant soil fumigant, has been effectively used for weed control in plasticulture tomato production system. However, due to ozone-depleting potential, methyl bromide is scheduled for phase-out from U.S. agriculture. With the impending ban of methyl bromide in the U. S., an effective alternative is required. Laboratory experiments were conducted to compare the persistence of allyl isothiocyanate (AITC) in soil under Low Density Polyethylene (LDPE) and Virtual Impermeable Film (VIF) mulches. Additionally, field experiments were conducted to evaluate tomato tolerance and the effectiveness of AITC against yellow nutsedge (*Cyperus esculentus*), Palmer amaranth (*Amaranthus palmeri*), and large crabgrass (*Digitaria sanguinalis*). The laboratory experiments were organized in a completely randomized design with three replications. Soil treated with a known concentration of AITC was placed in glass jars covered with LDPE and VIF mulches from 0 to 21 d after treatment. AITC was extracted from the treated soil from each jar and analyzed by gas chromatography. The field experiments were organized in a randomized complete block design with a factorial treatment structure including 2 mulch types (LDPE and VIF) and 6 rates of AITC (0, 15, 75, 150, 750, 1500 kg/ha), replicated four times. Additionally, a standard rate of methyl bromide was included for comparison. AITC was applied to the soil and immediately incorporated using a roto-tiller. Raised beds were prepared after AITC incorporation and covered with LDPE or VIF mulch. Tomato transplants were planted 3 wk after applying the plastic mulch. Crop injury and weed control were visually rated every other week. Tomato fruits were harvested during the season and graded according to USDA standards. Data were subjected to analysis of variance, and treatment means were separated using Fisher's protected LSD ($P<0.05$). AITC persisted longer in the soil covered with VIF mulch compared with LDPE mulch. In field experiment, a maximum of 13% injury occurred in tomato at the highest AITC rate of 1500 kg/ha. AITC at 750 kg/ha or higher rate provided effective (> 90%) control of yellow nutsedge, Palmer amaranth, and large crabgrass up to 8 wk after transplanting. In addition, AITC at 750 kg/ha or higher rate reduced the number of viable weed propagules in the treated beds. Overall, VIF reduced the yellow nutsedge penetration through the plastic mulch compared to LDPE. In summary, application of AITC at 750 kg/ha under a VIF mulch can serve as a potential alternative of methyl bromide for weed control in plasticulture tomato production.

ITALIAN RYEGRASS CROSS RESISTANCE TO TWO ACCASE INHBITING WHEAT HERBICIDES.
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ABSTRACT

In 2007 and 2008, field studies were conducted to evaluate herbicide programs for control of Italian ryegrass in wheat. There were two field sites, one in Milan and one in Knoxville, Tennessee (TN). The Italian ryegrass population at Milan is resistant to diclofop-methyl and the population at Knoxville is susceptible. Herbicide programs included preemergence applications of diclofop-methyl, chlorsulfuron, flufenacet + metribuzin, or pendimethalin. Postemergence applications included diclofop-methyl, pinoxaden, chlorsulfuron + flucarbazone-sodium, and mesosulfuron-methyl. Italian ryegrass control with chlorsulfuron and flufenacet + metribuzin applied at preemergence was good at both locations. Italian ryegrass control with pendimethalin was incomplete at both locations, probably due to a lack of timely activating rainfall. Diclofop-methyl applied at preemergence controlled Italian ryegrass at Knoxville but did not at Milan therefore confirming resistance at Milan. Postemergence control of Italian ryegrass was good from all treatments except for diclofop-methyl at Milan. Yields were similar between all treatments except for the untreated control and the diclofop-methyl treatments at the Milan location where no control was observed thereby reducing yield. Even though pinoxaden is an ACCase inhibiting herbicide like diclofop-methyl it is still a valid option for control of resistant Italian ryegrass at the Milan location. However, other researchers have found that selected populations of diclofop-methyl resistant Italian ryegrass to be cross resistant to pinoxaden. Seed heads from several escapes of Italian ryegrass populations in northwest TN and one population from Union County, North Carolina (NC) were collected before harvest in 2006 and 2007. The selected populations were screened in greenhouse assays for resistance to the ACCase inhibiting herbicides diclofop-methyl and pinoxaden. There were 7 populations that were found to be resistant to diclofop-methyl out of the 37 total selections. Control with diclofop-methyl was less than 50% for each of the 7 populations. Fresh weights were taken at 28 days after treatment by trimming all plant parts at soil level and immediately weighing. The fresh weight data was converted to the percent of the weight of the untreated control for each population, when treated with diclofop-methyl all 7 resistant populations produced greater than 65% fresh weight of the control. It was also noted that any population not reaching the 65% or greater fresh weight did not form reproductive structures. The population from NC was the only one that was resistant to both diclofop-methyl and pinoxaden. Visual evaluations of control of the NC population with pinoxaden was 30% and the fresh weight was 55% of the untreated control. In order to further confirm the resistance to pinoxaden, a dose response assay was conducted in the greenhouse and also a PCR analysis was conducted to search for a mutation in the ACCase binding site. The growth rate reduction of 50% (GR_{50}) for the NC population was 68 g ai/ha and for a susceptible population the GR_{50} was 5 g/ha. The results from the PCR analysis were that the NC population had a target site mutation in the I1781L which is a substitution of isoleucine by leucine. Previous research has found that this target site mutation confers resistance to most aryloxypropionate and cyclohexanedione herbicides in other grass species as well.

EFFECT OF SIMULATED HERBIVORY ON GROWTH AND FINAL BIOMASS OF THE AQUATIC WEED HYGROPHILA, *HYGROPHILA POLYSPERMA* (ROXB.) T. ANDERS (ACANTHACEAE).

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ABSTRACT

Hygrophila, *Hygrophila polysperma* (Roxb.) T. Anders, (Family: Acanthaceae) is a rooted submerged or emerged herbaceous perennial aquatic invasive plant in Florida that is spreading to other warm water areas of the United States and Mexico. Hygrophila is a federal listed noxious weed, a Florida state listed Category II prohibited plant, and Florida Exotic Pest Plant Council category I invasive species. Also known as East Indian hygro, green hygro, Miramar Weed, oriental ludwigia and India swampweed, hygrophila is native to India or broadly to the Southeastern Asiatic mainland. Hygrophila poses a serious threat to all Florida waterways, particularly flowing fresh water and structured shorelines. It is capable of forming dense stands which can occupy the entire water column, causing disruption in navigation, irrigation and flood control systems. Hygrophila tolerates a wide range of water temperatures, and can competitively displace native aquatic plants in shallow water and river ecosystems because of its high growth rate and vegetative propagation. Recent experiences in south Florida indicate that practical solutions for long term control of this plant are not currently available. The invasive characteristics exhibited by hygrophila are consistent with the 'enemy escape hypothesis' which attributes the success of invasive plants to a lack of natural enemies. As a part of ongoing classical biocontrol project on this weed, a mesocosm experiment was undertaken in March 2008 to understand the impact of artificial 'herbivory' on growth and accumulation of final biomass of hygrophila at the at Biven's Arm Research Center located at the campus of the University of Florida, Gainesville, Florida. Herbivory simulation is a common method used by ecologists to study plant-herbivore interactions. Measuring the impact of simulated herbivory on plant response provides critical insights into plant compensation and tolerance to actual herbivory. The advantages of this method are the type, degree and frequency of damage can be controlled precisely thereby eliminating confounding biotic and abiotic effects. This method also removes the logistical difficulties associated with rearing and manipulating live herbivores. The objective of this 'simulated herbivory' experiment was to determine the effects of an insect defoliator on hygrophila growth and accumulation of final biomass and thus to determine the potential for insect natural enemies to control this federal noxious weed. The experiment was conducted using a randomized complete block design with 7 treatments. The treatments, which consisted of manual defoliations of plants, comprised 3 defoliation levels (0%, 50% & 100%) with 3 frequencies (defoliation once, twice or at weekly intervals). In total, 20 plastic pots (7 cm x 7cm x 6 cm) each containing a hygrophila sprig planted in a mixture of sand and soil (3:2), were randomly assigned to each treatment. Leaves were cut widthwise from the middle and from their bases with a sterile scissors to achieve 50% and 100% defoliation, respectively. To simulate field conditions, this replicated experiment was conducted in 3 outdoor concrete vaults (approx. 900 L capacity). Hygrophila plants were kept completely submerged and the water in the tanks was changed three times per week. The entire experiment lasted 8 weeks. Plant growth characteristics, e.g., plant height and numbers of sprigs per pot were recorded at weekly intervals. Initial (using a separate set of control plants) and final dry weight of the plants also was recorded. Data were analyzed by analysis of variance to compare the effects of treatments on final growth characteristics at 5% level of significance. The results showed that the growth and accumulated biomass of the defoliated plants were significantly lower than the controls. Plants subjected to 50 and 100% defoliation events twice or weekly during the experiment were severely impacted. These results suggest that an insect defoliator may be effective in reducing the growth and vigor of hygrophila.

TEXASWEED (*CAPERONIA PALUSTRIS*) INTERFERENCE IN DRILL-SEEDED RICE. R.K. Godara*, B.J. Williams, S.L. Angel; LSU AgCenter, Louisiana State University, Baton Rouge, LA

ABSTRACT

Field experiments were conducted at LSU AgCenter's Northeast Research Station near St. Joseph, LA on a Sharkey Clay soil in 2008 to study Texasweed interference in drill-seeded rice. The first experiment was an area of influence experiment laid out in a randomized complete block (RCB) design with 5 treatments and 8 replications. The five treatments were increasing distances: 20, 40, 60, 80 and 100 cm from a single Texasweed plant planted in the center of each rice plot. In each plot rice was harvested from five 20 cm wide concentric circular bands around the Texasweed plant. Rice yield and yield attribute data were analyzed for differences among various treatments using MIXED procedure of SAS. The second experiment was an interference experiment. Treatments were various Texasweed densities obtained by planting Texasweed seeds in experimental plots. Rice yield data from this experiment were subjected to regression analyses to quantify the yield losses caused by increasing weed densities. The third experiment was conducted to determine the critical period of Texasweed interference in drill-seeded rice. The experiment was laid out in RCB block design with three replications and was conducted using natural population of Texasweed. Treatments included weed competition periods of 0, 1, 2, 3, 4, 6, 8, and 12 weeks after planting (WAP) and weed-free periods of 0, 1, 2, 3, 4, 6, 8, and 12 WAP. Various treatments were imposed using selective herbicides and/or hand-weeding. Critical period of Texasweed interference was estimated by fitting logistic and Gompertz model to relative yield data of weedy competition period and weed-free requirement treatments, respectively, using NLMIXED procedure of SAS. Critical period was estimated at an allowable yield loss (AYL) of 5%. For all the three experiments plot size were 2 m x 4.5 m and 'Cocodrie' rice was drill-seeded in 19 cm rows using 100 kg seed/ha. Permanent flood were established five weeks after planting and maintained until two week prior to harvest. Nitrogen, in the form of prilled Urea, was applied at 126 kg/ha just before permanent flood and 42 kg/ha as a supplemental dose at panicle initiation. Experimental plots were kept free of grasses and other broadleaf weeds using selective herbicides and hand-weeding as and when required. All other standard agronomic practices recommended for rice were employed during the growing season.Area of influence experiment showed that rice yield was not significantly affected by the distance from Texasweed plant. However, regression analysis of rice yield and Texasweed density data showed significant reduction in rice yield due to increasing weed densities. Critical period of Texasweed interference was estimated to be between 2 and 8 WAP.

MAPPING AQUATIC VEGETATION USING SCOUTING DATA FROM CITIZEN VOLUNTEERS. B.R. Lassiter*, R.J. Richardson, G.G. Wilkerson, J. Johnson; Crop Science, North Carolina State University, Raleigh, NC

ABSTRACT

Hydrilla (*Hydrilla verticillata*) is a non-native invasive aquatic weed that forms dense mats, and restricts swimming and boating, and suppresses property values. Hydrilla also displaces natural vegetation, reduces habitat quality for fish, provides breeding habitat for mosquitoes, impedes commercial navigation, reduces drainage and increases flooding, and blocks intakes for hydroelectric turbines and potable water. Hydrilla is a serious problem in Lake Gaston, which is a 20,300 acre lake located on the border of Virginia and North Carolina. A 2007 vegetation survey of the lake indicated that there were 1,250 acres of hydrilla in the lake, which was a reduction from surveys during the previous year. Although management tools for aquatic weeds are limited, the creation of accurate vegetation maps can aid in a more integrated management plan for aquatic vegetation. In Lake Gaston, private contractors generate yearly vegetation maps at a cost of $30,000 to $40,000. The accuracy of these maps could be increased or the cost of production decreased by utilizing trained volunteers. Citizen volunteer scouts (Lake Gaston residents) expressed interest in volunteering their time to help with the hydrilla control efforts, and were subsequently trained in the identification of seven aquatic plant species, (including hydrilla) and the use of handheld GPS units. More than 30 individual volunteers worked alone or in groups of two to scout weeds during the months of September through November in 2007 and 2008. Scouts were organized into groups, and selected areas of interest along the lake in which to complete their scouting efforts. Volunteers used their own boats (both motor boats and kayaks) to collect data at 200 yard intervals along the lake shoreline. Data collected by the volunteers included water clarity and depth, as well as presence or absence of hydrilla and 6 other aquatic weeds. Volunteers also recorded the locations of floating mats of hydrilla, grass carp sightings, length of hydrilla shoots, whether the area had been treated with herbicides, and condition of the plants collected. Volunteers collected this data and correlated it to unique GPS coordinates using a specialized computer scouting program written by one of the citizen volunteers. Scouts spent at least 97 and 250 man-hours of labor in 2007, and 2008 respectively. In 2007, the fifteen citizen volunteers scouted an estimated 60 miles of shoreline (approximately 17% of total lakeshore) from at least 1,180 distinct sampling points. In 2008, twenty-four citizen volunteers scouted an estimated 200 miles of shoreline (approximately 60% of total lakeshore) from over 4,200 distinct sampling points. Data points from each year were overlaid on USGS topographic maps to display detailed displays of hydrilla presence or absence in the lake. Individual maps are available for download from the NCSU aquatic weed control website (http://www.cropsci.ncsu.edu/aquaticweeds/lgmaps/). The data collected from this research might complement the data collected by the independent contractors, and is currently being incorporated into their official reports that are supplied to Lake Gaston stakeholders. Future efforts include tracking the growth and movement of floating hydrilla mats using the GPS data and comparing growth from year to year to determine long-term spread or control.

INVESTIGATIONS INTO SUSPECTED MULTIPLE RESISTANCE OF HORSEWEED (*CONYZA CANADENSIS*) TO GLYPHOSATE AND PARAQUAT. T.W. Eubank*,[1] D.R. Shaw,[2] V.K. Nandula,[1] C.H. Koger,[1] J.H. Massey,[2] D.H. Poston[3]; [1]Miss. State University, Stoneville, MS, [2]Miss. State University, Miss. State, MS, [3]Pioneer Hi-Bred, Inc, Leland, MS

ABSTRACT

Glyphosate-resistant horseweed is rapidly becoming a serious concern for many Mississippi farmers. This has necessitated the need for additional research into the control of this troublesome weed with alternative chemistries. Previous research concluded that a horseweed population near Leland, MS was not effectively controlled with either glyphosate (60 to 65% control at 0.86 kg ae/ha) or paraquat (55 to 63% control at 0.84 kg ai/ha) at 4 WAT. It was hypothesized that this horseweed population may exhibit multiple-resistance to both glyphosate and paraquat. Seed from the suspected resistant horseweed population (R) was collected from areas which had previously been treated with glyphosate and paraquat. A susceptible horseweed population (S) near Clarksdale, MS was selected as a comparison. R and S horseweed seeds were planted into a standard potting media and germinated in a growth chamber at 25 C and a 14 h photoperiod. Emerged plants were then transplanted to 10 cm pots and transferred to a greenhouse. Herbicide treatments were initiated when plants uniformly reached 15 cm in diameter. Treatments included: glyphosate at 0.025, 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.3, and 6.7 kg/ha; paraquat at 0.02, 0.03, 0.07, 0.14, 0.28, 0.56, 0.84, 1.12, and 2.24 kg/ha; and a nontreated control. Adjuvants were included as per herbicide label recommendations. Treatments were applied using an air-pressurized indoor spray chamber equipped with an 8002E flat-fan nozzle calibrated to deliver a spray volume of 140 L/ha. Visible injury was evaluated weekly up to 3 wk after treatment and fresh weights recorded. Treatments were replicated and experiments repeated in time. Results indicate that the LD_{50} for S horseweed when treated with paraquat was 0.05 to 0.18 kg/ha, whereas the LD_{50} for R horseweed was 0.96 kg/ha. The LD_{50} for S horseweed treated with glyphosate was 0.08 kg/ha, whereas the LD_{50} for R horseweed was 0.53 to 1 kg/ha. Thus, the resistant horseweed population exhibited a 5- to 19-fold increased resistance to paraquat and 6- to 13-fold resistance to glyphosate when compared to a susceptible horseweed population.

CULTURAL AND CHEMICAL METHODS TO IMPROVE PERENNIAL RYEGRASS ESTABLISHMENT IN DENSE BERMUDAGRASS. T.L. Mittlesteadt*, M.J. Goddard, J.B. Willis, S.D. Askew; Turfgrass weed science, Virginia Tech, Blacksburg, VA

ABSTRACT

Bermudagrass (*Cynodon* sp.) is commonly used in the southern region of the United States and in the transition zone on golf courses and athletic fields. Its stoloniferous and rhizomatous growth habit allows for a turfgrass which provides excellent wear tolerance and recuperative ability. In the transition zone, bermudagrass enters dormancy in the fall leaving the turf brown. It is common for turf managers to overseed dormant bermudagrass with perennial ryegrass (*Lolium perenne* L.) to provide a green playing surface during the fall and winter months. Establishing perennial ryegrass in dense bermudagrass can be challenging due to thick verdure produced by aggressively growing bermudagrass species. It is difficult to obtain good seed to soil contact which is essential for establishing turfgrasses from seed. Therefore our objective is to evaluate different chemical and cultural treatments to improve establishment of perennial ryegrass in dense bermudagrass. Studies were conducted in Blacksburg, VA at the Glade Road Research Facility and at the Turfgrass Research Center on 'Patriot' bermudagrass. Overseeding dates were September 20, 2007 and October 2, 2008. Chemical and cultural treatments were applied one day prior to overseeding. Perennial ryegrass was seeded at 273 kg/ha pure live seed. A split-plot experimental design was used with two experimental factors. Factor A was cultural treatments and were randomly assigned to main plots. Factor B was chemical treatments and were randomly assigned to split plots within each whole plot. All treatments were replicated three times. Whole plots were 3 by 7m with each split plot being 1.8 by 3m. Cultural treatments included a nontreated check, topdressing with sand at a depth of 0.6 cm, following seeding, verticutting in one direction, verticutting in two directions, and core aerification in one direction combined with verticutting in two directions. Chemical treatments included a nontreated check, trinexapac ethyl at 194.3 g ai/ha, triclopyr at 627.6 g ai/ha, and triclopyr at 627.6 g ai/ha combined with mesotrione at 280 g ai/ha. In an attempt to simulate conditions that turf managers face when overseeding, traffic was applied to every plot weekly beginning 4 weeks after seeding using a traffic simulator. Visual ratings included percent perennial ryegrass cover and turf color. Percent perennial ryegrass cover was rated on a scale of 0 to 100%, where 0% is no perennial ryegrass cover and 100% is complete perennial ryegrass cover. Turf color was rated on a 1 to 9 scale, where 1 is poor and 9 is excellent and less than 5 indicates unacceptable turf. Percent perennial ryegrass cover was also assessed using line intersect counts with 100 intersections per plot. Turf color was also assessed using a Fieldscout TCM NDVI Turf Color Meter. Means were separated using Fisher's Protected LSD test at P=0.05 for perennial ryegrass cover and turf color. Results from the 2007 study indicate that cultural treatments had the most impact on perennial ryegrass establishment 1 MAT. Furthermore, combining chemical treatments with cultural treatments improved perennial ryegrass establishment in some cases, but color is sacrificed when triclopyr and mesotrione are used. Topdressing and core aerification in one direction combined with verticutting in two directions resulted in significantly more perennial ryegrass cover than other cultural treatments without sacrificing color. In 2008 no significant differences in perennial ryegrass cover could be detected between any of the cultural treatments or chemical treatments.

IMPROVING CREEPING BENTGRASS INFESTED TURF WITH MESOTRIONE AND SEEDING. M.J. Goddard*, J.B. Willis, S.D. Askew; Turfgrass Weed Science, Virginia Tech, Blacksburg, VA

ABSTRACT

Creeping bentgrass is maintained as a desirable turf on many golf course fairways, greens, and tees. Cultural practices such as core aeration, slicing, and seeding can move propagules into surrounding turfgrass, causing weed problems. Until recently, selective control of creeping bentgrass in cool season turf has not been available. Mesotrione is a herbicide that received registration for use in turfgrass in 2008 under the trade name Tenacity™. Mesotrione can selectively control creeping bentgrass in cool season turf and is safe to use at seeding of many cool season turfgrasses. When patches of creeping bentgrass are controlled, voids in the turf canopy are unsightly and may lead to other weed infestation. By integrating the use of mesotrione at different timings before and after seeded reestablishment of the contaminated areas, we hope to provide an option for optimum bentgrass control while preserving turfgrass quality. Our objectives are to 1) evaluate mesotrione for bentgrass control during seeded establishment of four turfgrasses, and 2) determine optimum timing for controlling creeping bentgrass during seeded establishment of turfgrasses. This trial was initiated at two locations in Blacksburg, VA in 2007. The first location was established on August 7, 2007 in a tall fescue rough infested with bentgrass at Blacksburg Country Club (BCC). The second location was established August 9, 2007 on an L-93 creeping bentgrass fairway at Virginia Tech's Turfgrass Research Center (TRC) which was reestablished to Kentucky bluegrass, perennial ryegrass, tall fescue, and fine fescue seeded at 147, 391, 488, and 391 kg pure live seed/ha, respectively. Treatments were arranged in a randomized complete block design with 5 treatments and 4 replications. At each location, treatments included mesotrione applied at 140 and 175 g ai/ha, 2 weeks prior to seeding, at seeding, and 3 weeks after seeding (WAS); mesotrione applied at 140 g ai/ha, 4 and 2 weeks prior to seeding, at seeding, and 3 WAS; mesotrione applied at 140 g ai/ha, 2 weeks prior to seeding, at seeding, and 3 and 5 WAS; and a nontreated check. At BCC, initial bentgrass cover at the trial location was between 82 and 96%. All treatments resulted in greater than 96% control of creeping bentgrass 11 WAS and were not significantly different. At this same rating, tall fescue cover ranged from 76-83% in all treatments. Evaluations the following spring showed all treatments contained greater than 97% tall fescue for each treatment combination. At the TRC, turfgrass cover in the reestablished areas varied due to germination rates of the different species. The best treatment resulted in 20, 72, 44, and 20% cover 2 months after seeding, and 74, 94, 86, and 53% cover the following spring for Kentucky bluegrass, perennial ryegrass, tall fescue, and fine fescue, respectively. No treatments caused unacceptable injury to the newly seeded turfgrasses. The integration of mesotrione at seeding is a very effective method of reestablishing desirable tolerant cool season turfgrasses from seed in an area where bentgrass formerly was a problem.

INTEGRATED USE OF BIOACTIVE, GREEN, AND PLASTIC MULCHES TO SUPPRESS *CYPERUS ROTUNDUS* AND *C. ESCULENTUS* IN TOMATO. Y.M. Shabana*,[1] E. Rosskopf,[2] A. Abou Tabl,[1] R. Charudattan,[1] W. Klassen,[3] J.P. Morales-Payan[4]; [1]Plant Pathology, University of Florida, Gainesville, FL, [2]USDA, ARS, USHRL, Fort Pierce, FL, [3]Tropical REC, University of Florida, Homestead, FL, [4]Horticulture, University of Puerto Rico-Mayaguez, Mayaguez, Puerto Rico

ABSTRACT

Purple and yellow nutsedges (*Cyperus rotundus* and *C. esculentus*, respectively) are among the world's most problematic weeds that impact virtually every horticultural crop grown in Florida and the Caribbean. As an alternative to conventional methods of control that includes the use of soil fumigation with methyl bromide, we tested nine hay mulches (shoot straw of bahiagrass, cogongrass, cowpea, millet, yellow nutsedge, sorghum Sudangrass, sunnhemp, and rye) and three green mulches (shoot biomass of cowpea, millet, and sorghum Sudangrass) as a means to suppress nutsedge growth in a raised-bed tomato (cv. Tygress) field. In addition, two fungus-infested cogongrass hays (infested with the nutsedge pathogen *Dactylaria higginsii* [Dh] or the saprophytic fungus *Trichoderma* sp. [Tri]), and two plastic mulches (black and infra-red transmissible [IRT]) were tested. The black plastic mulch and the Dh-infested cogongrass mulch consistently reduced nutsedge emergence and growth more than the other organic mulches and the IRT plastic mulch. Among the organic mulches, cogongrass infested with Dh or Tri and cowpea, sunnhemp, Bahiagrass, and cogongrass provided the highest levels of nutsedge suppression. No disease symptoms developed on nutsedge plants when Dh- or Tri-infested cogongrass was used as the mulch. Both plastic mulches (black and IRT) and Tri-infested cogongrass enhanced tomato yield and the proportion of larger fruits. The highest yield of extra large tomatoes per plant was obtained when these mulches were applied.

MECHANISMS CAUSING SUDANGRASS SUPPRESSION OF CANADA THISTLE. J.B. Masiunas*, A. Bicksler; Natural Resources and Environmental Sciences, University of Illinois, Urbana, IL

ABSTRACT

Greenhouse experiments determined the mechanisms that Sudangrass and mowing used to suppress Canada thistle. The treatments were: 1) thistle alone; 2) thistle mowed three times; 3) thistle grown with sudangrass; 4) thistle grown with sudangrass and mowed three times with residue removed; and 5) thistle grown with sudangrass, mowed three times, and retaining surface mulch. Sudangrass, mowing, and mulch reduced thistle shoot biomass, number of shoots, and root biomass. Sudangrass competition reduced thistle fitness more than mowing alone. Further experiments found Sudangrass allelopathy did not reduce thistle fitness. Competition for light and depletion of root carbohydrate reserves was the most likely mechanism causing suppression of Canada thistle.

IMPROVED HOST-RANGE EVALUATION OF PLANT PATHOGENS FOR CLASSICAL BIOLOGICAL CONTROL OF INVASIVE WEEDS. D.K. Berner, W.L. Bruckart*, C.A. Cavin, J.L. Michael; Foreign Disease-Weed Science Research Uint, USDA-ARS, Ft. Detrick, MD

ABSTRACT

Efficacy and safety remain as central tenants in development of any candidate organism for biological control of any pest. Recently, attempts have been made to improve the process, particularly with regard to host range determination. However, there are significant questions about test plant taxonomy and phylogeny, which complicate construction of test species lists for host range determinations. As a consequence, uncertainties arise over whether non-target effects, i.e., any lack of observed specificity in greenhouse evaluations, are representative of the species or peculiar only to the collection of germ plasm used in the test. Advances in generation and availability of molecular genetic information have now allowed molecular data to be incorporated with disease reaction data to improve host range determination. Evaluation of *Colletotrichum gloeosporioides* f. sp. *salsolae* (CGS), a facultative fungal pathogen of *Salsola tragus* (Russian thistle or tumbleweed), is used to illustrate a comparison of results from a conventional host range analysis (i.e., disease ratings) with those from a mixed model analysis method that combined disease rating data with DNA sequence data. Disease ratings were based on a scale from '0' to '4', with '0' = no macroscopic symptoms, and the remaining rating values assigned in increments of 25% necrosis. A distance matrix of the genetic relationships among species, based upon internal transcribed spacer DNA sequences, was generated. To arrive at the relative affect CGS was likely to have on each species, including those not available for testing, disease rating data were combined with the distance matrix derived from DNA sequences and analyzed with mixed model equations to produce Best Linear Unbiased Predictors (BLUPs) for each species. Results of tests showed that of the 91 species of plants inoculated, most were not diseased (BLUP not significantly different from zero). Results also indicated that a group of five species in a distinct clade within the tribe Salsolae had significantly higher BLUPs than plants in other tribes of the Chenopodiaceae. BLUPs for the target, *S. tragus*, were not significantly different from those of three other species, *Salsola collina*, *Salicornia bigelovii*, and *Nitrophila mohavensis. S. collina* is an invasive weed in the USA, but the latter two species are native. Based on these results, additional tests are in progress to determine the effects of disease on physiological responses of these non-target species. Use of mixed model analysis has proven robust, in that results from a similar evaluation of the rust fungus, *Uromyces salsolae* from Russian thistle, revealed a candidate with a much more limited host range.

DEVELOPMENT OF BIOLOGICAL CONTROL OF GIANT REED (*ARUNDO DONAX*) IN THE RIO GRANDE BASIN OF TEXAS AND MEXICO. P.J. Moran*, J.A. Goolsby; Beneficial Insects Research Unit, USDA-ARS, Weslaco, TX

ABSTRACT

Giant reed (*Arundo donax* L.) also known as carrizo cane, is an exotic perennial grass that has invaded riparian corridors in the southwestern U.S. The most severe infestations are in the Lower Rio Grande Basin (> 50,000 ha), where giant reed along the Rio Grande and Mexican tributaries threatens critical water resources, alters stream flow patterns, increases stream bank erosion and flood damage, fuels wildfires along rivers, displaces native wildlife, and hinders river access for law enforcement personnel. Currently, giant reed infestations are being managed with costly chemical and mechanical control. The USDA-Agricultural Research Service has developed a biological control program involving several insects from the native range of giant reed in Mediterranean Europe. Two agents, a stem-galling wasp, *Tetramesa romana*, and a scale insect, *Rhizaspidiotis donacis*, that feeds on side shoots and rhizomes, have been recommended for field release in North America on the basis of host range, biology, and efficacy studies. These agents do not harm non-target native grasses, crops, or habitat associates, produce many offspring on giant reed, complete multiple generations per year, and can be produced in large quantities, indicating that they will rapidly establish populations on both mature shoots and on young regrowth shoots following mechanical or chemical control. In greenhouse studies, combined attack by the wasp and scale significantly reduced plant height and increased shoot mortality compared to plants protected from attack. Laboratory studies are underway on additional biological control agents, including a fly that feeds on and kills juvenile giant reed shoots, and a leaf sheath-mining fly. Technology is now being developed to inundate field populations of giant reed with biological control agents, and to integrate this approach with mechanical and chemical control approaches. Our primary goal is to reduce the ecological and economic impacts of giant reed in the Rio Grande Basin of Texas and northern Mexico and elsewhere.

THE INTERACTIONS OF TROPICAL SODA APPLE MOSAIC TOBAMOVIRUS AND *GRATIANA BOLIVIANA* (COLEOPTERA: CHRYSOMELIDAE), AN INTRODUCED BIOLOGICAL CONTROL AGENT OF TROPICAL SODA APPLE (*SOLANUM VIARUM*). W.A. Overholt*,[1] L. Markle,[1] E.N. Rosskopf,[2] V. Manrique,[1] J. Albano,[2] E. Cave,[1] S. Adkins[2]; [1]Indian River Research and Education Center, University of Florida, Fort Pierce, FL, [2]USDA/ARS, Fort Pierce, FL

ABSTRACT

Tropical soda apple (*Solanum viarum* Dunal (Solanaceae) (TSA) is a South American invasive plant of rangelands, pastures and natural areas in Florida. A chrysomelid beetle from South America, *Gratiana boliviana* Spaeth, has been released at >300 locations in Florida for biological control of TSA since 2003. TSA is a host of several plant viruses, including the newly described Tropical soda apple mosaic virus (TSAMV). We investigated the influence of TSAMV infection of TSA plants on developmental time, leaf tissue consumption, longevity, fecundity and feeding preference of *G. boliviana*, and also tested transmission of the virus by the beetle. Developmental time was approximately 10% slower when beetles were fed on infected plants, and adults consumed only about 50% as much leaf tissue compared to uninfected plants. Longevity did not differ between females reared on infected and uninfected plants, but females fed on uninfected plants produced 71% more eggs than those fed on infected plants. Adult *G. boliviana* preferentially fed on uninfected plants when given a choice. There was no evidence of TSAMV transmission by *G. boliviana*. The potential impacts of TSAMV infection on the effectiveness of *G. boliviana* as a biological control agent are discussed.

AGRICULTURAL COMMUNICATIONS IN A NEW MEDIA WORLD. C. Zimmerman*; ZimmComm New Media, Holt Summit, MO

ABSTRACT

What do today's web savvy growers do when in need of information? Just like most anyone else they go online and search for it with services like Google. So how do you join the online conversation so your message gets through the clutter? One of the best ways is with frequently updated topical blogs and podcasts and participating in online social networks. The investment in creating your own blog or podcast is minimal other than your time. If you're passionate about your subject and like to write or talk then let your inner voice out through new media tools. The benefits to using new media mechanisms include communicating in a very personal way directly with your target audience, allowing your audience to subscribe to your content, becoming easy to find in search engines searches and creating an online archive of your work. With the use of RSS (really simple syndication), which is the mechanism that drives the subscription element of new media, you'll be reaching growers in a way you've never thought possible. Chances are they'll be the thought leaders who adopt new technology first. Do you know a grower without a mobile phone today? Those phones are the device that much of this new media technology is built to feed. Why not be one of the first to provide vital information they need on the device they carry around with them? Live online examples of the various new media communication platforms and handouts with links to resources highlight this presentation.

LINKING THE FARMERS' PERCEPTION AND WEED MANAGEMENT BEHAVIOR WITH ACTUAL ON-FARM WEED PRESSURE. M.M. Riemens*,[1] R.Y. van der Weide[2]; [1]Wageningen University and Research Centre, Plant Research International, Wageningen, Netherlands, [2]Wageningen University and Research Centre, Applied Plant Research, Lelystad, Netherlands

ABSTRACT

Decisions that influence weed management are made at several different levels. Two levels that can be distinguished are the environmental level and the farm level. Decisions at the environmental level influence the availability of weed management tools. Decisions at the farm level influence whether these available weed management tools are applied or not. However, very little is known about the way the decision maker at the farm level (the farmer) deals with weed management in relation to other activities on the farm. The objective of the exploratory research reported here is to investigate how the farmers' perceptive on their own weed management strategy relates to his/her weed management activities and get a better understanding of the farmers weed management behaviour. We address the following research questions: how relates the farmers' perceptive on their own weed management strategy with his/her weed management activities? Can the difference between farms with low and high weed densities be explained with the difference in their weed management behaviour? And if so, how relates the farmers' perspective of farmers with high weed densities to the actual weed management on these farms? Determines the actual weed pressure the moment and amount of weed control? Or is weed control something that is carried out whenever there is time left? Several factors influencing weed management behaviour and densities will be identified and discussed in a conceptual framework.

BEST MANAGEMENT PRACTICES IN A WORLD OF RISKS AND CONSTRAINTS. J.L. Gunsolus*; University of Minnesota, St. Paul, MN

ABSTRACT

Diversification of weed management tactics have been in decline in Midwestern USA corn and soybean production since the adoption of glyphosate resistant crops over ten years ago. How can farmers be convinced that it is in their best interests to diversify their weed management tactics? Constraints to commodity-based cropping systems include low economic margins that require greater land area and production efficiency. Therefore, the farmer's focus is on maximum crop yields, short-term financial returns, minimum production complexity and weed control, not weed prevention. Thus, the farmer is very sensitive to input costs, effectiveness of weed control, and convenience in application and timing, with an aversion to herbicide-induced crop injury. To address this lack of diversification, evaluation of Integrated Weed Management (IWM) tactics that could better align economic returns and timeliness of weed control with weed biology and weed-crop interference were the areas of focus. Risk assessment as a function of time of annual weed control and duration of weed-crop interference was assessed and returns on investment of several herbicide application strategies (e.g. sequential preemergence / postemergence and two-pass postemergence) were analyzed in corn and soybean. Results indicated corn to be sensitive to early-season weed interference and at risk of yield loss if annual weeds were not removed by the V4 crop stage when early-emerging weeds were about 10 cm. Delays of 4 to 7 days beyond this period resulted in yield loss of approximately 3 bu/A/day. Analysis of economic returns also reflected corn's sensitivity to early-season weed interference with consistently favorable economic returns for the preemergence / postemergence strategy. The shift of focus from initial cost of investment to return on investment and the risk of yield loss due to delays in weed control revealed some of the hidden costs of simplified weed management tactics and demonstrated the value of herbicide diversification. Successful implementation of IWM strategies must address areas that are valued by the farmer such as efficacy and economics and provide clear evidence of risks to production using their current tactics. Successful implementation of IWM must also address constraints to production such as the size of the farming operation and the farmer's time and labor constraints.

INVESTIGATING THE HUMAN DIMENSION OF WEED MANAGEMENT - NEW TOOLS OF THE TRADE. D. Doohan*,[1] R. Wilson[2]; [1]The Ohio State University, Wooster, OH, [2]The Ohio State University, Columbus, OH

ABSTRACT

The human dimension of weed management is most evident when farmers make decisions contrary to science-based recommendations. Why do farmers resist adopting practices that will delay herbicide resistance, or ignore new weed species or biotypes until it is too late? Weed scientists for the most part have ignored such questions or considered them beyond their domain and expertise; continuing to focus instead on fundamental science and technology. Recent, pressing concerns about widespread failure of herbicide-based weed management, and acceptability of emerging technologies necessitates a closer look at the farmer decision-making process and the role that weed scientists can play in that process. Here we present a circular risk analysis framework characterized by regular interaction with, and input from farmers. The framework utilizes mental models to probe the deeply held beliefs of farmers regarding weeds and weed management. A mental model is a complex, often hidden web of perceptions and attitudes that govern how we understand and respond to our world. One's mental model may limit the ability to develop new insights and adopt new ways of management. Mental models research employs structured open-ended interviews that enable the investigator to exhaust the subjects' thinking regarding the topic. Farmers in our research demonstrated the fundamental attribution error; whereby, they attributed problems with weed management primarily to factors outside of their control such as uncontrolled weed growth on neighboring properties and environmental factors such as weather. Farmers also identified specific processes that contribute to weed problems that were not identified by experts; specifically, the importance of floods and faulty herbicide applications in the spread of weeds. Farmers expressed an overwhelming preference for controlling weeds with herbicides, a preference that was reinforced by their extreme dislike for weeds. Here we see the typical inverse relationship between perception of risk and benefit. If we like an activity or an entity we are apt to believe it has many benefits and almost no risks. Thus the ability for farmers to appreciate the risks associated with over-reliance on herbicides is diminished. Farmers saw little value in preventive measures for weed control, in keeping with findings from research on preventive health care. We expect that increased communication with farmers will lead to a deeper understanding of their decision process, ultimately facilitating the development of audience-specific outreach programs that will enhance the probability of higher quality management decisions.

CONCEPTS AND TOOLS FOR COLLABORATIVE WEED DEMOGRAPHIC MODELING. N. Holst*; Aarhus University, Slagelse, Denmark

ABSTRACT

Simulation models of weed demography are surprisingly similar in design. Structured around the weed life cycle, the models differ mostly in the detail to which each component is modeled and in whether the complexities of weather, space and genetics are included or ignored. But if so many models are similar in purpose and meaning, why then have they all been developed as if in isolation with no re-use of earlier published models? While certain equations and algorithms are re-used, the models themselves lead isolated lives offering no options or interfaces to link one model directly with another. I will argue that we as weed modelers need a standardized set of tools that will enable us to collaborate truly. Such tools should facilitate the direct re-use and combination of models: Download the annual life cycle models of species *A* and *B*, combine them with soil model *C* and weather generator *D*, and set it all in the context of cropping system model *E*. I will present the latest developments of the international WeedML team (www.weedml.org/) to formulate such a modeling framework.

FROM MODELS AND DATABASES TO DECISION SUPPORT: LEARNING FROM SUCCESS. L. J. Wiles*,[1] G. Dunn,[2] D. Krueger[3]; [1]USDA-ARS-WMR, Fort Collins, CO, [2]USDA-ARS-ASR, Fort Collins, CO, [3]AgRenaissance Software LLC, Raleigh, NC

ABSTRACT

Weed management decision support systems for producers include models of weed community dynamics and related databases. In spite of efforts to make these decision support systems (DSS) inexpensive, widely available and easy to use, producers do not use these tools. One explanation for this lack of adoption is that the DSS did not address the long-term effects of weed management. In this case, more extensive and improved scientific modeling of weed community dynamics and gathering of related information into databases will lead to better answers to "what if I did..." and consequently, improved DSS for weed management. Or is a new direction needed? Lack of adoption is not unique to DSS for weed management. In the 1970's, the discipline of operations research recognized that use of DSS did not meet expectations. Thirty years later, limited use of agricultural DSS was lamented. In retrospective examinations, scientists attributed limited adoption first to lack of technology and poorly designed software and, later, to not including producers in the development of these systems. Good technology and user involvement are essential for, but do not ensure, producers will use a DSS. Yet producers do use, and even buy, computer software for farm management decisions. Examples include a commercial product, FieldRecon, a farm and field record keeping system based on the journaling concept; and two DSS developed by the USDA-ARS. These are IFEAT, a user friendly spreadsheet tool for helping no-till farmers quickly assess the economic benefits of various leasing and management options; and the Drought Impact Calculator, a tool to help ranchers assess the impact of drought on forage production and optimal herd size using weather data that the program retrieves from the internet. Success of these products is attributed to a specific and clearly defined purpose, simple and familiar software, farm-specific solutions and, of course, a focus on economics. We think producers will more likely use a DSS that is integrated with their recordkeeping systems and that DSS need to targets producers' concerns rather than be built around the type of "what if..." questions that can be answered with scientific models and databases.

NEW DIRECTIONS IN THE MODELING OF WEED-CROP INTERACTIONS. R.G. Smith*, D.A. Mortensen, M.R. Ryan; The Pennsylvania State University, University Park, PA

ABSTRACT

A primary question in plant community ecology is how, given that plants share the same basic resource requirements, and that the most competitive species should exclude all others, can there be so many species coexisting within a given area. Several models have been proposed to account for plant coexistence, most involve resource niche differentiation and have considerable relevance to agroecosystems. Here we describe a new resource niche differentiation hypothesis and explain how it could be used to model the competitive interactions between weeds and crops across a range of agricultural management systems. The basic tenants of the hypothesis are (1) agricultural systems are unique in that management practices such as crop rotation, source of fertility, and weed management influence the quantity and quality of inputs to the soil, (2) these inputs directly or indirectly become soil resource pools from which crops and weeds derive nutrition, and (3) the intensity of weed-crop competition depends on the diversity of the soil resource pool. Therefore, management practices that alter the nature and diversity of soil resource pools should be expected to influence the intensity of competition between weeds and crops. This model leads to the novel prediction that along a gradient of increasing cropping-system diversity, the relative strength of weed-crop competition should decrease. Similarly, the degree to which crops and weeds overlap in their niche breadth (determined by species-specific functional traits for resource acquisition) will determine the extent to which weed-crop competition weakens as resource pool diversity increases. While there have been no direct tests of this hypothesis in agricultural systems, we highlight evidence from the applied ecological and agricultural literature that provides strong support for various components of this model. We propose that this model may account for the apparent difference in crop tolerance to weeds in organic systems relative to conventional systems. We also report on a recent agricultural experiment examining the effects of crop diversity on yields and weed communities that supports the predictions of the model and shows that as row-crop diversity increases incrementally from continuous monoculture (single crop-derived resource) to a six crop-species rotation (multiple crop-derived resource pools), the slope of the relationship between corn yield and weed biomass shifts from negative to positive. This model provides testable hypotheses regarding the intensity of weed-crop competition. Validation of this model would have important implications for (a) the development of weed thresholds that are context specific, (b) integrated pest management strategies that aim to reduce weed competition, and (c) understanding factors that regulate diversity across agricultural landscapes.

WEED COMMUNITY CHANGES WITH COVER CROPS AND CROP ROTATION IN ORGANIC VEGETABLE PRODUCTION. M. Bhan*, C.A. Chase; Horticultural Science, University of Florida, Gainesville, FL

ABSTRACT

Two field experiments were started in summer 2006 to assess organic cropping systems for shifts in weed flora. One experiment utilized fall yellow squash and spring bell pepper and fall broccoli and spring sweet corn were used in the other experiment. Treatments were cropping systems that varied in levels of complexity and were arranged in a randomized complete block design with four replications. The simple cropping system consisted of weedy summer fallow prior to vegetable monoculture. Four intermediate cropping systems utilized cover crops in summer - pearl millet (PM) and sorghum sudangrass (SS), sunn hemp (SH) and velvet bean (VB) planted prior to vegetable monoculture. Two complex cropping systems included either planting pearl millet-sunn hemp (PMSH) or sorghum sudangrass-velvet bean (SSVB) mixtures in summer. In the complex systems, row middles of fall squash and broccoli were planted with rye-hairy vetch and crimson clover as living mulches, respectively; and bush bean intercrops were used in both spring vegetables. Soil samples were collected just prior to initiating the study and annually for two years. Results are reported for the first year. Soil samples from three different soil layers, 0-5 (upper), 5-10 (middle), and 10-15 (bottom) cm from the surface were kept in a greenhouse to identify and count emerging weeds. The most abundant weeds before the experiment in summer 2006 were sedges, cudweed, Mexican tea and oldfield toadflax in all layers. Of these only Mexican tea was no longer abundant by summer 2007 and southern crabgrass incidence had expanded to all layers. Other weeds included carpetweed in upper, Florida pusley and hairy indigo in the bottom layers after one year, respectively. Cudweed was higher in SS than in both complex systems in upper and middle layers of squash-pepper experiment. False sedge was higher in SH than PM and SS systems in middle and bottom layers. In broccoli-sweet corn, southern crabgrass occurrence was more prominent in SS and SSVB than in VB and fallow systems in the upper layer. Oldfield toadflax densities were higher in VB than PM systems in the upper layer. Hairy indigo was dominant in PMSH, VB and fallow systems in the lower layer. Species abundant in 2006 continued to be abundant in 2007. Additionally, some species in 2006 increased in abundance by 2007 and was dependent upon soil depth sampled.

COMPARISON OF ORGANIC WEED MANAGEMENT STRATEGIES IN SWEET CORN AND SNAP BEANS FOR PROCESSING. H. Johnson*, J. Colquhoun, R. Rittmeyer; Horticulture, University of Wisconsin, Madison, WI

ABSTRACT

Over 40% of the hectarage of vegetables grown in the US are for processing. Consumer interest in organically produced vegetables has stimulated interest from processors in producing organic sweet corn and snap beans. A significant hurdle in developing this industry is the ability to grow organic vegetables on a large-scale where existing small-scale weed control methods, such as hand weeding, are not practical. This study focused on the feasibility of managing weeds in organic sweet corn and snap beans, utilizing methods that are practical in large hectarage. Tactics such as rotary hoe, inter-row cultivation and a stale seedbed were evaluated alone or in combination. Handweeded and herbicide-based treatments were included for each crop for comparison. Percent weed control, weed biomass, and yield were quantified and net profit was calculated for each treatment. Organic weed management was feasible in snap beans, with yield similar between several of the organic treatments and the herbicide treatment in all three years of the study. Inter-row cultivation was the most effective means of organic weed control in snap beans. Organic weed management was possible in snap beans because it is a short season crop and an effective competitor with weeds in the crop row. Organic weed management was more difficult in sweet corn due to the longer crop season and poor competition with weeds in the crop row. In sweet corn, the organic treatments ivolving three inter-row cultivations was the only one consistently similar in yield to the herbicide treatments. Higher net profits were attained for most of the organic treatments in both crops due to the organic premium. Market saturation and organic premium adjustments are factors for grower consideration in this potential industry, particularly for sweet corn production.

A PRECISION GUIDED, SHIELDED PROPANE FLAMER FOR POSTEMERGENCE WEED CONTROL IN VEGETABLE CROPS. C.M. Herrmann*, B.H. Zandstra, R.V. Tocco; Horticulture, Michigan State University, East Lansing, MI

ABSTRACT

Broadcast propane flaming is widely used in organic vegetable production to control small weeds prior to crop emergence. Postemergence broadcast flaming is not commonly practiced due to the susceptibility of most vegetable crops to heat injury. A computer-guided, shielded propane flamer was constructed to provide adequate separation of the crop and heat source. Four 1.5m long stainless steel shields trap and direct heat into inter-row spaces. An Eco-Dan local positioning system steers the shields in close proximity to the crop rows, maximizing the treated area. Field trials were established in 2008 to assess the machine's utility for postemergence weed control in vegetable crops. Various combinations of ground speed, from 1.61 to 6.44 km/hr, and propane pressure, from 0.07 to 0.28 MPa, were evaluated in snap beans. Treatments were applied to weeds at the 4-8 leaf stage. Speed treatments of 1.61 km/hr resulted in crop injury. Pressure treatments of 0.07 MPa gave less than 80% weed control. Speed of 3.22 km/hr in combination with propane pressures of 0.14 to 0.28 MPa gave greater than 80% weed control of most broadleaf weeds and did not injure the crop. Speed of 6.44 km/hr in combination with pressure of 0.28 MPa resulted in 80-85% weed control of pigweeds and lambsquarters and caused no crop injury. The machine was capable of attaining good weed control at moderate levels of propane consumption. Additional equipment will be installed to allow for shielded herbicide application. Future research will assess the machine's utility as a postemergence shielded flamer/herbicide applicator in several vegetable crops.

STALE SEEDBEDS FOR CUCUMBER AND GREEN PEA PRODUCTION: DO THEY HELP? STALE SEEDBEDS FOR CUCUMBER AND GREEN PEA PRODUCTION: DO THEY HELP? T.W. Miller*; Washington State University, Mount Vernon, WA

ABSTRACT

Studies were conducted to determine the effectiveness of stale seedbeds for weed control in western Washington. In 2007 cucumber plots, herbicides and flame improved weed control at 2 WAT compared to no treatment at all stale seedbed timings, except for the 3-d seedbed. At that timing, weed control from pyroflufen and flame was statistically similar to no control. Overall, there was little difference between treatments at 2 WAT, indicating that all provided a degree of weed control. By August, however, no treatments were continuing to provide acceptable weed control. In 2008, nearly every treatment resulted in excellent weed control. Cucumber vine and fruit weight was maximized when cucumbers were seeded after 0 or 3 d. Paraquat reduced vine and fruit weight compared to other PRE herbicide. There was no difference in weed biomass for stale seedbed timing, PRE herbicide. Based on these data, it appears that when cucumbers are planted late in the season, as in 2008, weed growth is minimized and herbicides or flame is not necessary for successful cucumber productivity. In green pea in 2007, weed control was effective for several treatments, but was best for glyphosate, paraquat, and glufosinate, with control in mid-July ranging from 81 to 89%. Delaying pea seeding up to 14 d did not generally aid in weed control. In 2008, weed control at pea harvest from use of PRE treatment with POST herbicides was effective for several treatments, but was best when any product or flame was used with the 7-d stale seedbed, or when glyphosate or paraquat were used in the 0-d seedbed, or when glufosinate or pyraflufen were used on the 3-d seedbed. Weed control after the 14-d seedbed was unacceptably low. Despite this, pea vine and pod biomass was maximized by using any herbicide or flame on a 14-d seedbed, and weed biomass was minimized by using any of the herbicides on a 14-d seedbed. These data indicate that stale seedbeds may offer green pea producers another option to enhance weed control, and flame offers an option for organic producers to improve weed control and pea productivity.

DIFFERENCES IN CLOMAZONE TOLERANCE AMONG SWEETPOTATO VARIETIES. H.F. Harrison*, D.M. Jackson; U.S. Vegetable Laboratory, USDA/ARS, Charleston, SC

ABSTRACT

Differences in clomazone tolerance between sweetpotato clones were first observed following use of the herbicide for weed control in fields containing the sweetpotato breeding project at the U.S. Vegetable Laboratory. Susceptible clones exhibited severe foliar bleaching and reduced growth; whereas, the most tolerant lines were not injured. Twelve clones chosen based on these observations were included in a greenhouse experiment to quantify differences in clomazone tolerance. The most tolerant clone, Beauregard exhibited lower injury rating and shoot weight reduction at 8.0 mg ai clomazone/kg potting medium than the most susceptible clone, 04-N01, exhibited at 1.0 mg/kg. Based on response curves generated from regression analyses, the clomazone concentration that caused moderate injury or growth reduction in Beauregard clones was approximately 8 to 10 times greater than the concentration that caused a similar response in 04-N01. Fifty two commercial cultivars and advanced experimental lines were evaluated for clomazone tolerance in the greenhouse, and several susceptible lines were identified. Many of the sweetpotato clones demonstrating high or intermediate susceptibility to clomazone were developed by the sweetpotato breeding project at the U.S. Vegetable Laboratory. These clones were developed over many years and share a common ancestry, which suggests that clomazone susceptibility was passed genetically from one generation to the next. These observations indicate that some sweetpotato genotypes are highly susceptible to clomazone. Since the herbicide is an important component in sweetpotato weed management, developing cultivars that are susceptible should be avoided. This could probbly be accomplished by using the herbicide routinely in sweetpotato breeding plots and discarding lines that demonstrate unusually high injury. The relatively large differences in clomazone tolerance observed in sweetpotato indicate that there is potential to breed cultivars with increased tolerance. Sweetpotato clones with increased tolerance would improve crop safety and may allow use of higher clomazone rates which control more weed species than are controlled with lower rates.

VEGETABLE RESPONSE TO EPTC UNDER VARIOUS PLASTIC MULCHES. R.D. Wallace*,[1] S. Culpepper,[1] A. MacRae,[2] L. Sosnoskie,[1] T. Grey[1]; [1]Crop and Soil Sciences, University of Georgia, Tifton, GA, [2]Horticulture, University of Florida, Wimauma, FL

ABSTRACT

With the loss of methyl bromide, alternatives are being thoroughly evaluated for economic feasibility, ease of application, and range of pest control provided. One alternative fumigant currently available is PicChlor 60, which is 60% chloropicrin and 40% 1,3-dichloropropene. This fumigant effectively controls soil-borne fungi, diseases, and nematodes, but not weeds. Lack of weed control limits PicChlor 60's applicability in areas that have high populations of nutsedge, which are not impeded by polyethylene mulches. Incorporating a herbicide effective against nutsedge into a methyl bromide alternative system would be beneficial. *S*-ethyl dipropylthiocarbamate (EPTC) is the active ingredient of Eptam, which is a herbicide that controls many annual grasses and broadleaf weeds as well as some perennial weeds, including purple (*Cyperus rotundus*) and yellow nutsedge (*Cyperus esculentus*). The purpose of this study was to evaluate the tolerance of several vegetable crops to EPTC. The study, a randomized complete block design with two sets of treatments (EPTC rate and mulch type) combined factorially and replicated three times, was begun on February 27, 2008. PicChlor 60 was shank injected at 196 L/ha eight inches below the bed tops. EPTC was applied to the final bed surface immediately prior to laying mulch at rates of 0, 2.3, 3.5, and 4.7 L/ha. Two mulches covered the EPTC and the bed top, low-density polyethylene (LDPE) or a high barrier Blockade mulch (VIF). Beds were 0.9 m wide and 30.5 m long, divided into four crops, and were irrigated using a single drip line placed in the center of the bed. Crops were planted March 27, 2008 using a transplanter and manual labor to insert transplant seedlings. Four crops were chosen to evaluate crop tolerance: "Heritage" bell pepper (*Capsicum annuum*), "Bella Rosa" tomato (*Lycopersicon esculentum*), "Santana" eggplant (*Solanum melongena*), and "Delight Seedless" watermelon (*Citrullus lanatus*). Two rows of bell pepper were planted, whereas there was one row of tomato, eggplant and watermelon. Crops were rated for herbicide injury throughout the season and each crop was taken to harvest. Eggplant and watermelon were more tolerant to EPTC as compared to pepper and tomato when EPTC was applied under VIF. At harvest, pepper, tomato, eggplant, and watermelon were injured 3, 0, 0, and 0%, respectively, by EPTC at 4.7 L when applied under LDPE. Injury to the aforementioned crops was 93, 92, 43, and 13%, respectively, when EPTC was applied at 4.7 L under VIF. In pepper, yield (fruit/ha) was not impacted by EPTC when applied under LDPE as compared to the no EPTC control. Yield was reduced 98, 95, and 98% by EPTC applied at 2.3, 3.5, and 4.7 L/ha, respectively, when applied under VIF. Similarly, tomato yield was not impacted by EPTC when applied under LDPE as compared to the no EPTC control. Yield was reduced 44, 82, and 97% by EPTC applied at 2.3, 3.5, and 4.7 L/ha, respectively, when applied under VIF. Eggplant and watermelon yields were not affected by the mulch by herbicide interaction, although yields tended to be greater when using EPTC under LDPE as compared to VIF. At 4.7 L/ha EPTC, eggplant produced 49,753 fruit/ha under LDPE and 41,142 fruit/ha under VIF. Watermelon production at 4.7 L/ha EPTC under LDPE produced 22,724 fruit/ha. Under VIF at 4.7 L/ha EPTC, watermelon yielded 21,049 fruit/ha.

EVALUATION OF THE TOLERANCE OF FOUR TOMATO TYPES TO EPTC APPLIED UNDER METALIZED AND VIF MULCH. A.W. MacRae*, R.O. Kelly; Gulf Coast Research and Education Center, University of Florida, Wimauma, FL

ABSTRACT

An experiment was conducted in the fall of 2008 to determine the tolerance of four different types of tomatoes to Eptam applied under plastic mulch. Eptam was applied at 2, 3, and 4 pts/A under VIF 'Blockade' and Metalized 'Canslit' plastic mulch. The Eptam was applied to the finished bed top just prior to laying of the plastic mulch. Also included was a non treated control. The beds were fumigated with both 1,3 dichloropropene and chloropicrin at the time of bed formation. Cherry 'BHN 268', grape 'Jolly Elf', plum 'Mariana', and round 'FL47' tomatoes were transplanted into the beds three weeks after Eptam application. All applications of Eptam provided better control of yellow and purple nutsedge than the non treated control. Application of Eptam under VIF mulch caused greater visual injury and plant stunting than that applied under metalized mulch. As rates of Eptam increased when applied under VIF mulch, plant height decreased for all tomato types tested. When averaged over all harvests, this stunting of the tomato plants caused a reduction in yield for both the plum and round tomatoes when Eptam was applied at 3 or 4 pints under VIF mulch. Both grape and cherry tomatoes did not show this same reduction in yield, possibly due to their aggressive growth and fruiting habits. While less stunting was observed when Eptam was applied under metalized mulch, Eptam at 4 pts/A caused a reduction in yield for both plum and round tomatoes. Observations from this test show that Eptam is not safe to apply under VIF mulch, but under metalized mulch 2 pts/A did not reduce yield of any of the tomatoes tested. Cherry and grape tomatoes appear to have more tolerance to Eptam than either plum or round tomatoes.

PERFORMANCE OF METHYL BROMIDE ALTERNATIVES FOR WEED CONTROL. E.N. Rosskopf*,[1] N. Kokalis-Burelle,[1] F.B. Iriarte,[2] D.M. Butler,[1] J. Muramoto[3]; [1]USDA, ARS, Fort Pierce, FL, [2]Iowa State Univ., Ames, IA, [3]Univ. of California, Santa Cruz, CA

ABSTRACT

Numerous research trials were conducted over five years to evaluate potential alternatives to methyl bromide for control of a broad spectrum of soilborne pests, including nematodes, plant pathogenic fungi, and weeds. Trials were conducted at the field demonstration, experimental plot, greenhouse, and laboratory scales, depending on the registration and/or developmental status of the compounds or techniques tested. Chemical materials tested include methyl iodide:chloropicrin (MeI) and dimethyl disulfide:chloropicrin (DMDS) combinations. Methyl iodide is registered for use in Florida under the trade name Midas and there is a current experimental use permit for dimethyl disulfide under the name Paladin. Weed control with both materials was comparable to methyl bromide in raised-bed production of tomatoes and flat fumigation floriculture production of celosia, caladium, and delphinium. In one flat fumigation trial on sunflower, weed control with 701 L/ha of DMDS under low density polyethylene was lower than with 468 L/ha under metalized film and methyl bromide. Generally, weed control with these fumigants was statistically equivalent to methyl bromide, although somewhat higher numerically with DMDS. In raised bed trials in a tomato-melon double crop, the combination of halosulfuron-methyl, metolachlor, and rimsulfuron provided weed control during the tomato crop that was equivalent to methyl bromide, although the control was not equivalent by the end of the melon crop. Other chemicals tested include ethanedinitrile, and a novel combination of organic compounds referred to as SPK. SPK has been tested in laboratory, greenhouse, and microplot trials and has broad-spectrum activity. In greenhouse and microplot trials, yellow and purple nutsedge (*Cyperus esculentus* and *C. rotundus*), goosegrass (*Eleusine indica*), crabgrass (*Digitaria sanguinalis*), smooth pigweed (*Amaranthus hybridus*), and sicklepod (*Senna obtusifolia*) were controlled with a solution containing as little as 2.25% of the active ingredient. The level of control achieved was equivalent to a weed-free check. This material is also an excellent nematicide and broad-spectrum fungicide. Ethanedinitrile has been tested in laboratory assays only. Yellow nutsedge tuber germination was reduced to 10% with a concentration of 20 mg/L and was completely eliminated with 50 mg/L. Germination of common purslane (*Portulaca oleraceae*) seeds was also reduced to 0% with the 20 mg/L treatment. Sicklepod seeds were more resistant to the treatment and 100 mg/L was required to reduce germination below 10%. Non-chemical alternatives that are being investigated include soil solarization, the combination of paper mulch and plastic mulch, and anaerobic soil disinfestation (ASD). In recent trials testing soil solarization for snapdragon production, clover control was higher with solarization than with the 67:33 formulation of methyl bromide chloropicrin at 224 kg/ha lb/A under metalized film, and was equivalent to methyl iodide and other methyl bromide treatments. Solarization treatments were also equivalent to the fumigants for control of other weed species. ASD combines heating through soil solarization with brief periods of soil saturation. Anaerobicity is measured using oxidation-reduction potential probes and a period of approximately seven days of anaerobic conditions have been reported necessary for control of soilborne diseases in parts of the US, the Netherlands, and Japan. Treatments in Florida included the addition of composted broiler litter to improve moisture retention, and molasses as a carbon source to stimulate microbial activity. In a raised bed application of ASD prior to planting of a bell pepper crop, control of nutsedge emerging though the plastic at mid-season was equivalent to methyl bromide. Although variable, weeds emerging through plant holes at mid-season were reduced in all treatments receiving four acre inches of water at the onset of the trial when compared to the untreated check. At pepper harvest there were few significant differences between ASD treatments and the untreated check with regard to nutsedge emerging through the plastic, but all treatments had fewer weeds emerging through the plant holes than the untreated check.

WEED MANAGEMENT WITH NON-FUMIGANT TREATMENTS IN STRAWBERRY. S.A. Fennimore*, J.B. Weber, J.B. Samtani; Plant Sciences, University of California Davis, Salinas, CA

ABSTRACT

The main goal of this project is to facilitate the adoption of methyl bromide (MB) alternative treatments. Major constraints to the complete phase-out of MB and adoption of alternative fumigants in California are regulatory and not technical. Alternative fumigants such as 1,3-dichloropropene (1,3-D) and chloropicrin are being used on about half of the California strawberry hectarage. However, regulatory limits on additional use of 1,3-D prevent the complete phase out of MB. To avoid regulatory constraints, we have concluded that the ideal alternatives to MB are non-fumigant treatments and we have undertaken research to identify effective non-fumigant treatments for California strawberry. Trials were conducted during 2007 and 2008 to evaluate several heat (steam) and biofumigant treatments for control of soil pests and yield compared to methyl bromide plus chloropicrin (MBPic). Field studies were conducted near Salinas and Watsonville, CA. The treatments included: steam, furfural at 672 kg ha^{-1}, MBPic 392 kg ha^{-1}, and mustard seed meal at 2240 kg ha^{-1}. Weed densities and fruit yields were monitored throughout the season. Analysis of variance (ANOVA) and mean separation using LSD's at P= 0.05 was performed on all data. Treatments which controlled weeds were steam, and MBPic. Furfural effectively controlled weeds at Salinas but not at Watsonville. The reason for this furfural inconsistency is unknown. Treatments that produced strawberry fruit yields similar to MBPic were steam, mustard meal and furfural. With the exception of steam, we conclude that treatments such as mustard meal or furfural will require use of an herbicide in combination to control both soilborne diseases and weeds.

SOLARIZATION AND STEAM HEAT FOR SOIL DISINFESTATION IN FLOWER AND STRAWBERRY. C.A. Gilbert*,[1] S.A. Fennimore,[2] K. Subbarao,[2] R. Goodue,[1] J.B. Weber[2]; [1]Plant Science, University of California, Davis, Davis, CA, [2]Plant Science, University of California, Davis, Salinas, CA

ABSTRACT

Soil solarization performance in coastal areas of California is often inconsistent due to fog and cool summer temperatures that do not allow soil to reach high temperatures required to reliably kill soil pests. The objective of this study was to develop an economically feasible combined solarization and steam heat, soil disinfestation system for field-grown cut flowers and strawberry. Field studies were conducted at the Spence Research Farm at Salinas, CA (strawberry) and at a commercial farm (cut-flower) at Prunedale, CA in the 2007-08 and again in fall of 2008 for the 2008-2009 seasons. For both strawberry and cut flower production, results show that steam treatments with and without solarization controlled weeds equal or better than methyl bromide. For both cut flower and strawberry production systems, raised beds were prepared as finished seed beds with starter fertilizer and drip irrigation tape installed following standard production practices. Plot beds were 1.3 to 1.8 m wide by 6.1 m long. Prior to treatment application, pathogen (*Verticillium sp.)* and weed seed samples were enclosed in permeable nylon mesh bags. After completion of treatment application, seeds and pathogens were removed from the bags and their viability determined using tetrazolium tests for weed seeds and petri dish assays for the pathogen. The design was a randomized complete block replicated six times. Treatments included 67% methyl bromide plus 33% chloropicrin (MBPic, 67:33) at 392 kg ha^{-1} applied by chemigation through the drip irrigation system, control, solarization alone, steam alone, and steam plus solarization. Prior to application of clear tarp for solarization, beds were irrigated to bring the soil moisture to sufficient levels for proper heat conduction and solarization. For steam + solarization treatments, beds were solarized for two weeks prior to steam application and for two weeks after application (total of four weeks). For the steam treatments, steam was injected for sufficient time to raise the temperature of the beds to 70°C for 30 min. After 30 min., steam disinfestation was discontinued. During the solarization and steam disinfestations process, temperatures were monitored continuously using temperature probes (Hobo, Pocasset, MA) installed in beds at 5, 15, 30 and 45 cm depths. The amount of fuel, time and labor needed for treatment application were recorded. Strawberry transplants and bulbs for cut flower were planted at the end of the 4 week treatment period. Periodically through the growing season, weed density counts in each plot were recorded. Weeds were harvested from the field, and fresh biomass recorded. Hand weeding times were monitored periodically throughout the growing season. Solarization alone did not control weeds; hold down weeding times or kill weed propagules as consistently as MBPic. However steam with or without solarization resulted in weed control similar to MBPic. Steam treatments with and without solarization were sufficient to control *Verticillium* as compared with the control and solarization alone. Strawberry fruit yields in steam treatments were comparable to MBPic.

TOLERANCE OF STRAWBERRY CULTIVARS TO TERBACIL, SULFENTRAZONE AND FLUMIOXAZIN. D. Doohan*, T. Koch; Horticulture and Crop Science, The Ohio State University, Wooster, OH

ABSTRACT

Tolerance of strawberry cv Brunswick, Cabot, Darselect, Evangeline, Honeoye and Jewel to terbacil was evaluated in three trials located on medium and light textured soils in northern Ohio. Terbacil was applied at 84, 168, and 336 g/ha either immediately after planting or 3 weeks after planting. Plots were kept weed-free until winter mulching by cultivation and hand-weeding. A weed free control plot was included that received no herbicide. The experimental design was a randomized complete block with a split-plot treatment design in which main plots were herbicide treatments and sub-plots were strawberry cultivars. Each treatment was replicated 4 times and a plot was a single row of strawberry. Cultivar response to sulfentrazone was assessed at another site where the soil had been limed to a pH of 7. Plots in this field were maintained weed free until the onset of dormancy in November at which time sulfentrazone was applied at 209, 420 and 840 g/ha. Crop response in these trials was evaluated at 1, 3 and 6 weeks after application (WAA), in the case of terbacil or 1,3 and 6 weeks after emergence in spring (WAE) in the case of sulfentrazone. Crop injury was greater when terbacil was applied at planting than when applied 3 weeks after planting. Strawberry cultivars varied in response to terbacil rate and timing of application. The effect of location was not significant except at 336 g/ha. Cultivar sensitivity as indicated by leaf chlorosis at 1 WAT was greatest in Honeoye>Evangeline>Darselect=Jewel= Brunswick>Cabot. Chlorosis increased with increasing rates of terbacil and was maximum with the 336 g/ha (2X) rate applied to Honeoye the same day as transplanting. At the recommended rate of 168 g/ha applied the same day as transplanting, Brunswick, Cabot and Darselect were not injured relative to an untreated control. Regardless of initial injury, chlorosis of all varieties declined rapidly as new leaves developed and 6 WAT was almost impossible to detect. Significantly lower yield was detected in Honeoye and Evangeline when terbacil was applied at planting, corresponding with the observed ranking of cultivar sensitivity the previous spring. Yield reductions were only noted at the highest rates (168 and 336 g/ha). However, no effect on yield was noted when terbacil application was delayed until 4 WAP. Strawberry cultivars responded differentially when treated with sulfentrazone. Cabot, Evangeline and Jewel were the most sensitive varieties. Brunswick and Honeoye were not affected even at the 2X rate (840 g/ha). However, yield of fruit was not affected by sulfentrazone rate in any variety. Fourteen cultivars were evaluated for their response to flumioxazin (108 g/ha) applied to dormant strawberry in late November and late March, and at renovation in early July. July applications did not cause significant injury; however, late fall and early spring applications resulted in severe but transitory stunting of most cultivars.

PERENNIAL WEED MANAGEMENT WITH MESOTRIONE IN WILD BLUEBERRY (*VACCINIUM ANGUSTIFOLIUM*). N.S. Boyd*; Environmental Science, Nova Scotia Agricultural College, Truro, NS, Canada

ABSTRACT

Mesotrione efficacy on perennial weed species varies with time of application. Experiments were conducted in multiple commercially managed blueberry fields in 2007 and 2008 to determine the growth stage of goldenrods (*Solidago* spp.) and black bulrush (*Scirpus atrovirens*) most susceptible to post-emergent applications of mesotrione and to determine if mesotrione efficacy is greater following hexazinone or terbacil applications. Mesotrione was applied post emergence at 101g ai/ha in 300 L/ha of water with 0.2% v/v Agral 90 when plants were 10cm tall, 30cm tall, at flower bud initiation, or when shoots were in full bloom. Hexazinone was applied before shoot emergence at 1.9 kg ai/ha in 200 L/ha of water. Sixty percent control of goldenrod top-growth was achieved at all application timings before full flower. Applications at full flower were ineffective. Hexazinone significantly reduced goldenrod shoot density but there was no significant interaction between pre- and post emergent herbicide applications. A single application of mesotrione did not effectively control established black bulrush tufts. Seventy percent control of black bulrush was achieved with two applications (early and late summer) of mesotrione which is comparable to control levels achieved with the current industry recommendation. Mesotrione applied in the sprout year and fruit year of wild blueberry did not significantly affect fruit bud number or berry yields.

THE IR-4 PROJECT: UPDATE ON WEED CONTROL PROJECTS. M. Arsenovic*, D.L. Kunkel, J.J. Baron; IR-4 Project, Rutgers University, Princeton, NJ

ABSTRACT

The IR-4 Project is a publicly funded effort to support the registration of pest control products on specialty crops. The IR-4 Project continues to meet specialty-crop grower's needs for weed control options despite the challenges of a mature market for herbicides and the selectivity of specialty crops to many of the more-recently-introduced herbicides. The Pesticide Registration Improvement Act continues to effect IR-4 submissions and EPA reviews of packages. IR-4 submitted herbicide petitions to the EPA from October 2007 to September 2008 for: Endothall on vegetable, root and tuber group; vegetable, leaves of root and tuber group; vegetable, bulb group; vegetable, leafy except Brassica group; vegetable Brassica, leafy group; vegetable, legume group; vegetable fruiting group; vegetable cucurbit group; fruits, citrus group; fruit, pome group; fruit, stone group; berry and small fruit group; grape; nut tree group; grain, cereal group; grain, cereal, forage, fodder, and straw group; grass, forage, fodder, and hay group; animal feed, nongrass group; mint and rice; MCPA on pea (re-registration); pendimethalin on olive; prometryn on carrot, celeriac, cilantro, okra and parsley. From October 2007 through September 2008, EPA has published Notices of Filing in the Federal Register for: Cyhalofop-butyl on wild rice; pronamide on lowgrowing berry subgroup, except strawberry; and sulfentrazone on vegetable, tuberous and corm subgroup; Brassica, head and stem subgroup, Brassica, leafy greens subgroup, vegetable, fruiting group, okra, succulent pea, flax, and strawberry. EPA established tolerances from October 2007 to September 2008 for: Dicamba on sweet corn; dichlobenil on canebbery subgroup; bushberry subgroup and rhubarb; dimethanamid on radish, rutabaga, turnip (rootsand tops greens), pumpkin and winter squash; ethalfluralin on dill, mustard, potato, rapeseed; flumioxazin on asparagus, dry bean, vegetable fruiting group, okra, melon subgroup, bushberry subgroup, and nut tree group; fluroxypyr on fruit, pome group, and millet; mesotrione on cranberry; sethoxydim on gold of pleasure, crambe, cuphea, echium, hare's ear mustard, lesquerella, lunaria, meadowfoam, milkweed, mustard, oil radish, poppy, sesame, and sweet rocket.

EFFECT OF VEGETATION-FREE AREA AND IRRIGATION ON NEWLY PLANTED PEACH. J.K. Buckelew*, D.W. Monks, W.E. Mitchem, K.M. Jennings; North Carolina State University, Raleigh, NC

ABSTRACT

Competition by weeds for water and nutrients is greatest during a peach orchard's first 3 or 4 yr and weeds can delay profitable first harvests. The preferred orchard floor management system in the southeastern US is a 3 to 3.7 m wide vegetation-free strip in the tree row with ground cover in the middles between tree rows. A study was conducted from 2006 to 2008 on newly planted peach to determine if this strip can be narrowed to reduce herbicide use per hectare. The objective was to determine if tree growth and early yields of young peach can be maintained or maximized with the addition of irrigation and the narrowing of the vegetation-free strip in the tree row. Peach trees were planted in winter 2005 and 2006 at Clayton and Jackson Springs, NC, respectively. Soils were a Norfolk sandy loam and a Candor sand (respectively) with a volunteer (feral) ground cover consisting of primarily large crabgrass. The experiment was a two factor, randomized complete block design with vegetation-free widths (VFW) of 0, 0.6, 1.2, 2.4, 3, and 3.7 m and irrigation (either irrigated or nonirrigated) as factors. Herbicide strips were established at planting and maintained with flumioxazin and paraquat as needed. Generally, irrigated trees were watered when the soil moisture sensors read 20 cb or above in the 3 m irrigated plots. Measured growth parameters included tree cross-sectional area (TCSA), foliar nutrition, yield, fruit soluble solids and firmness, and leaf color. Soil moisture in all plots was also recorded. Harvest season totals (kg/tree) for irrigated and nonirrigated plots followed a linear plateau trend, with the predicted join point (the value of the VFW at which the yield is maximized) of 5.1 and 7.1, respectively (Jackson Springs) and 3.3 (Clayton, irrigated). The nonirrigated plots at Clayton displayed a linear relationship for yield. Fruit soluble sugars displayed a (negative) linear plateau trend for irrigated and a (positive) linear trend for nonirrigated at Jackson Springs. Fruit soluble sugars (ss) were not different by VFW, but irrigation factor was significant, with the mean ss of irrigated plots (11.99) being higher than nonirrigated plots (11.51). The optimal VFW for a two year old irrigated tree for maximum TCSA appears to be 2.9 at Clayton and 4.1 at Jackson Springs, while the optimal VFW for a nonirrigated two year old tree is 6.1 and 8.2, respectively. Hence, the benefit of irrigation is large. At Clayton and Jackson Springs, the irrigated zero and 0.6 m VFWs were smaller than the nonirrigated 3.7 m VFW. Likewise, the irrigated 1.2 and 2.4 m VFW at both locations were not different from the 3.7 m, nonirrigated VFW. This observation can be interpreted that irrigation allows reduction of herbicide strip width down to 1.2 m without reduction in TCSA. In Jackson Springs, nonirrigated plots had higher % foliar N than irrigated plots. In year 2006 and 2008, a VFW effect was present with predicted join points of 1.6 and 3.8 for irrigated and nonirrigated, respectively. No VFW effect on % N was found for 2007, probably because of the drought and lack of competitive weeds.

PURPLE NUTSEDGE (*CYPERUS ROTUNDUS*) MANAGEMENT IN ORCHARDS AFTER TWO YEARS OF TREATMENT WITH SULFENTRAZONE, HALOSULFURON, AND TERBACIL. W.E. Mitchem*,[1] W.G. Henderson,[2] D.W. Monks,[1] K.M. Jennings[1]; [1]North Carolina State University, Raleigh, NC, [2]Clemson University, Clemson, SC

ABSTRACT

A trial was established in 2007 on one year old "Topaz" peach trees to evaluate peach tree response and purple nutsedge control from applications of sulfentrazone, halosulfuron, and terbacil as part of a total orchard weed control program. The study was conducted in Lexington County, SC on a loamy sand soil. The test design was a randomized complete block with four replications. All herbicides were applied with CO_2 pressurized backpack sprayer calibrated to deliver a spray volume of 187 L ha^{-1} at 267 kPa using TeeJet 8002DG flat fan nozzles. Herbicides were applied as a directed spray to the base of trees resulting in a 3 m wide herbicide band. Herbicide treatments consisted of sulfentrazone + norflurazon applied at 0.21 kg ha^{-1} + 2.7 kg ha^{-1} once and applied sequentially at 0.14 kg ha^{-1} + 1.4 kg ha^{-1}, flumioxazin at 0.42 kg ha^{-1} followed by (fb) halosulfuron at 0.05 kg ha^{-1}, flumioxazin at 0.42 kg ha^{-1} + halosulfuron at 0.035 kg ha^{-1} fb halosulfuron at 0.035 kg ha^{-1}, and Terbacil at 0.9 kg ha^{-1} applied sequentially. In 2007 the initial treatment sprays were applied May 10 followed by a June 22 application with one exception being the lone halosulfuron treatment following flumioxazin which was applied June 10. In 2008 the same plots were maintained and a second year of herbicide treatment was initiated under the same trees so that we had treated the same area two consecutive years with the same herbicide treatments. Applications dates were April 10, May 30, and June 13. Application time was based upon purple nutsedge height of 7.5 to 10 cm. Paraquat at 1.12 kg ha^{-1} and a non-ionic surfactant at 0.25 % v v^{-1} was included for non-selective postemergence weed control. Throughout the summer in 2007 and 2008 purple nutsedge control was estimated visually on 0 to 100 % scale. In April 2008 purple nutsedge density was determined by counting the number of plants in a 0.3 m square quadrant. At the end of the summer in 2007 sulfentrazone + norflurazon applied sequentially, flumioxazin fb halosulfuron at 0.05 kg ha^{-1}, and flumioxazin + halosulfuron fb halosulfruon provided 60, 84, and 56 % control which was similar. The sequential applications of terbacil, and sulfentrazone + norflorazon applied at 0.21 kg ha^{-1} + 2.7 kg ha^{-1} provided 41 and 23 % control, respectively which was not as good as flumioxazin fb halosulfuron at 0.05 kg ha^{-1}. In April 2008 prior to herbicide application purple nutsedge density counts were collected. The treatments that reduced purple nutsedge populations relative to the non-treated check were sequential applications of sulfentrazone + norflurazon and terbacil, and flumioxazin fb halosulfuron at 0.05 kg ha^{-1}. On August 6, 2008 purple nutsedge control with sulfentrazone + norflurazon applied sequentially and flumioxazine fb halosulfuron at 0.05 kg ha^{-1} was 99 and 98 %, respectively, and was better than control provided by sequential applications of terbacil and the single application of sulfentrazone + norflurazon which was 58 and 41 %, respectively. The 74 % control provided by flumioxazin + halosulfuron fb halosulfuron was similar to all treatments.

CONTROL OF KOCHIA WITH DPX-KJM44 ALONG OKLAHOMA HIGHWAY RIGHTS-OF-WAY. D. Montgomery*, C. Evans, D. Martin; Horticulture & Landscape Architecture, Oklahoma State University, Stillwater, OK

ABSTRACT

A research study was conducted during 2008 to evaluate the effectiveness of several herbicide treatments for selective postemergence control of kochia. Treatments were applied on 29 May to 1-10 inch tall kochia, 1-4 leaf stage large crabgrass, and common bermudagrass at 100% green-up. Treatments were applied using a CO2 pressurized sprayer calibrated to deliver 20 gallons of water/A and were arranged in a randomized complete block design with three replications. Treatments evaluated included DPX-KJM44 at 0.25, 0.5, 1.0, and 2.0 oz. a.i./A alone, and combined with Telar at 0.375 oz. a.i./A, DPX-MAT28 at 0.25, 0.5, and 1.0 oz. a.i./A, Telar alone at 0.375 oz. a.i./A, and Milestone VM at 0.75, 1.0, and 1.75 oz. a.i./A. All treatments included a methylated seed oil at 1.0% V/V. Plots were visually evaluated at 32, 62, and 91 days-after-application (DAA) for percent weed control and percent common bermudagrass injury as compared to untreated plots. This study was conducted under ideal growing conditions including moderate temperatures and good rainfall throughout the duration of the study. At 32 days-after-application DPX-KJM44 at 0.5, 1.0 and 2.0 oz. a.i./A, DPX-KJM44 at 1.0 and 2.0 oz. a.i./A tank-mixed with Telar, and DPX-MAT28 at 1.0 oz. a.i./A were all producing good to excellent control of kochia (85-99%). At this time lower rates of KPX-KJM44 tank-mixed with Telar and lower rates of DPX-MAT28 were providing moderate kochia control (65-73%). All other treatments were providing poor control of kochia at 32 DAA. At 62 DAA kochia control increased for all DPX-KJM44 and DPX-MAT28 treatments. All treatments of DPX-KJM44 and DPX-MAT28 at 0.5 and 1.0 oz. a.i./A were producing excellent kochia control (91-100%). There was a small DPX-KJM44 rate response at that time but kochia was very susceptible to even the lowest rates evaluated. The lowest rate of DPX-MAT28 was providing moderate kochia control (78%) at 62 DAA. All other treatments were providing poor kochia control at 62 DAA. Kochia control at 91 DAA was very similar to that produced at 62 DAA. All of the treatments that were producing excellent kochia control at 62 DAA were maintaining this high level of control into late summer. This was a very positive result as this research site received several good rainfall events in midsummer which typically would promote kochia germination. The DPX-KJM44 and MAT28 products were producing good postemergence control of existing kochia and preventing later kochia from emerging. The Telar and Milestone VM treatments in this study produced poor kochia control throughout the duration of the study. At 32 DAA DPX-KJM44 at 2.0 oz. a.i./A alone, or when tank-mixed with Telar was producing good to excellent control of large crabgrass (85-95%). At that time DPX-MAT28 at 1.0 oz. a.i./A was producing moderate control of large crabgrass (75%). By 62 DAA control of large crabgrass had decreased for all treatments. Treatments containing DPX-KJM44 at 2.0 oz. a.i./A alone, or combined with Telar were maintaining moderate levels of control (65-73%). AT 91 DAA all treatments were producing poor large crabgrass control. Common bermudagrass injury was evaluated throughout the duration of this study. At 32 DAA a small amount of common bermudagrass phytotoxicity was noticed with DPX-KJM44 at 2.0 oz.a.i./A alone, or tank-mixed with Telar (3-7%). This amount of bermudagrass toxicity was more than acceptable and was not evident at 62 and 91 DAA.The authors would like to express their appreciation to the Oklahoma Department of Transportation and DuPont for their support of this research effort.

INFLUENCE OF WEED CONTROL PRACTICES ON PRODUCTION AND ARTHROPOD DIVERSITY IN A ZINFANDEL VINEYARD IN THE CENTRAL COAST OF CALIFORNIA. R.G. Leon*,[1] P.P. Sanguankeo[2]; [1]EARTH University, San Jose, Costa Rica, [2]California Polytechnic State University, San Luis Obispo, CA

ABSTRACT

In the Central Coast of California, wine grape growers are making efforts to reduce production costs while looking for weed control practices that promote biodiversity in their vineyards. For this reason, a field study was conducted in Paso Robles, CA in 2006 and 2007 evaluating the effect on weed and ground dwelling arthropod communities and Zinfandel grape-vine production of five weed control practices: 1) flumioxazin, 2) simazine, 3) cultivation, 4) cover crop, and 5) untreated control. The herbicide treatments had approximately 10 times less and the cultivation half the weed biomass shown by either the cover crop or untreated control treatments. The arthropod abundance differed among treatments only in 2007 being higher in the cover crop and untreated control. Also, there was a positive relationship between weed and arthropod diversity ($r^2 = 0.63$, $P = 0.02$ in 2006; $r^2 = 0.79$, $P < 0.001$ in 2007). Laboratory seed predation tests of two frequently captured carabid beetles, *Calathus ruficollis* and *Agonum maculicolle*, indicated their preferences for black mustard (*Brassica nigra*) and shepherd's purse (*Capsella bursa-pastoris*). Using these seeds in the field study revealed that treatments with higher weed diversity and biomass favored arthropod removal of these weeds, which was around 20-40% in the cover crop and untreated control doubling the predation observed in the cultivation and herbicide treatments. Also, the cover crop suppressed the growth (50-100% reduction) of weed species considered important by local growers such as horseweed (*Conyza canadensis*), panicle willowherb (*Epilobium brachycarpum*), scarlet pimpernel (*Anagallis arvensis*), and sowthistle (*Sonchus* sp.). The highest grapevine yields were observed in the flumioxazin and simazine treatments. However, one pass of cultivation during early spring provided enough weed control allowing yields similar to the herbicide treatments. Under cover crop and untreated control conditions yield was reduced around 20% in 2006 (rainy year) and 48% in 2007 (dry year). The results showed that it is beneficial to encourage plant diversity within the vineyard because arthropod diversity and ecological services are favored, but this has to be done in combination with properly timed POST control actions to minimize yield reductions. Additionally, under limited soil moisture conditions, the use of PRE herbicides could prove important to maintain vine yields.

IMPROVED ASPARAGUS WEED CONTROL WITH FLUMIOXAZIN AND MESOTRIONE. B.H. Zandstra*, C.M. Herrmann, R.V. Tocco; Horticulture, Michigan State University, East Lansing, MI

ABSTRACT

Asparagus is a perennial crop which usually is grown using no-tillage practices in Michigan. Current residual weed control practices depend on PS II inhibitors, including diuron, linuron, metribuzin, and terbacil. Use of these herbicides for many years has resulted in a preponderance of perennial weeds in asparagus, as well as resistant biotypes of pigweeds. Recent registration of flumioxazin and mesotrione has given asparagus growers more tools to manage difficult weeds. Experiments were conducted at East Lansing and Hart, MI over several years to determine the effectiveness of these new compounds and to develop use recommendations. Mesotrione was applied at rates of 0.105 to 0.538 kg/ha, alone or in combination with s-metolachlor. Flumioxazin was applied at 0.215 and 0.429 kg/ha preemergence. Mesotrione at rates of 0.105 and 0.235 gave good control of most annual broadleaves, but did not control common milkweed, clammy groundcherry, wild carrot and hairy nightshade. At rates of 0.420 and 0.538 it gave fair to good control of wild carrot and common milkweed. It did not control hairy nightshade or clammy groundcherry sufficiently at any rate. Asparagus tolerated mesotrione quite well, but there was some fern bleaching in late summer. Asparagus tolerated flumioxazin quite well, with some slight scarring of spears in the earliest harvests. Flumioxazin controlled most annual weeds well, but was not effective against spotted knapweed, wild carrot, and horseweed. Both herbicides were effective against pigweeds. Flumioxazin and mesotrione will improve residual weed control in asparagus but they will have to be used in combination with other herbicides to obtain the desired level of weed control.

EVALUATION OF PREEMERGENCE HERBICIDES FOR LETTUCE PRODUCTION. P.J. Dittmar*, K.M. Jennings, B. Jester, D.W. Monks; Department of Horticultural Science, North Carolina State University, Raleigh, NC

ABSTRACT

Field studies were conducted in North Carolina in 2008 to determine tolerance of transplanted and direct seeded romaine lettuce. The first experiment evaluated crop tolerance of transplanted romaine lettuce and weed conrol to preemergence (PRE) herbicides. Cutleaf evening primrose control was greatest ($\leq$ 3 plants/15 ft plot) with halosulfuron at 0.38, 0.56, and 0.75 oz a.i./A and imazethapyr at 0.016, 0.023, and 0.031 lbs a.i./A. However, halosulfuron at 0.38, 0.56, and 0.75 oz a.i./A stunted plants 49, 59, and 55%, respectively, 2 WAT (wk after treatment). Likewise, clomazone at 0.25, 0.38, and 0.50 lbs a.i./A stunted transplanted lettuce 29, 29, and 66%, 6 WAT. Symptoms of clomazone injury to transplanted lettuce consisted of bleached the leaves. *S*-metolachlor caused the leaves of the lettuce to curl and twist, first noticed at 4 WAT. Pronamide at 0.85, 1.25, and 1.65 lbs a.i./A and pendimethalin at 0.57, 0.86, and 1.14 lbs a.i./A did not injure transplanted romaine lettuce. The second experiment evaluated tolerance of direct seeded romaine lettuce and weeds to preeemergence herbicides. Treatments were applied the day of planting after seeding [0 wk after planting (WAP)] and 4 WAP. Imazethapyr at 0.023 and 0.031 lbs a.i./A was applied only at 4 WAP and caused no lettuce injury. Greater crop injury occurred when herbicides were applied at 0 WAP than when herbicides were applied 4 WAP. Of the 0 WAP treatments, pronamide at 1.25 (83% injury, 3 WAP) and 1.65 (91%, 3 WAP) lbs a.i./A and *S*-metolachlor at 1.24 (80%, 3 WAP) and 1.71 (98%, 3 WAP) lbs a.i./A. caused the greatest injury. Bensulide at 5.5 and 8.3 lbs a.i./A and pendimethalin at 0.86 and 1.14 lbs a.i./A applied 0 WAP had less injury than the other 3 herbicides. The 0 WAP treatment of all herbicides provided greater control of hairy galinsoga, goosegrass, and feral tomato than the 4 WAP treatments. At 4 WAP application, weeds were already 0.5 to 3 inches tall with 3 to 8 true leaves. All herbicides included in this study except imazethapyr provided only PRE control. Hairy galinsoga control by imazethapyr 0.023 and 0.031 lbs a.i./A was 83 and 92%, respectively. Pronamide, bensulide, pendimethalin, and imazethapyr were safe to transplanted romaine lettuce and provided weed control. Transplanted romaine lettuce was more tolerant of herbicides than seeded lettuce. The evaluated herbicides were safer on transplanted romaine lettuce than direct seeded due to the larger size of transplanted lettuce at time of application. However, delaying herbicide application to direct seeded lettuce until it reaches a size where it is more tolerant to herbicides may be too late to provide acceptable weed control.

POSTEMERGENCE ANNUAL BLUEGRASS CONTROL AND PREEMERGENCE CRABGRASS CONTROL WITH FEBRUARY APPLICATION. R. Blanton*; Entolology, Soils & Plant Sci, Clemson University, Clemson, SC

ABSTRACT

Annual Bluegrass is a cool season grass native to Europe and is a troublesome, bunch- grass weed in most turfgrass situations. It is the most troublesome winter annual grass weed on golf courses. Its prolific seed production capability disrupts the appearance and uniformity of the turf stand. It has a competitive growth habit and has poor heat and disease tolerance, which often leaves bare or thin areas in the turf. Crabgrass is a summer annual that reproduces primarily by seeds and is low-growing, which makes control by mowing difficult. Crabgrass is tolerant of hot, dry, compacted soils after establishment, and may spread aggressively to crowd out desirable grasses. In February 2008, a study was conducted to evaluate the efficacy of several combinations of herbicides for postemergent annual bluegrass and preemergent crabgrass control. Initial applications were made on February 8, 2008 followed by sequential applications 60 days after initial treatments (DAIT). The study, located in Pickens County, SC at Clemson University was conducted on a Tifway Bermudagrass experimental turf plot with a history of crabgrass infestation. Plot size measured 2.0 m by 3.0 m, replicated three times. Treatments were applied using a CO2 backpack sprayer calibrated at 20 GPA, at 30 p.s.i., with 8003 flat fan spray tips. Treatments were: Reward (diquat) at 0.93 lb ai/A + Barricade (prodiamine) at 0 .5 lb ai/A (Initial) followed by Barricade at 0.5 lb ai/A 60 DAIT; Roundup (glyphosate) at 0.5 lb ai/A + Barricade at 0 .5 lb ai/A (Initial) followed by Barricade at 0.5 lb ai/A 60 DAIT; Finale (glufosinate) at 1.5 lb ai/A + Barricade at 0.5 lb ai/A followed by Barricade at 0.5 lb ai/A 60 DAIT; Revolver (foramsulfuron) at 0.025 lb ai/A + Barricade at 0 .5 lb ai/A (Initial) followed by Barricade at 0.5 lb ai/A 60 DAIT; Monument (trifloxysulfuron) at 0.03lb ai/a + Barricade at 0 .5 lb ai/A + non-ionic surfactant at 0.25% V/V (Initial) followed by Barricade at 0.5 lb ai/A 60 DAIT; Princep (simazine) at 2lb ai/A + Barricade at 0 .5 lb ai/A (Initial) followed by Barricade at 0.5 lb ai/A 60 DAIT; Barricade alone at 0 .5 lb ai/A (Initial); and Barricade at 0 .5 lb ai/A (Initial) followed by Barricade at 0 .5 lb ai/A. Ratings taken throughout the study included annual bluegrass and crabgrass control on a 0 to 100% scale, where 0 = no control and 100 = complete control. Tifway Bermudagrass phytotoxicity was rated on a 0 to 100% scale, where 0 = no injury and 100 = dead turf. Thirty percent was deemed the maximum acceptable level of turf injury. With the preemergent crabgrass study, on July 30, 2008 (173 DAIT) and for the remainder of the study, control was observed to be 70-73%. Roundup + Barricade (Initial) followed by Barricade 60 DAIT, Revolver + Barricade (Initial) followed by Barricade 60 DAIT, and Princep + Barricade (Initial) followed by Barricade 60 DAIT provided 73% control for the remainder of the study. Turf injury was minimal. Future research at Clemson University will be to evaluate new and existing herbicides for postemergence annual bluegrass and preemergence crabgrass control. We will also evaluate various herbicide combinations, rates, and timings for improved annual bluegrass and crabgrass efficacy.

HERBICIDES AS SYNERGISTS FOR MYCOHERBICIDES AND VICE VERSA. J. Gressel*; Weizmann Institute of Science, Rehovot, Israel

ABSTRACT

While there have been some successes in controlling introduced weeds with "classical" mycoherbicidal organisms brought from the center of origin of the weed, there have been few sustainable commercial successes with "inundative" mycoherbicides derived from weed-specific local pathogens for control of intractable major global weeds. This lack of success is partly due to an evolutionary balance that must be between a highly specific pathogen and its target weed that requires that the pathogen not kill; if high virulence were to occur, both weed and pathogen would become extinct. Herbicides can temporarily shift the balance, synergistically enhancing virulence while the herbicide is present. Such synergies can even be "coalative", where neither component kills the weed, but both together do so. Two approaches have been used to establish synergy: (1) use a herbicide that generally weakens the weed, allowing the mycoherbicide to establish, e.g. 2,4-D to weaken so that a pathogen could act on the weed; (2) use a herbicide to specifically suppress one of the host defense mechanisms, e.g. glyphosate to suppress the production of phytoalexins derived from the phenyl propanoid pathway in leguminous weeds. Finding herbicides for the first approach can be achieved by random screening; the second approach by first elucidating the defense mechanisms of the weed. Clearly some herbicides will work as synergists in a dual manner, generally weakening, while also suppressing specific defenses. Some herbicides, notably glyphosate kill weeds less completely and more slowly in sterile conditions, and their efficacy might be synergistically enhanced by adding pathogens. Indeed, it is possible that molecules that seemed inefficient in sterile industrial screens for herbicides would provide excellent weed control if they were mixed with the right microorganisms to synergize their activity. Nature rarely uses single, stand-alone compounds to kill or protect. Synergies are the rule, and we should learn from nature.

HERBICIDES AS RIPENERS FOR SUGARCANE. E.P. Richard, C.D. Dalley*, R.P. Viator; USDA-ARS Sugarcane Research Unit, Houma, LA

ABSTRACT

At the start of the sugarcane harvest season in Louisiana, late-September or early-October, sucrose content in sugarcane is relatively low compared to late in the harvest season. In order for early-harvested sugarcane to be profitable, chemicals, primarily herbicides, have been evaluated for their efficacy in increasing sucrose content of sugarcane, i.e. ripening The first sugarcane ripener registered for use in the U.S. was glyphosine, in 1975, which was replaced by glyphosate in 1980. Glyphosate is the only sugarcane ripener registered for use the U.S. Applied at 0.14 to 0.49 kg ae/ha, glyphosate inhibits growth of the apical meristem while synthesis and transport of sucrose to the maturing stalk internodes continues. Increases in sucrose content of as much as 30% can be measured in as few as 3 weeks with ripener applications of glyphosate being most effective while sugarcane is actively growing - conditions unfavorable for natural ripening. Glyphosate often reduces gross cane yields (Mg cane/ha), but sugar yields (kg sugar/ha) are increased because the increase in theoretically recoverable sugar (TRS; kg sugar/Mg cane) is enough to offset reductions in gross cane yields. Glyphosate use is restricted to the ratoon crops in Louisiana and Texas and only to the final ratoon crop in Florida. It is also applied to sugarcane in Hawaii where sugarcane is only harvested once from a planting after a 2-yr growing season. Restrictions in use in Louisiana, Texas, and Florida are based on the concerns of potential injury to the subsequent ratoon crop from a misapplication. Applications can result in stunting and bleaching of shoots that emerge the following spring with the severity of the injury dependent on rate, treatment to harvest interval, and variety. The effects on the following year's ratoon crop are usually transient and have been shown to impact yield only when additional stresses are encountered. A number of other herbicides have also been tested with limited success. The ACCase-inhibitor, fluazifop, has been tested in the U.S. and has been used commercially in other sugarcane producing countries. Several ALS-inhibitors, including imazapyr and nicosulfuron, as well as the gibberellin inhibitor trinexapac-ethyl, have also been tested. All of these have increased sucrose content while having a lesser impact on gross sugarcane yields and spring regrowth, but per hectare sugar yields have generally been lower than those obtained with standard glyphosate applications. The need for an alternative ripener to glyphosate may present itself if glyphosate-resistant sugarcane is adopted commercially. Glyphosate-resistant sugarcane would be a benefit primarily for controlling perennial grasses such as bermudagrass and johnsongrass as well as the annual itchgrass in Louisiana and the perennial napiergrass in Florida.

PHARMACEUTICAL USES OF HERBICIDES AND CLOSELY RELATED COMPOUNDS. S.O. Duke*; USDA, ARS, University, MS

ABSTRACT

For many years, virtually all pharmaceutical companies had an agrochemical division. This was partly to maximize the benefits of expensive chemical synthesis efforts by searching for many types of useful biological activity. Leads for phrarmaceuticals and pesticides often overlap, in some cases leading to both pharmaceuticals and herbicides. This review will focus on herbicides and herbicide classes that have been found to have potential pharmaceutical properties, both as therapeutics that act through human molecular target sites and those that act on infectious agents. An example of the first case are compounds that target acetyl CoA carboxylase in plants to inhibit fatty acid synthesis and in humans as an anti-inflamatory agent. Other such examples are triketones that can act as both herbicides and as treatments for the genetic disease tyrosinaemia. Examples of the second case are the relatively large number of herbicides that have anti-*Plasmodium* spp. activity. It turns out that *Plasmodium* spp. have an organelle that is apparently a vestigial chloroplast, the apicoplast. Although, our lab has found that apicoplast-associated target sites are not necessarily likely to be good targets for herbicides with chloroplast-localized targets. Other herbicides, such a dinitroanilines, are active against several protozoan parasites by the same mechanism by which they kill plants, interaction with tubulin to halt cell division. These and other multiple activities of various herbicides and herbicide classes provide perspective on the broad biological activity of herbicides.

GLYPHOSATE ACTIVITY ON PLANT DISEASES AND POTENTIAL IMPACT ON PLANT HEALTH AND YIELD IN ROUNDUP READY® CROPPING SYSTEMS. F. Kohn*,[1] M. South,[1] K. Kretzmer,[1] W. Duncan,[1] G. Bogosian,[1] P. Morris,[1] M. Nishikawa[2]; [1]Monsanto Co., Saint Louis, MO, [2]Monsanto Co., Sao Paulo, Brazil

ABSTRACT

Initial laboratory and field studies showed glyphosate activity against rusts in glyphosate resistant wheat (*P. triticina, P. striiformis)* and Asian soybean rust, caused by *Phakopsora pachyrhizi*, in glyphosate-resistant soybeans. Further investigations into the disease control activity of glyphosate against a broader spectrum of plant pathogens demonstrated that that the application of glyphosate as technical material or as Roundup® formulations can suppress the incidence and/or severity of a range of plant diseases. Experiments under growth chamber and field conditions have shown that glyphosate can suppress symptoms of disease from a range of economically important pathogens, and that applications of Roundup products have the potential to reduce yield loss in the presence of significant disease pressure. The fungicidal mode of action of glyphosate is attributed to inhibition of fungal EPSPS, with disease suppression primarily provided by systemic glyphosate. Suppression of disease may be provided from both pre and post infection applications of glyphosate. Our results indicate that glyphosate has the potential to suppress diseases caused by a wide range of fungal pathogens, and could provide incremental disease control benefits in glyphosate-resistant cropping systems.

USES OF HERBICIDES TO STUDY PLANT BIOCHEMISTRY AND PHYSIOLOGY. F.E. Dayan*; USDA-ARS, University, MS

ABSTRACT

Herbicides are small molecules that inhibit specific molecular target sites within plant biochemical and/or physiological pathways. Inhibitions of these sites often have catastrophic consequences that are lethal to the treated plants. The specific affinity of these compounds for their respective target sites makes them useful tools study and dissect the intricacies of plant biochemical and physiological processes. The elucidation of the chloroplast electron transport chain was achieved in part through the use of specific photosynthetic inhibitors such as diuron and paraquat, which act on photosystem II and I, respectively. Work stemming from the discovery of the binding site of PSII inhibiting herbicides was ultimately awarded the Nobel Prize in 1988. Though not as prestigious as the seminal work on photosynthesis, our knowledge of other plant processes has also advanced significantly through the use of herbicides as molecular probes. Other examples of the use of herbicides to study plant biochemistry and physiology will be given for compounds that target lipid synthesis, branched-chain and aromatic amino acid synthesis, porphyrin and carotenoids synthesis, mitosis, cell wall formation, and growth regulation.

GROWTH REGULATION AND OTHER SECONDARY EFFECTS OF HERBICIDES. E.D. Velini*,[1] M.L. Trindade,[1] S.O. Duke[2]; [1]São Paulo State University, Botucatu, Brazil, [2]NPURU - ARS, USDA, Oxford, MS

ABSTRACT

Most herbicides are compounds that interact with proteins in plants inhibiting metabolic pathways or physiological processes. As a consequence of the inhibition, plants will die or stop growing. The auxin agonists are exceptions as they promote an auxin-overdose and uncontrolled growth in plants. As all herbicides act on pathways or processes crucial to plants, on a forward or on a reverse way, possibly low doses of any herbicide can be used to modify plant growth, development, or composition. In addition, some safeners can have effects other than just protecting plants against herbicide injury. Auxin agonists (like dicamba and 2,4-D) are effective low cost plant growth regulators. Currently, 2,4-D is still used in tissue cultures (as a source of auxins), to induce rooting or blossom setting, to control fruit ripening, to reduce drop of mature fruits or to delay senescence during storage. Glyphosate, the most used herbicide all over the world, is also widely applied at low rates to ripen sugarcane. Low rates of glyphosate also can: a) stimulate plant growth (this effect is called hormesis); b) improve the absorption of some nutrients like P and K; c) reduce the availability of some cationic elements like Fe, Cu and Mn; d) induce the accumulation of compounds of industrial interest like shikimic acid; e) deplete the contents of phenolic compounds (like salicylic acid or IAA) and carotenoids; f) make plants more sensitive to biological control by pathogens; and g) interfere with lignin accumulation (this effect is rate and species dependent). When applied at recommended rates for weed control, glyphosate can inhibit rust diseases in glyphosate-resistant wheat and soybean. Fluridone blocks the carotenoid biosynthesis by inhibition of phytoene desaturase and is effective in reducing the production of abscisic acid (AIB) in drought-stressed plants. It is essential to evaluate the effects of other extensively used herbicides that inhibit carotenoid synthesis (like isoxaflutole, clomazone, mesotrione and low rates of glyphosate) on AIB accumulation and drought tolerance. Among the ALS inhibitors, sulfometuron-methyl is widely used to ripen sugarcane and Imazapyr, Imazapic and imazethapyr can be used to suppress turf species growth. Trifluralin and other mitosis inhibitors can be used to suppress root growth. Fluazifop-p-butyl, clethodim and sethoxydim are inhibitors of ACCase and can be used to ripen sugarcane. Fluazifop-p-butyl also can be used at low rates to suppress grass growth. Diquat and paraquat accept electrons from photosystem I and induce the lipid peroxidation. Both compounds are fast acting herbicides and have been used to desiccate crops prior to harvest. Paraquat and carfentrazone (Protox inhibitor) are promising compounds to be applied to sugarcane prior to harvest to promote ripening and the desiccation of green leaves, simplifying their harvest and use in producing electricity or ethanol by hydrolysis. Protox inhibitors also can improve plant resistance to diseases. Glufosinate (a GS inhibitor) is widely used to desiccate crops prior to harvest. Among the commercially available safeners, naphthalic-anhydride applied as seed treatment can improve corn yield. Besides protecting plants cotton and rice plants against the effects of clomazone, like other phosphorodithioate-based compounds, dietholate (a cytochrome P450 monooxygenase inhibitor) also can be used as an extender. Mefenpyr-diethyl can protect wheat plants against the effects of fenoxaprop-p-ethyl and when applied alone (without the herbicide), it can increase the total lipid content of wheat plants; this effect can be useful if it takes place in other plant species that can be effectively used to produce oil.

HERBICIDES AS HARVEST AIDS. J.L. Griffin*, J.M. Boudreaux; Louisiana State University Agricultural Center, Baton Rouge, LA

ABSTRACT

Determinate soybean varieties representing Maturity Groups V, VI, and VII were planted in the South in the 1980's and 1990's. During that time weeds were a major limiting factor to soybean production. Morningglory was particularly troublesome and in cases where climbing and wrapping of soybean plants occurred, it was impossible to harvest with a combine. The herbicide paraquat was used to desiccate weed foliage and improve harvest efficiency. The improvement in soybean grade through reduced seed moisture and foreign material from use of paraquat more than offset the cost. Because paraquat works quickly, soybeans could be harvested 5 to 7 days after application. With the introduction of Roundup Ready technology in the mid-1990's, soybean variety development programs for the South shifted toward Group IV (indeterminate) and Group V varieties. The paraquat label differentiates between indeterminate and determinate varieties. Specifically, the Gramoxone Inteon (paraquat) label states that for indeterminate varieties; apply when at least 65% of the seed pods have reached a mature brown color or when seed moisture is 30% or less. For determinate varieties apply when plants are mature, i.e., beans are fully developed, 50% of leaves have dropped, and remaining leaves are yellowing. The label is clearly written to assure crop safety. If soybean foliage is removed before all seed on the plant have reached physiological maturity soybean seed weight and yield can be affected. With the shift toward earlier planting and use of more early maturing indeterminate varieties over the last few years, a delayed maturity problem refereed to as "green bean" syndrome has become more widespread. Presence of green stems, green pods, or leaf retention or combinations of these has been linked to stinkbug injury, fungicide application, and stress factors. Regardless of the culprit, the presence of green plant material can delay soybean harvest, increase seed moisture, and can affect foreign material and seed damage when graded at the elevator. The dockage associated with these factors can be significant. The green bean problem is more prevalent in indeterminate varieties but has occurred in determinate varieties as well. Both indeterminate and determinate soybean varieties are photoperiod sensitive but they differ in regard to growth characteristics after flowering is initiated. Research was conducted over two years to evaluate Gramoxone Inteon at 1.0 pt/A alone and with Aim (carfentrazone) at 1.4 oz/A as a soybean harvest aid. Soybeans were treated at 60, 50, 40, 30, and 20% average seed moisture determined from seed collected from the top 4 nodes of plants. Experiments were conducted using 'Asgrow 4403RR', a Group IV indeterminate variety and 'Asgrow 5903RR', a Group V determinate variety. Application of Gramoxone Inteon to the indeterminate variety at 60% average seed moisture reduced yield 15%. At 50% average seed moisture, yield was not negatively affected and harvest was 10 to 14 days earlier than the nontreated. For the determinate variety, yields were reduced with application at 60 and 50% average seed moisture, 22 and 16%, respectively. At 40% average seed moisture, yield was not negatively affected and harvest was 7 to 15 days earlier than the nontreated. Reduced 100-seed weight accompanied the reduction in soybean yield of both varieties, which would be expected when soybean leaves are removed before seed fill is complete. Soybean seed moisture decreased around 10% every 7 to 10 days for both varieties. Finding show that application timing was more flexible for the indeterminate variety. Removal of leaf material too early for an indeterminate variety would result in reduced seed weight for only those seed in the top of the plant canopy as compared with a determinate variety where seed at both the top and bottom of the canopy would be affected. Application of Gramoxone Inteon decreased number of green stems, pods, and leaves and seed moisture at harvest resulting in earlier harvest. Addition of Aim did not antagonize soybean desiccation and could be added when broadleaf weeds such as morningglory are present.

SOIL INTERACTIONS WITH DPX-KJM44 AND DPX-MAT28. B. Lindenmayer*, P. Westra, G. Brunk; Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO

ABSTRACT

Aminocyclopyrachlor is a new herbicide under development by DuPont. It controls a wide range of broadleaf weed species in non-cropland. Currently, aminocyclopyrachlor is formulated as the free acid (DPX-MAT28) and in a methyl-ester form (DPX-KJM44). The objective of this study was to examine soil adsorption characteristics of both formulations across a range of soils with various soil properties. Radio-labeled DPX-KJM44 and DPX-MAT28 were each added to 2g of the six different soils which were sterilized with $HgCl_2$. Liquid scintillation spectroscopy (LSS) was performed to quantify the radioactivity remaining in solution after 24 hours and to calculate K_d values, which were then correlated with soil properties. The study was also repeated without $HgCl_2$ to examine the effects of soil microbes on herbicide adsorption. Results of this study indicate greater adsorption of DPX-KJM44 (K_d=3.25) across all soils compared to DPX-MAT28 (K_d=0.27) both with and without $HgCl_2$. Soil adsorption of DPX-KJM44 was reduced when $HgCl_2$ was removed from the solution which may indicate conversion of the DPX-KJM44 to DPX-MAT28 by soil microbes. Finally, DPX-KJM44 adsorption increased with increasing soil OM while DPX-MAT28 adsorption decreased with increasing soil pH. Soil OM accounted for 64% of DPX-KJM44 adsorption and soil pH accounted for 45% of DPX-MAT28 adsorption. Therefore, soil OM and pH may play critical roles in determining residual herbicide activity in the soil as well as adjusting application rates for different soils. Future research will continue to examine soil interactions with aminocyclopyrachlor by determining herbicide dissipation over time of both formulations and further examine DPX-KJM44 conversion to DPX-MAT28.

PERSISTENCE OF TRICLOPYR IN ALASKA SUBARCTIC ENVIRONMENTS. S.S. Seefeldt*,[1] D.L. Barnes,[2] R.D. Ranft,[3] W.J. Rhodes,[2] M. Zhang,[3] W.E. Schnabel[2]; [1]USDA/ARS, Fairbanks, AK, [2]Civil and Environmental Engineering, University of Alaska Fairbanks, Fairbanks, AK, [3]Natural Resources and Agricultural Sciences, University of Alaska Fairbanks, Fairbanks, AK

ABSTRACT

Field dissipation and vertical mobility of the butoxyethyl ester of triclopyr was assessed in two distinct geographic locations within the state of Alaska. Interior sites near Delta Junction included vegetated plots within highway rights-of-way (ROW) and Conservation Reserve Program (CRP) fields and a coastal site within ROW near Valdez. Triclopyr was broadcast applied at 2.2 kg ai/ha with 0.25% v/v non-ionic surfactant (talloil) on the ROW, whereas a dose-response study was used on CRP fields with 2.2, 1.1, 0.6 and 0.3 kg ai/ha. Soil samples were collected at 0-5, 10-18 (in the ROW), 15-30 (in the CRP), and 30-38 cm depths before, immediately following application and periodically over the course of a year. Environmental conditions were monitored and soil properties were measured. Soil samples were extracted with diethyl ether and esterified with boron trifluoride to enable analysis via gas chromatograph mass spectrometer. Triclopyr residues persisted at the 0-5 cm depth for at least 300 days following application at all sites. Transient increases in concentration at the 0-5 cm depth were observed, presumably resulting from residue wash-off associated with precipitation events or, in the spring, possible deposition from treated vegetation on the ground surface. Vertical mobility of triclopyr was limited, indicated by a large proportion of non-detects and relatively low concentrations recorded at the 10-18 cm and 30-38 cm depths. Increased amounts of vegetation at the Valdez location resulted in reduced amounts of triclopyr in the soil. Degradation rates at both sites were equivalent during the growing season. If triclopyr were to reach ground or surface waters through transport from the target area, concentrations should remain well below toxic levels with respect to aquatic and terrestrial organisms.

CORRELATING RESIDUAL HERBICIDE RATES AND SORPTION COEFFICIENTS IN SOILS OF CONTRASTING TEXTURE. P.J. Christoffoleti*,[1] V.C. Cardinali,[1] A.C. Dias,[1] M. Nicolai,[1] A.M. Iaia,[2] V.L. Tornissielo,[3] L.H. Campos,[1] L. Menegatti,[1] T.C. Mueller[4]; [1]Crop Science, University of Sao Paulo, Piracicaba, Brazil, [2]Crop Science, University of Mato Grosso, Cuiabá, Brazil, [3]Cena, University of Sao Paulo, Piracicaba, Brazil, [4]Plant Sciences, University of Tennessee, Knoxville, TN

ABSTRACT

Sorption-desorption interactions of pesticides with soil determine the availability of pesticides in soil for transport, uptake, and microbial degradation. These interactions are affected by the physical and chemical properties of pesticide and soil, and consequently the efficacy of the recommended rate sprayed. Herbicide rate recommendations of pre emergent herbicides are based on the soil texture classes of the whole area to be sprayed, however site specific variation in the clay and organic matter content may interfere with the selectivity and efficacy of the herbicide, so rate recommendations based on variable rate application may improve the rational of herbicide application. Therefore, this research evaluated the soil texture variation related to clay and organic matter content on the efficacy of the residual herbicides diuron and hexazinone sprayed in sugarcane in Brazil, in order to built recommendation curves of variable rates for site specific application of herbicides. The trials were conducted in Ecotoxicology lab of CENA-ESALQ-USP in Piracicaba, Brazil from June to November 2008. Four contrasting soil textures (soil 1 - sandy, 2 - sandy loams, 3 - clay, 4 - clay loam) were sampled from 0-20 cm in Iracemapolis and Piracicaba, SP, Brazil. The experimental design was completely randomized, with factorial arrangement: 4 soils x 5 rates (either diuron or hexazinone), with three replications. Five diuron concentrations were used: 0.19, 0.42, 0.84, 1.68, and 3.34 mg L^{-1}, with average radioactivity of 5.21 MBq L^{-1}, five concentrations of hexazinone: 0.12, 0.22, 0.66, 2.17, and 6.03 mg L^{-1} with radioactivity of 5.83 MBq L^{-1}. After the sorption, a desorption study was done with five herbicide concentrations, followed by three desorptions only for the concentration equivalent to the maximum recommended rate: 0.84 and 0.22 mg L^{-1}, for the herbicides diuron and hexazinone, respectively. There was a strong correlation between soil texture and adsorption coefficient, with diuron being more bounded to the soil constituents, with K_d values ranging from 4.0 (soil 1) to 84.75 (soil 3). Hexazinone was less retained into the soil constituents, with K_d ranging from 0.49 (soil 1) to 1.93 (soil 3). Hysteresis was observed for both herbicides; however, diuron was more retained in the soil constituents. A field study was conducted with variable rate application based on the soil texture and organic matter variation in Goianesia - GO, Brazil in a sugarcane field. Results showed good correlation between rates and soil texture variation, and the overall rate of the site specific application in the area was similar to the label recommendation rate based on the soil texture classification. There was no evidence of differences in the efficacy and selectivity when site specific variable rate was sprayed compared to the conventional non variable rate application. The results of this research show that it is possible to make a correlation of herbicide rate according to soil texture site specific variability and adsorption coefficient.

EFFECT OF SOIL PH AND PREVIOUS USE HISTORY ON ATRAZINE DISSIPATION IN SOIL. T.C. Mueller*, L.E. Steckel, M. Radosevich; University of Tennessee, Knoxville, TN

ABSTRACT

Atrazine degradation has been documented by previous researchers. This study is the report of a multi-year year study that examined the interaction of soil pH with differing levels of atrazine exposure over a 4 year period. Soil pH ranged from 5.2 to 7.1, and atrazine exposures ranged from none (0) to 8 applications over a 4 year period (for each year, one application at planting and one early postemergence). The entire plot area was uniformly managed to reduce potential confounding effects due to cropping history, tillage, and other factors. In this study, there was no effect of atrazine use history, although all plots displayed rapid atrazine dissipation, with half lives in plots of pH > 5.5 being less than 4 days. Soil pH had a marked effect, with slower atrazine dissipation in those plots that had a pH < 5.5. This pH and previous atrazine history effect was consistent in laboratory and field environments. Implications of these findings include probable reduction in weed control due to more rapid atrazine dissipation, and also reduced loadings into surface water due to more rapid atrazine degradation.

TIMED RELEASE OF FLURPRIMIDOL FROM A GRANLAR FORMULATION IN MULCHES AND SAND SOIL. T.L. Grey*,[1] M. Czarnota,[2] T. Potter,[3] A.T. Bunnell[4]; [1]Crop and Soil Sciences, University of Georgia, Tifton, GA, [2]Horticulture Science, University of Georgia, Griffin, GA, [3]Southeast Watershed Research Laboratory, USDA/ARS, Tifton, GA, [4]SePRO Corporation, Carmel, IN

ABSTRACT

Flurprimidol is a plant growth regulator that can be applied as a granular formulation. Understanding flurprimidol release from a granular formulation and movement in various mediums will impact how it is utilized. Dissipation of flurprimidol from a granular formulation and movement through organic media and sand were evaluated in a greenhouse and laboratory experiment. Experimental variables included media type, depth, and irrigation event. Dissipation isotherms were determined by applying non-linear regression. Mobility was evaluated using columns filled with media, which was surface spiked with the granular formulation, and then irrigated once daily for 22 consecutive days. Leachate was collected and analyzed by HPLC-MS. Half life (DT_{50}) as defined as time to 50% reduction, varied between sand, media, and media depth. Flurprimidol dissipation was rapid through sand with DT_{50} of 6 days. DT_{50} increased with increasing media depth from 5 to 10 cm for pine bark plus sand, 18 and 35 days, and hardwood bark plus sand, 77 and 173 days, respectively. Maximum flurprimidol leaching was a cumulative 71% of applied amounts over 22 irrigation events through the sand. Hardwood and pine bark media allowed less than 25% of flurprimidol to escape through the column. Data for all media indicated that flurprimidol was mobile through the substrates, but exhibited hysteresis with pine bark and hard wood bark media. An initial pulse of flurprimidol will release slowly from this formulation over time. These results indicate that flurprimidol will dissipate from a granular formulation over time and that it will have movement through sand soil and pine bark and hardwood bark media to reach the roots of growing plants.

FACTORS AFFECTING PESTICIDE RUNOFF FROM WARM-SEASON TURFGRASS. J.H. Massey*,[1] P.A. Ampim,[2] B.A. Stewart[1]; [1]Plant and Soil Science, Mississippi State University, Mississippi State, MS, [2]Texas AgriLife Research and Extension, Texas A & M University, Dallas, TX

ABSTRACT

This study was conducted to improve the understanding and modeling of pesticide runoff from bermudagrass (*Cynodon dactylon* [L] Pers. x *Cynodon transvalensis* Burtt-Davy) and zoygrass (*Zoysia japonica* Steud.). Factors investigated include pesticide physicochemical properties, mowing height, and plot size. The turfgrass species were maintained to simulate either golf course fairways or residential lawns. The runoff studies used a split plot design and were conducted on plots having 3% slope that ranged in size from 4- to 466-m^2. 2, 4-D herbicide, flutolanil fungicide, and chlorpyrifos insecticide were co-applied at 1.12 kg ai/ha, 2.24 kg ai/ha and 2.24 kg ai/ha, respectively. The conservative tracer KBr (10 kg/ha) was applied immediately before initiation of simulated rainfall (38 mm/h for 90 min) 24 h after pesticide application. Runoff from the plots was collected at approximately five-minute intervals and analyzed using HPLC-UV. The runoff parameters measured included the maximum observed concentrations (ppb), total masses (g) and percentages of the applied chemicals observed in runoff. Various hydrological parameters were also measured. While the specific effects of grass species, mowing height, and plot size on runoff depended on the pesticide and runoff parameter analyzed, the total chemical masses in runoff were linearly proportional to plot size for the mobile (e.g., 2,4-D, Br^-), moderately mobile (flutolanil) and relatively immobile (chlorpyrifos) chemicals used in this study.

REDUCING WATER USE AND HERBICIDE RUNOFF BY MULTIPLE INLET PLUS INTERMITTENT RICE IRRIGATION. J.H. Massey*; Plant and Soil Science, Mississippi State University, Mississippi State, MS

ABSTRACT

Field studies were conducted to determine the potential for water savings and reduced nonpoint source runoff using multiple-inlet irrigation plus intermittent flooding as compared to continuously flooded rice. All water inputs and flood depths were recorded. Water samples were collected on a weekly basis for nutrient and pesticide analysis. Intermittent flooding did not affect pest pressure, plant-nutrient content, or rice yield or quality. However, intermittently-flooded rice used up to 50% less water than conventional flood practices. Simple visual devices that aided producers in managing their rice floods were installed and evaluated as part of this study. The water savings were due to (1) increased rainfall-holding capacity, and (2) reduced over-pumping and subsequent tailwater runoff. Based on 25-year historical precipitation data, model results predict an average increase in rainfall capture of 67% and a 60% reduction in tailwater runoff using intermittent versus a conventional flood system. Adoption of intermittent flooding could significantly reduce energy and water use in rice production while improving surface water quality.

***ALYSSUM DESERTORUM* REDUCES THE DIVERSITY AND ABUNDANCE OF SOIL BACTERIAL POPULATIONS IN YELLOWSTONE NATIONAL PARK.** B. Hamilton*,[1] E. Hellquist[2]; [1]Biology, Washington and Lee University, Lexington, VA, [2]Biology, SUNY-Oswego, Oswego, NY

ABSTRACT

Alyssum desertorum (ALDE) is a weed in Yellowstone National Park that produces nearly complete mono-cultures in at least 80 hectares of prime pronghorn and bison winter foraging range. To support the National Park Service's efforts to restore native vegetation to the area we conducted an analysis of bacterial diversity and abundance in soils of ALDE and a native grass Sandberg bluegrass (*Poa secunda*:POSE). We also quantified the effect of glyphosate application (1.12 kg/ha) on bacteria in soils of ALDE seven days after application. Terminal restriction length polymorphism analysis was used to determine bacterial diversity and quantitative polymerase chain reaction (q-PCR) was used to quantify total and nitrogen cycling bacteria (ammonia and nitrite oxidizing). Bacterial taxonomic unit diversity was 36±8 and 22±4 in soils of POSE and ALDE, respectively. Glyphosate application to ALDE did not have an effect on bacterial taxonomic diversity (21±6). Bacterial community composition did differ with POSE and ALDE sharing only 10 taxonomic units. Total bacterial abundance was reduced by 2-fold, ammonia oxidizing bacteria by 3-fold and nitrite oxidizing bacteria by 3.5-fold. Glyphosate abundance of nitrite oxidizing bacteria to levels close to detection limits of qPCR. ALDE alters bacterial community diversity and abundance (total and N-cycling) potentially impacting decomposition and N-cycling. The application of glyphosate may further have impact of nitrate accumulation in ALDE soils.

WIND DISPERSED SEEDS FROM CARGO ENTERING THE PORTS OF SEATTLE AND TACOMA, 2007-2008. M.L. Smither-Kopperl*; USDA-APHIS-PPQ, SeaTac, WA

ABSTRACT

Several species of wind dispersed seeds are classified as Federal Noxious Weeds (FNW), and prohibited from entry into the United States. Wind dispersed seeds present particular challenges for interception; they may be dispersed over long distances, the seeds are small and light and can adhere to a variety of surfaces including the exterior of shipping containers and wooden pallets. Agriculture Specialists of Customs and Border Protection inspect cargo for the presence of FNW. Interceptions are sent to USDA-APHIS for identification. This documents the risk pathway for entry of wind dispersed FNW on maritime cargo into the ports of Seattle and Tacoma, WA. The four most frequently intercepted FNW in 2007 and 2008 respectively were cogongrass (*Imperata cylindrica* (L) Beauv.) (40, 130), mission grass (*Pennisetum polystachion* (L.) Schult.) (10, 24), wild sugarcane (*Saccharum spontaneum* L.) (23, 37) and Tridax daisy, (*Tridax procumbens* L.) (4, 19). There were seasonal differences in interceptions for cogon grass, which peaked in June and July, while wild sugarcane interceptions were greatest during October and November. The major countries of origin for cogon grass were China, Japan, Malaysia, Vietnam and Italy, 50% of all interceptions were from China. The major countries of origin for mission grass were Vietnam, Malaysia, Thailand and Turkey; and, 64% of interceptions were from Vietnam. The major countries of origin for wild sugarcane were India, China, Guam, Japan, and the Philippines; 26% of interceptions were from India and 25% from China. The major countries of origin for Tridax daisy were Vietnam, China, and Australia, 27% of all interceptions were from Vietnam, and 22% from Australia. During 2008, 16% of interceptions of wind dispersed FNW were from container inspections, and 32% from wooden pallets.

A SUMMARY OF FEDERAL NOXIOUS WEED (FNW) REGULATORY ACTIVITIES IN THE EASTERN REGION. A. Man-Son-Hing*; US Department of Agriculture-Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Raleigh, NC

ABSTRACT

Presently, Animal and Plant Health Inspection Service's Federal Noxious Weed Program is administered by Plant Protection and Quarantine. This program is designed to prevent the introduction of nonindigenous invasive plants into the United States. Additionally, it also serves to prevent the spread of newly introduced invasive plants within the United States. APHIS' noxious weed activities include exclusion, permitting, eradication of incipient infestation, survey, data management, public education, and integrated management of introduced weed, including biological control. The Eastern Regional Office has FNW program oversight throughout the eastern half of the United States. Demographically, this includes 27 states, Puerto Rico, and Washington D.C. The Eastern Regional Office works very closely with individual States through cooperative agreements to address many of the invasive issues. This collaborative union has proved to be very effective as most States have their own authority to regulate intrastate movement. At the same time, PPQ has the unique Federal authority to prevent the entry and interstate movement of harmful invasive plants and noxious weeds.

UPDATE ON THE FEDERAL NOXIOUS WEED REGULATORY PROGRAM. A.V. Tasker*; PPQ, USDA APHIS, Riverdale, MD

ABSTRACT

Federal Noxious Weeds (FNW) are regulated by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, Plant Protection & Quarantine (PPQ) based on risk assessment. Authority implemented by the Plant Protection Act of 2000 allows PPQ to require permits for the importation, exportation, or movement in interstate commerce of noxious weeds. A violation allows imposition of remedial measures upon any plant pest or noxious weed that is new to or not known to be widely distributed within the United States. The remedial measures are to "hold, seize, quarantine, treat, apply other remedial measures to, destroy, or otherwise dispose of any plant, plant pest, noxious weed, biological control organism, plant product, article, or means of conveyance" found in violation of the movement permit requirement. Stakeholders have encouraged APHIS to broadly expand the number of regulated species. As a partial response to this, APHIS is considering substantial revisions to the regulations on propagative plant materials known collectively as Quarantine 37 (7 CFR Part 319.37). One of the changes will establish an import entry category for plant taxa new to the U.S. to be excluded from import pending risk evaluation (NAPPRA). A number of other proposed rule changes for "Q-37" are in draft. Other proposed rule changes for APHIS regulations in draft are: 1) Add to the FNW list two *Lygodium* spp. recently quarantined under a Federal order; 2) Update the FNW weed regulations, including adding seven new spp. to the FNW list; 3) Implement rules for recognition of appropriate state programs as official control.

THE RESPONSE OF RYEGRASS (*LOLIUM TEMULENTUM*), CANARY GRASS (*PHALARIS MINOR*) AND WILD OAT (*AVENA FATUA*) TO DIFFERENT ADJUVANTS AND HERBICIDES. A. Mousavi Nik*,[1] M. Mollaei Kandelous,[2] M. Baghestani,[1] E. Zand,[1] N. Hosseyni Faradonbe,[3] A. Atri[1]; [1]Department of Weed Research, Plant Protection Research Institute, Tehran, Iran, Islamic Republic of, [2]Department of Irrigaation and Reclamation, University of Tehran, Tehran, Iran, Islamic Republic of, [3]Agronomy, Birjand univ. Iran, Birjand, Iran, Islamic Republic of

ABSTRACT

In order to evaluate the efficacy of different adjuvants and herbicides on control of ryegrass, canary grass and wild oat an experiment was conducted in greenhouse at weed research department during 2007. Three different studies in factorial experiment in randomized complete block design with six replications were carried out. Treatments in each trial including four various types of adjuvant (Edigor, Cytotogate, Cytohef and Volk oil) and four herbicides consisting, Pinoxadone(Axial) in five doses (300,400,500,600 and 700 gai/ha), Clodinafop propargyl (Topik) in two doses (dose 0.6, 0.8 gai/ha), Clodinafop propargyl (Behpic) in two doses (dose 0.6, 0.8 gai/ha) and Clodinafop propargyl (Karent) in two doses (dose 0.6, 0.8 gai/ha). Treatments were sprayed at 2-4 leaf stage of weeds and fresh and dry weight, the number of survive plant per pot and EWRC scoring, were measured 30 days after spraying. Statistical analysis showed significant differences between efficiency of herbicides at various adjuvants used. Volk showed the best efficacy on control of ryegrass as adjuvant especially when pinoxadon was used. In contrast, three different kinds of Clodinafop propargyl showed the less efficiency in control of ryegrass in compare to pinoxadon. Edigor and Volk were the best adjuvants in control of cannary grass, but there were not significant difference among various types of Clodinafop propargyl. Wild oat were completely controled by all of herbicide except pinoxadon at 300 gai/ha. It was concluded that pinoxadon and Volk had the best efficacy on control of studied weeds and there were not significant difference among varied types and doses of Clodinafop propargyl. Results also indicated that pinoxadon at 400 gai/ha with adjuvant could control weeds completely.

MEASURING SYNERGISTIC/ANTAGONISTIC EFFECTS OF GLYPHOSATE AND DICAMBA MIXES BY COMMON WEED SPECIES. J.A. Huff*,[1] D.R. Shaw,[1] J.W. Weirich,[1] C.A. Massey,[1] M.B. Wixson[2]; [1]Mississippi State University, Mississippi State, MS, [2]Helm Agro, Memphis, TN

ABSTRACT

Interest and research for herbicide resistant cropping systems has increased dramatically since the introduction of glyphosate-tolerant crops in 1996. New advancements in herbicide resistant cropping systems provide opportunities to help alleviate selection pressure currently applied by glyphosate-only systems. The dicamba-resistant gene is said to be close to the production stage in development. While there is no doubt dicamba-resistant genetics will have a huge impact on production practice, there are still questions that need to be answered about possible interactions with dicamba and glyphosate tank-mixtures. The objective of this research is to determine synergistic/antagonistic effects of glyphosate/dicamba combinations on a number of troublesome weeds. Sicklepod *(Senna obtusifolia* (L.) H.S. Irwin & Barneby*),* hemp sesbania *(Sesbania herbacea* (P. Mill.) McVaugh*),* prickly sida *(Sida spinosa* L.*),* johnsongrass *(Sorghum halepense* (L.) Pers.*),* barnyardgrass *(Echinochloa crus-galli* (L.) Beauv.*), and* broadleaf signalgrass *(Urochloa platyphylla* (Nash) R.D. Webster*)* were chosen to represent problematic Mississippi weed species. Seed for all species was planted in plastic pots that contained a 1:1 v/v mixture of soil/peat. Plants were sprayed at the 4-6 leaf stage with glyphosate, dicamba, and combinations of the two herbicides. Rates were chosen with the goal of achieving 40-70% control in order to determine synergistic/antagonistic responses. Visual ratings were taken out to 21 days, at which point plant fresh weight was determined and converted to percentage reduction based on the untreated check. Interaction between herbicides were determined statistically by methods outlined by Colby.

BLUE WINDSHIELD WIPER FLUID, HIGH OCTANE PERFUME, AND OTHER SUBSTANCES USED AS ADJUVANTS. R.K. Zollinger*; Plant Sciences, North Dakota State University, Fargo, ND

ABSTRACT

Experiments were conducted near Mapleton, ND to evaluate weed efficacy with glyphosate and various adjuvants. Bioassay species of coventional corn, sunflower, tame buckwheat, flax, quinoa, and amaranth were planted perpendicular to each plot length. Glyphosate was applied at 0.28 lb ae/A with adjuvants to large bioassay species. This study was designed to test several products that have been identified as used as adjuvants in North Dakota. Some adjuvants tested have been reported to replace or enhance herbicide activity comparable to AMS. The objectives of this study were to test these adjuvants with glyphosate without and with hard water. The leading practices of overcoming hard water herbicide antagonism involves at least 3 theories. 1. Sequestration - The sulfate from AMS sequester and precipitate antagonistic Ca, Mg, and others salts. Citric acid is another substance thought to sequester ions. 2. Chelation - the EDTA used in micronutrient solutions also is used in adjuvants. 3. pKa - lowering the pH of spray water below the important pKa values of herbicides by which the herbicide is changed to its acid form and is mostly non-reactive with unintentional ions. Adjuvants classified as AMS replacement (Water Conditioners) may have some or none of these properties. R-11 + ammonium sulfate (AMS), Class Act NG, and UltraSurf AMS contain the equivalent of 8.5 lb/100 gal AMS + NIS at labeled rates provided the greatest herbicide enhancement of adjuvants used in this study and were used as the standard to compare the other adjuvants. Helm-Ade (nonionic surfactant) partially enhanced glyphosate without hard water but not in hard water. H2O2 (hydrogen peroxide) at 1 qt/A applied without antagonistic salts in spray water hard water did not perform better than no adjuvant and did not overcome hard water antagonism. Monty's Fertilizer (MF) is labeled as an adjuvant (mostly as an NIS) contains 8-16-8 and is used at 8 and 16 fl oz/100 gallon of water. The adjuvant provided some enhancement to glyphosate without hard water but did not overcome hard water antagonism. Synurgize partially enhanced the activity of glyphosate and did not overcome hard water antagonsim. DRA-10 contains 0.96% polyoxyethylene and 99.04% inactive ingredients. Another description of ingredients was provided as potable water interblended with 1% resins having (OCH2CG)2-nOH structure producing undamaged linear homopolymer chains which carry zero surface charge (nonionic) capability. Without hard water and for most species tested it did not perform better than no adjuvant and did not overcome hard water antagonism. Citron partially overcame hard water antagonism but did not optimize weed control. Merge is an oil based adjuvant used in Canada and is similar to Dash used with Poast herbicide. Merge did not provide the enhancement of NIS as compared to other NIS based adjuvants and did not overcome hard water antagonism. AMADS contains monocarbamide dihydrogen sulfate (urea + sulfuric acid) and is an ingredient in several recently introduced products. AMADS enhanced glyphosate especially in controlling drought stressed weeds. ET-4000 reduces spray solution pH but reportedly contains detoxified sulfuric acid which lessens the risk of human exposure to those mixing and applying. AMADS reduces the spray solution to pH 2 or lower. AMADS and ET-4000 partially overcame hard water antagonism but did not optimize glyphosate activity to the level of AMS + NIS adjuvants. In summary, no adjuvant tested enhanced and optimized the activity of glyphosate nor overcame hard water antagonism to the same level as AMS + NIS adjuvants.

NEW CLASS OF PHOTOPROTECTING AGENTS. B. Eyheraguibel*, A. Ter Halle, G. Ledoigt, C. Richard; Université Blaise Pascal, Aubiere, France

ABSTRACT

Photodegradation is one of a major ways of pesticide dissipation on crop which can considerably reduce the amount of active ingredient, generate a loss of pesticidal activity and the formation of potential toxic photoproducts. To limit the photodegradation of active ingredients a new class of photoprotecting agents (PA) was developed. The capacity of eight natural and environmental friendly compounds to protect herbicides against inactivation by UV radiation was evaluated under simulated sunlight. Irradiation of herbicide sulcotrione at the recommended field rate was carried out with or without protecting compounds on thin cuticular wax films which mimic the leaves surface. Changes in the concentration of sulcotrione were determined using a HPLC-DAD system. Differences between initial concentration (C_0) and the concentration at the time of analysis (C) were assumed to be the amounts of degradation observed in the kinetic experiments. Sulcotrione sorbed onto cuticular wax undergoes fast photolysis reactions. Six from the eight tested compounds limit the degradation of sulcotrione and the formation of photoproducts. The rate of phototransformation can be decrease up to 3.7 time. The natural compounds developed as photoprotecting agents seem to be a promising technique to control photochemical dissipation of pesticides on leaf surfaces, providing a good efficacy and no toxicity.

AIR-PROPELLED ABRASIVES FOR POSTEMERGENCE WEED CONTROL. F. Forcella*; Soils Lab, USDA-ARS, Morris, MN

ABSTRACT

Novel forms of selective weed control are needed by many types of growers, but especially organic growers who are restricted from using synthetic herbicides. Abrasive grit made from corn cobs was expelled from a sand blaster at 517 kPa pressure and aimed at seedlings of common lambsquarters (*Chenopodium album*) and corn (*Zea mays*) positioned 300 mm distant. Most small weed plants were killed by one split-second blast of grit, but corn plants suffered little damage by the same treatment. Air-propelled grit made from agricultural residues possibly could be used for selective non-chemical weed control without the need for soil tillage.

NEODYMIUM MAGNETS IN SPRAY LINES ENHANCE DROPLET ATTACHMENT TO LEGUME FOLIAGE FOR CROP DUSTER APPLICATIONS. C. Ramsey*,[1] R.A. Williams[2]; [1]CPHST Lab, Fort Collins CO, USDA-APHIS, Fort Collins, CO, [2]Forestry, Uni. of Florida, Milton, FL

ABSTRACT

A patented spray system using electromagnetic technology was tested in two aerial application studies in 2007 and 2008 near Atmore, AL. The basic premise of electromagnetic spray technology is that individual droplets receive a magnetic charge (north or south pole) that subsequently attracts the droplets to an opposite charge on live foliage. The objectives of these beta studies were to first develop a removable spray system with this technology, and secondly test the system by quantifying the droplet counts onto water sensitive cards that were placed in the top of a crop canopy. The 2007 plane was a Grumman 164B and the 2008 plane was Air Tractor 400. The planes were modified with static, neodymium magnets that were removable so that the plane could fly runs with and without the magnets. Both planes had similar spraying systems which produced an average droplet size of about 400 microns. The planes were calibrated to spray 28 l/ha (3 GPA). The 2007 study involved two 61 m passes over cotton, with and without the magnetic spray system. The 2008 study was replicated with 61 m runs, including three runs for the magnetic system and three runs for the conventional system over top of soybeans. Both the cotton and soybean rows were planted in a north/south direction with all plane runs flying north/south over equally spaced (30 m) centerline rows. Ten water sensitive cards were placed 4.6 and 9.1 m east and west of each centerline run in 2007. In 2008 eight cards were placed at 4.6 m east and west of each centerline. Wind speed in 2007 ranged from 3.2 - 6.4 km/h (max speed = 10.3 km/h) from northwest to southeast in 2007, and in 2008 the wind was about gusting from 3.2 - 6.4 km/h (max speed = 7.4 km/h) from the east to the west. The 2007 spray droplet counts from the cards show an interaction between the card placement (east or west of spray centerline) and the type of spraying system (magnetic or nonmagnetic). The cards placed on the west side of the spray run (upwind side) received 51 and 28 droplets cm^2 for the magnetic and non-magnetic runs, respectively (p-value = 0.0006). Cards on the east side of the spray run received the same number of droplets (50 and 45 droplets cm^2) for both spraying systems. In 2008 there was no interaction between card placement and type of spraying system thus the data was pooled over the two study variables. The droplet counts were 19.8 and 14.2 droplets cm^2 for the magnetic and non-magnetic spraying systems, respectively (p-value = <0.0001). The 2008 card placement results show that 9.6 and 24.3 droplets cm^2 were deposited on the east and west placed cards, respectively, due to the westward wind direction (p-value = <0.0001). These beta study results are currently being confirmed by spray chamber studies that control most environmental variables, and also control spray volume, height, and speed.

THE EFFECT OF PESTICIDES, ADDITIVES, NOZZLE TIPS AND PRESSURES ON SPRAY PARTICLE SIZES AND DISTRIBUTION. R.N. Klein*,[1] J.A. Golus,[2] K.L. Nelms[2]; [1]Agronomy/Horticulture, University of Nebraska, North Platte, NE, [2]West Central Res/Ext Center, University of Nebraska, North Platte, NE

ABSTRACT

In 1987 the British Crop Protection Council adopted the spray droplet classification primarily to enhance efficacy. They use the term Spray Quality for droplet size categories. In 2000, the American Society of Agricultural Engineers Pest Control and Fertilizer Committee developed ASAE S572, Spray Nozzle Classification by Droplet Spectra, primarily to control spray drift. This standard defines spectrum categories for the classification of spray nozzles, relative to specified reference fan nozzles discharging spray into static air, or so that no stream of air enhances atomization. The droplet spectra produced by single elliptical orifice reference nozzles with specified liquid mixture, flow rates, operating pressures and spray angles, are specified by the standard to establish the threshold of division between nozzle classification categories. Generally the standard is based on spraying water through the reference nozzles and the nozzles to be classified. However, spray solution properties may affect droplet sizes. Most classifications of nozzles have been done with just water. Research has been conducted with a Sympatec Helos KF Analyzer. The systems uses laser diffraction to determine particle size. With the R6 lens, it can determine particle sizes in a range from 0.5 to 1230 microns. The nozzle tips are mounted on a boom with an electric linear actuator which moves the entire spray plume through the laser beam. A study was done to determine the particle size distribution of glyphosate and ammonium sulfate with and without different adjuvants. Spray Systems Extended Range, Turbo TeeJet, Turbo Flood and Air Induction nozzles were used. Both the herbicide and adjuvants affected particle size. Some nozzles are affected more than others, and would result in the nozzle receiving a different droplet spectra classification. Several other pesticides, nozzle tips and additives have been studied and the results will be reported.

THE INFLUENCE OF SPRAY COMPONENTS AND NOZZLE TYPE ON SPRAY DISTRIBUTION AND COVERAGE. G.K. Dahl*, J.V. Gednalske, E. Spandl; Winfield Solutions LLC, shoreview, MN

ABSTRACT

The influence of herbicide, formulation, adjuvant system, nozzle type and size can greatly affect the size and distribution of spray droplets. Comparisons were made between an XR 11004 extended range flat fan nozzle, an AI 11004 air induction nozzle and an AIXR 11004 air induction extended range nozzle. Mixtures sprayed through each of the nozzles included water alone, an adjuvant system that simulated the spray droplet size distribution of fully loaded K-salt glyphosate herbicides, the simulated glyphosate adjuvant system along with a modified vegetable oil deposition aid and drift control adjuvant and the simulated glyphosate adjuvant system with a guar type spray thickener drift control adjuvant. All treatments were applied at 10 gpa. The XR flat fan and the AIXR nozzles were sprayed at 30 psi and the AI nozzle was sprayed at 50 psi. Each spray mixture by nozzle comparison was conducted with no wind present and then again with a 7.5 to 8 mph wind. A high speed photograph was taken of each spray mixture, nozzle type and wind combination. The camera used was a Hasselblad 553 medium format camera with a Leaf 65 digital back. The lens used was a Zeiss Sonnar 120 mm. Shots were taken at f 8.5 at 1/500 second shutter speed. The pictures were backlit with a Prism SPOT strobe using a 500 nanosecond flash. The high speed photography provided excellent detail of the spray droplets in the spray patterns. The XR flat fan pattern contained smaller droplets than the patterns for the AI or AIXR nozzles. The simulated glyphosate adjuvant system contained many more very small droplets than water or the other mixtures and this was most evident with the XR flat fan nozzle. Both mixtures with deposition and drift reduction had fewer fines than the simulated glyphosate adjuvant alone mixture when using the XR flat fan nozzle. The mixture with modified vegetable oil deposition and drift control had fewer fines than the simulated glyphosate adjuvant alone when sprayed through the AI and AIXR nozzles. The guar type spray thickener drift control adjuvant greatly decreased the spray angle demonstrating why it should not be used with AI or AIXR nozzles.

ALTERNATIVE RICE STAND ESTABLISHMENT SYSTEMS TO MANAGE HERBICIDE RESISTANT WEEDS. A.J. Fischer*,[1] B. Linquist,[1] M. Moechnig,[2] R. Mutters,[3] J.E. Hill,[1] C. Greer,[4] L. Espino,[5] M. Milan,[6] J.W. Eckert[1]; [1]Plant Sciences Department, University of California, Davis, CA, [2]Plant Science Department, South Dakota State University, Brookings, SD, [3]Cooperative Extension, University of California, Oroville, CA, [4]Plant Sciences Department, University of California, Yuba City, CA, [5]Cooperative Extension, University of California, Colusa, CA, [6]Agroselviter, University Of Turin, Grugliasco, Italy

ABSTRACT

A four-year field study on five alternative rice stand establishment techniques was conducted in the Northern Sacramento Valley of California. The following systems have been evaluated since 2004: 1) conventional water-seed rice, 2) conventional drill-seeding, 3) water-seeding after spring tillage and a stale seedbed, 4) water-seeding after a stale seedbed without spring tillage, and 5) drill-seeding after a stale seedbed without spring tillage. These systems have demonstrated their potential for manipulating the kinds of weed species that emerge with rice. There were drastic differences in weed recruitment among systems, thus aquatic sedge and broadleaf weeds dominated the water-seeded systems, while the aerobic seedbeds of the drill-seeded systems favored early watergrass and barnyardgrass (*Echinochloa* spp.) and sprangletop (*Leptochloa fascicularis*). The stale seedbed technique (promotion of weed emergence with irrigation flushes, followed by pre-plant burn-down application of glyphosate) was extremely useful in depleting weed populations from the upper soil layer and diminishing weed emergence with the crop. If this technique was followed by no or limited soil disturbance prior to seeding rice, very little weed control was needed thereafter. In 2008, (fifth year), treatments were changed in plots from this experiment. Plots where rice had been conventionally water seeded for four years were heavily infested with aquatic weeds, these almost disappeared when rice was no-till drilled following a stale seedbed in 2008. Plots with heavy barnyardgrass and sprangletop infestations after 4 years of drill seeding rice were switched in 2008 to water seeding after a stale seedbed without any spring tillage; weeds were almost eliminated from these plots. All this was achieved only using glyphosate (stale-seedbed treatment), other herbicides could still be applied for 100% weed control and to prevent seed set by late emerging weeds. Alternating rice establishment systems from aerobic (dry seeding) to anaerobic (water seeding) regimes (and vice versa), combined with the pre-plant use of a total non-selective herbicide for which resistance does not yet exist in weeds of rice allowed for a major reduction of herbicide resistant weed infestations and to lower herbicide use. Yields were never different across treatments.

WEED SHIFTS AFTER FOUR YEARS OF VARIOUS WEED MANAGEMENT SYSTEMS IN NO-TILL CROPS. V.M. Davis*, G.R. Kruger, W.G. Johnson; Botany and Plant Pathology, Purdue University, West Lafayette, IN

ABSTRACT

Winter annual weeds such as common chickweed, purple deadnettle, smallflower buttercup, cressleaf groundsel, and annual bluegrass are common weeds in no-till cropping systems in the Eastern cornbelt. As densities of winter annual weed species increase in no-till fields over time, they can interfere with planting. Several researchers have demonstrated fall application of herbicides can eliminate winter annual weeds from fields in the spring prior to planting. The objective of this study was to evaluate the influence of crop rotation; winter wheat cover crops, residual non-glyphosate herbicides, and burndown application timing on weed diversity and density over multiple crop years. A field study was conducted from 2003 to 2007 in a no-till field located in southeastern Indiana where winter annual weeds are a common occurrence. The experiment was a split-plot design with crop rotation (soybean-corn or soybean-soybean) as main plots and management systems as subplots. Management systems were evaluated by quantifying in-field plant density in the fall following crop harvest, and seedbank density. Generally, fall-applied preplant herbicide applications reduced seedbank and in-field densities of all winter annual species. However, weed diversity and densities of different weed species responded to management practices uniquely. For instance, common chickweed was not influenced by crop rotation, fall versus spring preplant application timings, or winter wheat cover crop systems. Purple deadnettle, annual bluegrass, and smallflower buttercup densities were lower in systems using fall verses spring preplant application timings. Moreover, broadleaf winter annual weed densities were higher in systems that used in-crop glyphosate while annual bluegrass densities were lower in those systems. No-till crop producers likely need to rotate a variety of weed management strategies to minimize the likelihood densities of any one weed species increases to uncontrollable levels.

THE OKANOLA PROJECT: A NEW APPROACH TO WEED MANAGEMENT IN WHEAT. T.F. Peeper*, M.C. Boyles; Plant and Soil Sciences, Oklahoma State University, Stillwater, OK

ABSTRACT

Winter wheat, Oklahoma's principal crop, is often grown annually without rotation for generations. As moldboard plowing decreased after 1960, winter annual grasses weeds flourished. In 1976 Oklahoma St. Univ. created a new position for a weed scientist dedicated to wheat. Twenty five years and 45 graduate students later the list of herbicides for wheat was greatly expanded. Herbicide use was followed by weed shifts. Crop rotation was obviously needed for weed management and a winter crop would fit Oklahoma's continental climate best. Oklahoma was not alone in its need for an alternative winter crop. In 1991, Kansas St. Univ. began breeding winter canola. In 1999 they released a cultivar suitable for Oklahoma. By 2002, private breeders had glyphosate tolerant winter canola. Our field research indicated that winter canola was now a potentially profitable rotational crop for wheat growers that could improve weed management and facilitate adoption of notill. The "Okanola Project" was conceived as a broad based effort to educate wheat growers on winter canola production. Obstacles to introducing a totally new crop arose. Wheat seeding equipment often had difficulty metering canola seed. A more firm seedbed was needed. Potential insect and plant diseases were unknown. Insects, particularly aphids were major problems. Seed treatment insecticides have alleviated fall aphid problems. Aster yellows has been the only disease problem to date. Two issues unrelated to growing the crop emerged, i.e. residues of sulfonylurea herbicides used in wheat and market access. Grower education and tolerant cultivars mitigated residue problems. Harvest of winter wheat and winter canola coincide and occur rapidly as custom harvest crews move across the state. Distance to delivery points at harvest was a serious constraint to winter canola production. Most canola grown the first years moved to a North Dakota mill, reducing profits. In 2008, Producers Cooperative Oil Mill (PCOM) modified their mill in Oklahoma City to also crush canola and sunflower seed. The presence of this local market encouraged local grain elevators to accept canola. Financial risk to growers has been alleviated by the USDA-Risk Management Agency's introduction of crop insurance for winter canola in Oklahoma, Texas, and most of Kansas. Also, PCOM's "Act of God" contracts with growers guarantee a price for production from a specified acreage, rather than specified quantities. Acreage expansion is expected.

WEED MANAGEMENT TACTICS IN ORGANIC NO-TILL SOYBEANS. A.N. Smith*, S.C. Reberg-Horton, J.P. Mueller; Crop Science, North Carolina State University, Raleigh, NC

ABSTRACT

Demand for organic animal feeds is increasing rapidly in North Carolina. An estimated 9,534,000 kg (350,000 bushels) of organic soybeans were utilized in the state in 2007. North Carolina soybean farmers making the transition to organic production cite weed management as their biggest challenge. Currently, weed management for organic soybeans (*Glycine max*.) relies primarily on cultivation. The implementation of an organic no-till system provides possible economic and environmental benefits, from sale price premiums to soil erosion control, carbon retention, and organic matter buildup. Experiments were conducted at Goldsboro, Kinston and Plymouth, North Carolina in 2008. A rye (*Secale cereal*) cover crop ('Rymin') was planted in late fall and rolled/crimped or flail-mowed prior to planting to create a weed suppressing mulch with potential allelopathic properties. To augment weed control, one pre-emergence and two post-emergence weed management tactics were evaluated. The pre-emergence tactic employed granulated corn gluten meal as a banded application for in-row weed control. The two post-emergence tactics consisted of either clove oil as a directed under-canopy herbicide for in-row control or a high-residue cultivator for between-row control. Rolled rye resulted in pigweed (*Amaranthus retroflexus L*.) cover of 3% vs. 13% in flail-mowed rye. Corn gluten meal increased weed coverage at most locations and reduced yield by 208 kg ha^{-1} on average across locations. Compared with conventionally treated check plots, the rolled rye system resulted in equivalent soybean yields at Goldsboro and Plymouth where biomass was 10854 kg ha^{-1} and 9526 kg ha^{-1}, respectively. Additionally, rolled rye in combination with clove oil resulted in slightly higher soybean yields than conventional check plots at both sites. In Kinston, a low rye biomass of 6606 kg ha^{-1} was insufficient for adequate weed control and soybeans from rolled rye plots yielded 853 kg ha^{-1} less than those from conventional plots.

AN HERBICIDE SUSCEPTIBLE *LOLIUM RIGIDUM* POPULATION CAN BE MADE EVEN MORE HERBICIDE SUSCEPTIBLE. S. Manalil Velayudhan*, R. Busi, S.B. Powles; Western Australian Herbicide Resistance Initiative, University of Western Australia, Perth-WA, Australia

ABSTRACT

In other work we have established that in a herbicide-susceptible population of ryegrass (*Lolium rigidum*), minor genes for resistance to the Accase herbicide diclofop-methyl can be selected and enriched by a few cycles of recurrent selection at a sub-lethal diclofop-methyl rate resulting in a significant level of resistance. It is not known, at what frequency those minor resistance genes are and what their specific contribution towards resistance is (e.g. additive or multiplicative effect). Simulation modeling, with a set of parameters established, may help in evaluating the number of genes involved in the selected resistance trait, the initial gene frequencies and their relative contribution to the observed resistance level. However, to have an accurate estimation of genetic parameters involved, it is important to know what the real (lowest) herbicide sensitivity baseline. Here, we studied whether we could shift the population in the opposite direction by selecting for greater susceptibility to herbicides. *L. rigidum* plants were cloned (divided into two identical portions) at the six-leaf stage. One series of cloned plants was treated with a very low diclofop-methyl dose (94 g ha^{-1}). The untreated clone of an individual observed to be highly herbicide-susceptible was selected and bulk-crossed to obtain the selected seed progeny. Two consecutive cycles of selection towards greater herbicide susceptibility were conducted. Dose-response studies were conducted comparing the selected lines with the original population VLR1. A significant increase in herbicide susceptibility was observed (selected : unselected LD_{50} ratio = 0.5). The cross resistance profiling of the twice-selected line, compared to the original line VLR1, revealed not only that the selected population was more susceptible to diclofop-methyl but that there was a concomitant increased susceptibility to two other ACCase herbicides (haloxyfop and sethoxydim) and to the different mode of action ALS herbicide chlorsulfuron. The results indicated that minor genes for resistance were present in a herbicide-susceptible ryegrass population. These minor gene traits may be removed from a susceptible population of ryegrass further increasing the level of susceptibility over the unselected line. Importantly, increased susceptibility was also observed to other ACCase herbicides and a different mode of action suggesting the possibility of herbicide metabolism mediated by these unspecified minor gene traits. This was expected and it is consistent with the cross-resistance pattern exhibited by the highly resistant population selected at low doses of diclofop-methyl. The information obtained in this study may greatly contribute to understand the dynamics and the genetic base involved in resistance evolution subsequent to low dose herbicide selection.

WINTER WHEAT TOLERANCE TO BROADCAST FLAMING. S. Knezevic, S. Ulloa*, J. Ferrari-Neto, A. Datta; UNL, Concord, NE

ABSTRACT

Propane flaming could be included as an additional tool for weed control program in organic wheat productions. However, the crop tolerance to broadcast flaming must be determined first. Therefore, field experiment was conducted at the Haskell Agricultural Laboratory, Concord, NE in 2008 to determine winter wheat response to six propane rates applied at three growth stages of the crop, including: shoot elongation (SE), first node (FN), and boot stage (BS), which corresponded to the 4.0, 6.0, and 10.1 stages according to the *Feeks* scale of wheat growth and development. The propane rates included: 0, 12, 31, 49, 68, and 87 kg/ha (0, 2.5, 6.5, 10.5, 14.4, and 18.4 gal/acre). Flaming treatments were applied utilizing an ATV mounted flamer moving at a constant speed of 6.5 km/h (4 m/h). The response of wheat to propane flaming was evaluated in terms of visual injury at 7, 14, and 28 DAT, effects on yield components (spikes/m^2, seeds/spike, and 100-seed weight) and grain yield. Crop responses were described by log-logistic model. Overall response of wheat to propane flaming varied among growth stages and propane rates. In general, all three growth stages were sensitive to flaming and presented similar visual damage at 28 DAT. In particular, SE had the least yield loss and the least affected yield components compared to BS, which was the most susceptible stage to flaming resulting in highest yield loss, and largest loss of all yield components. Yield reduction is main concern with broadcasts flaming. Preliminary curve analysis suggested that arbitrarily acceptable yield reduction of about 5% (eg. threshold level) was achieved with the propane rate of about 5 kg/ha, regardless of the flaming stage. Based on our previous studies, propane rate of 60 kg/ha was needed for control most weed species, however such propane rate caused unacceptable yield losses of 25%, 32%, and 43% in this study for SE, FN, and BS, respectively. Therefore, due to unacceptable yield losses, we do not recommend the use of broadcast flaming in wheat at the above tested growth stages. sknezevic2@unl.edu

RESPONSE TO SELECTION WITH SUB-LETHAL GLYPHOSATE DOSES IN *LOLIUM* VS. *AVENA* POPULATIONS. R. Busi*, S.B. Powles; University of Western Australia, Perth, Australia

ABSTRACT

The rate of resistance evolution in weed populations subjected to recurrent selection at sub-lethal doses relies on additive genetic variation for resistance, the frequency of such minor gene traits endowing herbicide resistance and the capacity of surviving plants to respond to selection (i.e. incremental accumulation towards polygenic resistance). In general, self-pollinated plant species, compared to cross-pollinated species, have higher inter-population genetic diversity, higher level of homozygosity, but lower intra-population diversity (fewer genotypes). Rigid ryegrass (*Lolium rigidum* Gaud.) is an obligate cross-pollinated species while wild oat (*Avena fatua* L.) is mainly self-pollinated. Both are damaging grass weed species in many agricultural systems. Rigid ryegrass is highly genetically variable and we have shown that ryegrass is particularly responsive to recurrent selection at sub-lethal herbicide rates. In three generations of selection a susceptible biotype of rigid ryegrass (VLR1) evolved high level of resistance to diclofop-methyl or moderate level of glyphosate resistance. Likely, existing minor resistance gene traits for each specific herbicide could be additively enriched through cross-pollination among surviving plants. Conversely, in a self-pollinated species this may not occur or be a much slower evolutionary process. Here, we subjected a herbicide-susceptible population of *Avena* to recurrent selection at sub-lethal glyphosate rates for two consecutive generations to understand the contribution of the reproductive system towards the evolution of herbicide resistance. Selection was also conducted on five different populations collected in different agronomic regions from the Western Australian wheatbelt and the selected seed progeny analyzed. After two cycles of selection no significant difference was observed in survival or plants biomass in the glyphosate-selected versus the unselected population. The five different populations displayed significantly different response to sub-lethal rates of glyphosate in dose-response studies. However, the first glyphosate-selected progeny from each population showed no response to selection. No consistent increase in survival and/or plant biomass was evident in the selected progenies compared to the unselected parents. The results obtained in *Avena* are consistent with that observed in self-pollinated mouse ear cress (*Arabidopsis thaliana* L.) in which, seven cycles of recurrent glyphosate selection caused no shift in glyphosate resistance. Therefore, we conclude that cross-pollination is a significant factor in herbicide resistance evolution from recurrent selection at sub-lethal herbicide doses. Cross-pollination enables the progressive accumulation of minor genes while self-pollination limits response to sub-lethal dose selection. Full herbicide rates should be used by farmers. Herbicide rate cutting should be avoided especially where major cross-pollinated weed species are present in the cropping system (e.g. rigid ryegrass in Australia).

WEED FLAMING: AN ENGINEERING APPROACH. S. Knezevic*,[1] C. Bruening,[2] G. Gogos,[2] Z. Zhang,,[2] S. Ulloa[1]; [1]UNL, Concord, NE, [2]UNL, Lincoln, NE

ABSTRACT

Weed flaming is a thermal weed control technique which has been proven to be very effective in several crops. Propane is the typical fuel source and its combustion in presence of air can produce flame and gas temperatures approaching 2000°C. These high temperatures are behind the principle of weed flaming, which is to boil the water in the plant cells, resulting in cell wall leakage and fatal damage to the targeted weed. From an engineering viewpoint, heat must be carefully controlled to maximize its effectiveness and to guarantee only weeds are being killed during flaming treatment. We have developed an improved heat control method that yielded in a higher quality treatment. Through the use of computational fluid dynamics and experimental measurements, a hood/torch device has been designed and compared to an open flame torch currently on the market. Both temperature measurements and field testing have been conducted in the comparison. Temperature measurements showed that the hood/torch device concentrated the heat of combustion, producing a larger high temperature core than the open torch. This also resulted in a longer exposure time to high temperature gases. Results from field tests showed the hood/torch device has the potential to reduce the propane consumption rate by 30-50% and to provide much greater control of flames in windy field conditions. (sknezevic2@unl.edu).

WEED SURVEY – SOUTHERN STATES

2009

Broadleaf Crops Subsection

(Cotton, Peanut, Soybean, Tobacco, and Forestry)

Theodore M. Webster
Chairman

Information in this report is provided by the following individuals:

Alabama	Mike Patterson	John Everest
Arkansas	Ken Smith Jason Norsworthy Bob Scott Conner Fristoe	Dick Oliver Nilda Burgos John Boyd
Florida	Jay Ferrell Pat Minogue	Barry Brecke
Georgia	A. Stanley Culpepper David Moorhead	Eric P. Prostko J. Michael Moore
Kentucky	J. D. Green	J. R. Martin
Louisiana	Bill Williams Donnie Miller Jim Griffin	Daniel Stephenson Dearl Sanders
Missouri	Kevin Bradley	
North Carolina	Alan York Loren Fisher	David Jordan
Oklahoma	Don Murray	
South Carolina	Mike Marshall	
Virginia	Scott Hagood	Charles Johnson

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton.

Ranking	States		
	Alabama	**Arkansas**	**Florida**
Ten Most Common Weeds			
1	crabgrass spp.	Palmer amaranth	Florida pusley
2	morningglory spp.	barnyardgrass	nutsedge spp.
3	prickly sida	morningglory spp.	Southern crabgrass
4	sicklepod	crabgrass spp.	morningglory spp.
5	pigweed spp.	prickly sida	sicklepod
6	nutsedge spp.	horseweed	volunteer peanut
7	Florida pusley	broadleaf signalgrass	Florida beggarweed
8	spurge spp.	nutsedge spp.	crowfootgrass
9	goosegrass	velvetleaf	sida spp.
10	Horseweed	spurge spp.	common cocklebur
Ten Most Troublesome Weeds			
1	pigweed spp.	Palmer amaranth	Benghal dayflower*
2	horseweed	morningglory spp.	morningglory spp.
3	morningglory spp.	nutsedge spp.	volunteer peanut
4	nutsedge spp.	horseweed	Palmer amaranth
5	tropic croton	velvetleaf	Florida pusley
6	spurge spp.	barnyardgrass	nutsedge spp.
7	Florida pusley	fall panicum	bermudagrass
8	smartweed spp.	crabgrass spp.	Texas millet**
9	bermudagrass	broadleaf signalgrass	smallflower morningglory
10	hophornbeam copperleaf	prickly sida	coffee senna

*Benghal dayflower was previously known as tropical spiderwort.
**Texas millet was previously known as Texas panicum

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton (continued).

Ranking	States		
	Georgia	**Louisiana**	**Missouri**
Ten Most Common Weeds			
1	Palmer amaranth	henbit	crabgrass spp.
2	Texas millet**	cutleaf evening-primrose	pigweed spp.
3	smallflower morningglory	broadleaf signalgrass	morningglory spp.
4	*Ipomoea* morningglory spp.	browntop millet	common cocklebur
5	Florida pusley	pigweed spp.	goosegrass
6	crabgrass spp.	morningglory spp.	prickly sida
7	Florida beggarweed	barnyardgrass	velvetleaf
8	nutsedge spp.	nutsedge spp.	spurge spp.
9	sicklepod	johnsongrass	johnsongrass
10	bristly starbur	prickly sida	spurred anoda
Ten Most Troublesome Weeds			
1	glyphosate+ALS-resistant Palmer amaranth	browntop millet	Palmer amaranth
2	glyphosate-resistant Palmer amaranth	henbit	morningglory spp.
3	Benghal dayflower*	morningglory spp.	common cocklebur
4	Palmer amaranth	common waterhemp	velvetleaf
5	*Ipomoea* morningglory spp.	Palmer amaranth	prickly sida
6	Florida pusley	Texas millet**	johnsongrass
7	nutsedge spp.	redvine	spurge spp.
8	spreading/Asiatic dayflower	yellow nutsedge	perennial vines
9	smallflower morningglory	ryegrass	bermudagrass
10	Texas millet**	prickly sida	goosegrass

*Benghal dayflower was previously known as tropical spiderwort.
**Texas millet was previously known as Texas panicum

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton (continued).

Ranking	States		
	North Carolina	**Oklahoma**	**South Carolina**
Ten Most Common Weeds			
1	pigweed spp.	pigweed spp.	Palmer amaranth
2	large crabgrass	morningglory spp.	morningglory spp.
3	broadleaf signalgrass	red sprangletop	large crabgrass
4	morningglory spp.	large crabgrass	Texas millet**
5	goosegrass	Texas millet**	sicklepod
6	common lambsquarters	silverleaf nightshade	goosegrass
7	common ragweed	johnsongrass	nutsedge spp.
8	prickly sida	common cocklebur	prickly sida
9	sicklepod	yellow nutsedge	broadleaf signalgrass
10	smartweed spp.	devil's claw	Florida pusley
Ten Most Troublesome Weeds			
1	Palmer amaranth	morningglory spp.	Palmer amaranth
2	morningglory spp.	silverleaf nightshade	morningglory spp.
3	dayflower spp.	pigweed spp.	nutsedge spp.
4	goosegrass	red sprangletop	Texas millet**
5	common ragweed	yellow nutsedge	sicklepod
6	nutsedge spp.	common cocklebur	Florida pusley
7	horseweed	devil's claw	bermudagrass
8	Florida pusley	field bindweed	spurred anoda
9	sicklepod	johnsongrass	goosegrass
10	smartweed spp.	Texas millet**	broadleaf signalgrass

**Texas millet was previously known as Texas panicum

Table 1. The Southern States 10 Most Common and Troublesome Weeds in Cotton (continued).

Ranking	State **Virginia**
Ten Most Common Weeds	
1	Pigweed spp.
2	morningglory spp.
3	common cocklebur
4	large crabgrass
5	common lambsquarters
6	broadleaf signalgrass
7	yellow nutsedge
8	bermudagrass
9	common ragweed
10	jimsonweed
Ten Most Troublesome Weeds	
1	bermudagrass
2	pigweed spp.
3	Palmer amaranth
4	sicklepod
5	common ragweed
6	alligatorweed
7	purple nutsedge
8	Texas millet
9	mustard spp.
10	eastern black nightshade

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Peanut.

	States		
Ranking	**Alabama**	**Florida**	**Georgia**
Ten Most Common Weeds			
1	Florida beggarweed	nutsedge spp.	Palmer amaranth
2	nutsedge spp.	sicklepod	Florida beggarweed
3	morningglory spp.	Florida pusley	Texas millet**
4	Florida pusley	Florida beggarweed	sicklepod
5	sicklepod	morningglory spp.	Florida pusley
6	crabgrass spp.	bristly starbur	nutsedge spp.
7	prickly sida	Palmer amaranth	morningglory spp.
8	Texas millet**	crabgrass spp.	bristly starbur
9	bristly starbur	crowfootgrass	crabgrass spp.
10	Palmer amaranth	hairy indigo	tropic croton
Ten Most Troublesome Weeds			
1	Florida beggarweed	ALS-resistant Palmer amaranth	Palmer amaranth
2	nutsedge spp.	Benghal dayflower*	Florida pusley
3	Palmer amaranth	cowpea	Benghal dayflower*
4	Benghal dayflower*	hairy indigo	Florida beggarweed
5	groundcherry spp.	groundcherry spp.	nutsedge spp.
6	horsenettle	tropic croton	tropic croton
7	tropic croton	Texas millet**	sicklepod
8	wild poinsettia	Florida beggarweed	Texas millet**
9	maypop passionflower	morningglory spp.	morningglory spp.
10	prickly sida	bristly starbur	common bermudagrass

*Benghal dayflower was previously known as tropical spiderwort.
**Texas millet was previously known as Texas panicum

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Peanut (continued).

	States		
Ranking	**North Carolina**	**Oklahoma**	**South Carolina**
Ten Most Common Weeds			
1	large crabgrass	pigweed spp.	Palmer amaranth
2	broadleaf signalgrass	crownbeard	sicklepod
3	nutsedge spp.	prickly sida	morningglory spp.
4	morningglory spp.	eclipta	large crabgrass
5	prickly sida	yellow nutsedge	Texas millet**
6	goosegrass	morningglory spp.	goosegrass
7	common ragweed	johnsongrass	Florida pusley
8	common lambsquarters	large crabgrass	nutsedge spp.
9	common cocklebur	Texas millet**	tropic croton
10	pigweed spp.	spurge spp.	Florida beggarweed
Ten Most Troublesome Weeds			
1	common ragweed	yellow nutsedge	Palmer amaranth
2	eclipta	eclipta	sicklepod
3	pigweed spp.	ALS-resistant Palmer amaranth	Florida pusley
4	common lambsquarters	hophornbeam copperleaf	morningglory spp.
5	nutsedge spp.	horsenettle	nutsedge spp.
6	prickly sida	pigweed spp.	Texas millet**
7	Carolina horsenettle	crownbeard	Florida beggarweed
8	bermudagrass	spurge spp.	tropic croton
9	Texas millet**	silverleaf nightshade	goosegrass
10	Florida beggarweed	Texas millet**	bermudagrass

**Texas millet was previously known as Texas panicum

Table 2. The Southern States 10 Most Common and Troublesome Weeds in Peanut (continued).

Ranking	State **Virginia**
Ten Most Common Weeds	
1	Pigweed spp.
2	morningglory spp.
3	common cocklebur
4	large crabgrass
5	common lambsquarters
6	broadleaf signalgrass
7	yellow nutsedge
8	bermudagrass
9	common ragweed
10	jimsonweed
Ten Most Troublesome Weeds	
1	bermudagrass
2	pigweed spp.
3	Palmer amaranth
4	sicklepod
5	common ragweed
6	alligatorweed
7	purple nutsedge
8	Texas millet**
9	mustard spp.
10	eastern black nightshade

**Texas millet was previously known as Texas panicum.

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean.

	States		
Ranking	**Alabama**	**Arkansas**	**Florida**
Ten Most Common Weeds			
1	sicklepod	barnyardgrass	nutsedge spp.
2	pigweed spp.	broadleaf signalgrass	sicklepod
3	morningglory spp.	Palmer amaranth	Florida pusley
4	crabgrass spp.	morningglory spp.	Florida beggarweed
5	prickly sida	prickly sida	morningglory spp.
6	nutsedge spp.	crabgrass spp.	bristly starbur
7	Florida pusley	nutsedge spp.	Palmer amaranth
8	common ragweed	horseweed	crabgrass spp.
9	common cocklebur	ragweed spp.	crowfootgrass
10	groundcherry spp.	hemp sesbania	common cocklebur
Ten Most Troublesome Weeds			
1	sicklepod	Palmer amaranth	Benghal dayflower*
2	morningglory spp.	morningglory spp.	cowpea
3	groundcherry spp.	horseweed	hairy indigo
4	tropic croton	nutsedge spp.	groundcherry spp.
5	horsenettle	prickly sida	tropic croton
6	pigweed spp.	hemp sesbania	Texas millet**
7	Florida pusley	giant ragweed	Florida beggarweed
8	bermudagrass	barnyardgrass	morningglory spp.
9	horseweed	red rice	bristly starbur
10	carpetweed	broadleaf signalgrass	sicklepod

*Benghal dayflower was previously known as tropical spiderwort.
**Texas millet was previously known as Texas panicum.

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean (continued).

	States		
Ranking	**Georgia**	**Kentucky**	**Louisiana**
Ten Most Common Weeds			
1	Palmer amaranth	horseweed	henbit
2	sicklepod	smooth pigweed	cutleaf evening-primrose
3	crabgrass spp.	johnsongrass	broadleaf signalgrass
4	morningglory spp.	common ragweed	browntop millet
5	Texas millet**	prickly sida	pigweed spp.
6	common cocklebur	morningglory spp.	morningglory spp.
7	nutsedge spp.	common lambsquarters	barnyardgrass
8	Florida beggarweed	large crabgrass	nutsedge spp.
9	Florida pusley	honeyvine swallowwort***	johnsongrass
10	common ragweed	eastern black nightshade	prickly sida
Ten Most Troublesome Weeds			
1	Palmer amaranth	horseweed	browntop millet
2	sicklepod	honeyvine swallowwort***	henbit
3	morningglory spp.	trumpetcreeper	morningglory spp.
4	nutsedge spp.	common pokeweed	common waterhemp
5	Florida pusely	burcucumber	Palmer amaranth
6	Benghal dayflower*	eastern black nightshade	Texas millet**
7	Texas millet**	morningglory spp.	redvine
8	common cocklebur	giant ragweed	yellow nutsedge
9	Florida beggarweed	dandelion	ryegrass
10	roundup ready cotton	yellow nutsedge	prickly sida

*Benghal dayflower was previously known as tropical spiderwort.
**Texas millet was previously known as Texas panicum.
***honeyvine swallowwort was previously known as honeyvine milkweed

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean (continued).

	States		
Ranking	**Missouri**	**North Carolina**	**Oklahoma**
Ten Most Common Weeds			
1	waterhemp spp.	pigweed spp.	pigweed spp.
2	giant foxtail	large crabgrass	morningglory spp.
3	common cocklebur	broadleaf signalgrass	common cocklebur
4	morningglory spp.	morningglory spp.	large crabgrass
5	crabgrass spp.	goosegrass	johnsongrass
6	common ragweed	common ragweed	common lambsquarters
7	velvetleaf	common lambsquarters	velvetleaf
8	prickly sida	prickly sida	prickly sida
9	giant ragweed	sicklepod	Texas millet**
10	common sunflower	smartweed spp.	hemp sesbania
Ten Most Troublesome Weeds			
1	waterhemp spp.	Palmer amaranth	morningglory spp.
2	morningglory spp.	morningglory spp.	pigweed spp.
3	giant ragweed	dayflower spp.	common cocklebur
4	johnsongrass	eastern black nightshade	velvetleaf
5	common ragweed	Florida pusley	spurge spp.
6	common cocklebur	common lambsquarters	hemp sesbania
7	prickly sida	common ragweed	prickly sida
8	eastern black nightshade	sicklepod	johsnongrass
9	Palmer amaranth	common cocklebur	yellow nutsedge
10	Asiatic dayflower	horseweed	Texas millet**

**Texas millet was previously known as Texas panicum.

Table 3. The Southern States 10 Most Common and Troublesome Weeds in Soybean (continued).

	States	
Ranking	**South Carolina**	**Virginia**
Ten Most Common Weeds		
1	Palmer amaranth	pigweed spp.
2	sicklepod	common lambsquarters
3	morningglory spp.	morningglory spp.
4	goosegrass	common ragweed
5	Texas millet**	large crabgrass
6	Large crabgrass	common cocklebur
7	nutsedge spp.	prickly sida
8	Florida beggarweed	jimsonweed
9	Florida pusley	foxtail spp.
10	tropic croton	velvetleaf
Ten Most Troublesome Weeds		
1	Palmer amaranth	morningglory spp.
2	morningglory spp.	common lambsquarters
3	nutsedge spp.	cutleaf evening-primrose
4	Florida pusley	Palmer amaranth
5	Texas millet**	horseweed
6	common ragweed	bermudagrass
7	Florida beggarweed	yellow nutsedge
8	goosegrass	trumpetcreeper
9	coffee senna	johnsongrass
10	bermudagrass	broadleaf signalgrass

Table 4. The Southern States 10 Most Common and Troublesome Weeds in Tobacco.

	States		
Ranking	**Florida**	**Georgia**	**Kentucky**
Ten Most Common Weeds			
1	crabgrass spp.	crabgrass spp.	smooth pigweed
2	Florida pusley	Florida pusley	foxtail spp.
3	nutsedge spp.	morningglory spp.	large crabgrass
4	sicklepod	nutsedge spp.	morningglory spp.
5	Florida beggarweed	pigweed spp.	common lambsquarters
6	bermudagrass	common lambsquarters	johnsongrass
7	morningglory spp.	Florida beggarweed	Carolina horsenettle
8	bristly starbur	bermudagrass	common ragweed
9	Texas millet**	bristly starbur	hairy galinsoga
10	pigweed spp.	sicklepod	yellow nutsedge
Ten Most Troublesome Weeds			
1	nutsedge spp.	nutsedge spp.	honeyvine swallowwort***
2	bermudagrass	morningglory spp.	hairy galinsoga
3	morningglory spp.	bermudagrass	Carolina horsenettle
4	Benghal dayflower*	Benghal dayflower*	yellow nutsedge
5	sicklepod	pigweed spp.	morningglory spp.
6	Florida beggarweed	Florida beggarweed	johnonsgrass
7	bristly starbur	bristly starbur	smooth pigweed
8	pigweed spp.	common cocklebur	common lambsquarters
9	hairy indigo	sicklepod	common ragweed
10	wild poinsettia	Florida pusley	smooth groundcherry

*Benghal dayflower was previously known as tropical spiderwort.
**Texas millet was previously known as Texas panicum.
***honeyvine swallowwort was previously known as honeyvine milkweed.

Table 4. The Southern States 10 Most Common and Troublesome Weeds in Tobacco (continued).

	States		
Ranking	**North Carolina**	**South Carolina**	**Virginia**
Ten Most Common Weeds			
1	nutsedge spp.	Palmer amaranth	large crabgrass
2	large crabgrass	large crabgrass	nutsedge spp.
3	pigweed spp.	morningglory spp.	morningglory spp.
4	sicklepod	nutsedge spp.	common ragweed
5	broadleaf signalgrass	Texas millet**	horsenettle
6	common ragweed	broadleaf signalgrass	sicklepod
7	common lambsquarters	sicklepod	goosegrass
8	morningglory spp.	Florida pusley	bermudagrass
9	goosegrass	tropic croton	pigweed spp.
10	bermudagrass	bristly starbur	johnsongrass
Ten Most Troublesome Weeds			
1	morningglory spp.	Palmer amaranth	nutsedge spp.
2	pigweed spp.	morningglory spp.	morningglory spp.
3	nutsedge spp.	nutsedge spp.	large crabgrass
4	large crabgrass	Florida pusley	common ragweed
5	sicklepod	sicklepod	horsenettle
6	common ragweed	Texas millet**	pigweed spp.
7	common cocklebur	bristly starbur	johnsongrass
8	Carolina horsenettle	coffee senna	sicklepod
9	common lambsquarters	tropic croton	broadleaf signalgrass
10	broadleaf signalgrass	bermudagrass	common lambsquarters

**Texas millet was previously known as Texas panicum.

Table 5. The Southern States 10 Most Common and Troublesome Weeds in Forestry.

	States		
Ranking	**Arkansas**	**Florida**	**Georgia**[1]
Ten Most Common Weeds			
1	panicum spp.	dogfennel	bermudagrass
2	bahiagrass	gallberry	*Rubus* spp.
3	bermudagrass	saw palmetto	fescue spp.
4	broomsedge	common ragweed	dogfennel
5	goatweed	broomsedge	horseweed
6	horseweed	Chinese tallow	sicklepod
7	kudzu	cogongrass	eastern baccharis
8	ragweed spp.	Chinese privet	Texas millet**
9	goldenrod spp.	water oak	camphorweed
10	morningglory spp.	Japanese climbing fern	tropic croton
Ten Most Troublesome Weeds			
1	panicum spp.	cogongrass	bermudagrass
2	bahiagrass	saw palmetto	*Rubus* spp.
3	kudzu	bamboo	fescue spp.
4	morningglory spp.	Chinese privet	dogfennel
5	Japanese climbing fern	Japanese climbing fern	horseweed
6	*Rubus* spp.	broomsedge	sicklepod
7	broomsedge	Chinese tallow	eastern baccharis
8	goatweed	dogfennel	Texas millet**
9	horseweed	blackberry spp.	camphorweed
10	ragweed spp.	titi	tropic croton

[1] Establishment phase for non-cutover sites.

Table 5. The Southern States 10 Most Common and Troublesome Weeds in Forestry (continued).

	States	
Ranking	**Georgia**[2]	**Louisiana**
Ten Most Common Weeds		
1	sweetgum	*Rubus* spp.
2	*Quercus* spp.	Chinese privet
3	*Acer* spp.	johnsongrass
4	gallberry	horseweed
5	wax myrtle	dogfennel
6	saw palmetto	giant ragweed
7	*Nyssa* spp.	sweetgum
8	privet	red oak
9	*Carya* spp.	blackgum
10	kudzu	hickory
Ten Most Troublesome Weeds		
1	sweetgum	sweetgum
2	*Quercus* spp.	red oak
3	*Acer* spp.	winged elm
4	gallberry	Chinese tallow
5	wax myrtle	broomsedge
6	saw palmetto	hickory
7	*Nyssa* spp.	red maple
8	privet	boxelder
9	*Carya* spp.	*Rubus* spp.
10	kudzu	giant ragweed

[2] Site prep and woody release sites.

STATE WEED PUBLICATIONS

State: ALABAMA

Prepared by: Mike Patterson

Internet URL: http://www.aces.edu/pubs/

Source: Bulletin Room, Alabama Cooperative Extension System, #6 Duncan Hall, Auburn University, Auburn, AL 36849

Number	Title
CIRCULARS	
ANR-48	Weed Control in Lake and Ponds
ANR-65	Kudzu: History, Uses, & Control
ANR-104	Controlling Smutgrass in Alabama Pastures
ANR-322	Weed Control in Home Gardens
ANR-453	Christmas Tree IPM
ANR-465	Weed Control for Commercial Nurseries
ANR-616	Weeds of Southern Turfgrasses ($15.00)
ANR-715	Cotton Defoliation
ANR-811	Conservation Tillage for Corn in Alabama
ANR 854	Weed Control in Residential Landscape Plantings
ANR-908	Moss and Algae control in Lawns
ANR-909	Tropical Soda Apple in Alabama
ANR-951	Weed Control Around Poultry Houses and Other Farm Building
ANR-975	Poisonous Plants of the Southern United States ($4.00)
ANR-1058	Brush Control
ANR-1128	Weed Identification for Horticulture Crops
ANR-1241	Wanted Dead Not Alive: Cogongrass
INFORMATION SHEETS	
2004IPM-2	Commercial Vegetable IPM
2004IPM-8	Peach IPM
2004IPM-11	Apple IPM
2004IPM-22	Weed Control in Commercial Turfgrass
2004IPM-27	Pecan IPM
2004IPM-28	Forage Crops IPM
2004IPM-223	Noncropland IPM
2004IPM-360	Peanut IPM
2004IPM-413	Soybean IPM
2004IPM-415	Cotton IPM
2004IPM-428	Corn IPM
2004IPM-429	Grain Sorghum IPM
2004IPM-453	Christmas Tree IPM
2004IPM-458	Small Grain IPM
2004IPM-478	Small Fruit IPM
2004IPM-590	Chemical Weed Control for Home Lawns
2004IPM-978	Alfalfa IPM

State: ARKANSAS

Prepared by: Bob Scott, John Boyd, and Ken Smith

Internet URL: http://pubs4sale.uaex.edu/

Order from: Dr. Bob Scott, Box 391, 2301 South University, University of Arkansas Cooperative Extension, Little Rock, AR 72204
[1]Bernadette Hinkle, Box 391, Little Rock, AR 72203

Number	Title
PUBLICATIONS	
FSA 2149	Ryegrass Identification Keys
FSA 2152	Prevention and Control of Glyphosate Resistant Pigweed in Roundup Ready Soybean and Cotton (color)
FSA 2155	Sod Farm Weed Control (color)
FSA 3054	Musk Thistle (color)
FSA 6123	Nursery Series: Weed Control in Container Nurseries
FSA 6124	Woody Plant Control in Landscapes
FSA 6127	Nursery Series: Weed Control in Field Nurseries
FSA 6137	Weed Control in Landscape Plantings
MP-44	Recommended Chemicals for Weed and Brush Control in Arkansas
MP-1691	Weeds of Arkansas Lawns, Turf, Roadsides, and Recreation Areas: A Guide to Identification ($5.00)
MP-370	Turfgrass Weed Control for Professionals
FSA-2080	Pasture Weed and Brush Control
FSA-2109	Home Lawn Weed Control

A weed control chapter is included in each of the following publications:

MP-192	Rice Production Handbook
MP-197	Soybean Production Handbook
MP-214	Corn Production Handbook
-----	Grain Sorghum Production Handbook
-----	Technology for Optimum Production of Soybeans

Information fact sheets for weed problems in commodity groups such as rice, soybean, forage, cotton, etc. are published as necessary. Color posters of weeds in Wheat, Pastures, and Lawns I and II are also available.

State: Florida

Prepared by: Jay Ferrell, Ken Langeland, William Stall, and Brian Unruh

Internet URL: http://edis.ifas.ufl.edu/publications.html

Order from: Extension Weed Specialist, Agronomy Department, 303 Newell Hall, P.O. Box 110500, University of Florida, Gainesville, FL 32611-0500

1 Dr. W. M. Stall, Extension Vegetable Weed Specialist, 1255 Fifield Hall, Univ. of Florida, Gainesville, FL 32611-0690

2 Dr. D. P. H. Tucker, Extension Citrus Management Specialist, IFAS-AREC, 700 Experiment Station Road, Lake Alfred, FL 33850

3 Dr. K. A. Langeland, Extension Aquatic Weed Specialist, Center for Aquatic Plant Research, 7922 NW 71st Street, Gainsville, FL 32606

4 Dr. B. R. Unruh, 1523 Fifield Hall, Gainsville, FL 32611

5 University of Florida Publications, P.O. Box 110011, Gainesville, FL 32611-0011

Number	Title
SS-AGR-001	Weed Control in Tobacco
SS-AGR-002	Weed Control in Corn
SS-AGR-003	Weed Control in Peanuts
SS-AGR-004	Weed Control in Cotton
SS-AGR-005	Weed Control in Soybeans
SS-AGR-006	Weed Control Sorghum
SS-AGR-007	Weed Control in Small Grains Harvested for Grain
SS-AGR-008	Weed Control in Pastures and Rangeland
SS-AGR-009	Weed Control in Sugarcane
SS-AGR-010	Weed Control in Rice
SS-AGR-012	Florida Organo-Auxin Herbicide Rule
SS-AGR-014	Herbicide Prepackage Mixtures
SS-AGR-015	Diagnosing Herbicide Injury
SS-AGR-016	Approximate Herbicide Pricing
SS-AGR-17	Brazilian Pepper-Tree Control
SS-AGR-22	Identification and Control of Bahiagrass Varieties in Florida
SS-AGR-50	Tropical Soda Apple in Florida
SS-AGR-52	Cogongrass (Imperata cylindrica) Biology, Ecology and Control in Florida
SS-AGR-80	NATURAL AREA WEEDS: Skunkvine (Paederia foetida)
SS-AGR-100	Principles of Weed Management
SS-AGR-101	Applications Equipment and Techniques
SS-AGR-102	Calibration of Herbicide Applicators
SS-AGR-108	Using Herbicides Safely and Herbicide Toxicity
SS-AGR-109	Adjuvants
SS-AGR-164	Natural Area Weeds: Air Potato (*Dioscorea bulbifera*)
SS-AGR-165	Natural Area Weeds: Carrotwood (*Cupaniopsis anacardioides*)
SS-AGR-21	Natural Area Weeds: Old World Climbing Fern (*Lygodium microphyllum*)
SS-ORH-0044	2003 University of Florida's Pest Control Recommendations for Turfgrass Managers
AGR-72	Labeled Aquatic Sites for Specific Herbicides
AGR-79	Florida Department of Environmental Protection Aquatic Plant Management Permits

A-87-63	Application Procedure for Use of Grass Carp for Control of Aquatic Weeds
A-87-73	Biology and Chemical Control of Algae
A-87-103	Biology and Chemical Control of Duckweed
A-87-113	Chemical Control of Hydrilla
A-87-123	Florida DNA Aquatic Plant Control Permit Program
ENH-84	Weed Control Guide for Florida Lawns
ENH-88	Activated Charcoal for Pesticide Deactivation
ENH-90	Pesticide Calibration Formulas and Information
ENH-94	Metric System Conversion Factors
ENH-100	Response of Turfgrass and Turfgrass Weeds to Herbicides
ENH-124	Pest Control Guide for Turfgrass Managers
FS WRS-7	Tropical Soda Apple: A New Noxious Weed in Florida
HS-88	Weed Management in Apples
HS-89	Weed Management in Blackberries
HS-90	Weed Management in Blueberries
HS-91	Weed Management in Grapes
HS-92	Weed Management in Nectarines
HS-93	Weed Management in Peaches
HS-94	Weed Management in Pears
HS-95	Weed Management in Pecans
HS-96	Weed Management in Plums
HS-97	Susceptibility of Weeds to Herbicides
HS-107	2001 Florida Citrus Pest Management Guide
HS-1881	Weed Management in Commercial Citrus
HS-1891	Weed Control in Cold or Brassica Leafy Vegetables
HS-1901	Weed Control in Cucurbit Crops
HS-1911	Weed Control in Eggplant
HS-1921	Weed Control in Okra
HS-1931	Weed Control in Bulb Crops
HS-1941	Weed Control in Potato
HS-1951	Potato Vine Dessicants
HS-1961	Weed Control in Strawberry
HS-1971	Weed Control in Sweet Corn
HS-1981	Weed Control in Sweet Potato
HS-1991	Weed Control in Pepper
HS-2001	Weed Control in Tomato
HS-2011	Weed Control in Carrots and Parsley
HS-2021	Weed Control in Celery
HS-2031	Weed Control in Lettuce, Endive, and Spinach
HS-7061	Estimated Effectiveness of Recommended Herbicides on Selected Common Weeds in Florida Vegetables

CIRCULAR, BOOKS, AND GUIDES

SS-AGR-20	2009 Weed Management Guide in Agronomic Crops and Non-Crop Areas
2805	Families, Mode of Action and Characteristics of Agronomic, Non-Crop and Turf Herbicides
4592	Weed Control Guide for Florida Citrus
676	Weed Control in Centipede and St. Augustinegrass
678	Container Nursery Weed Control
707	Weed Control in Florida Ponds
8524	Weed Control in Sod Productions
1114	Weed Management for Florida Golf Courses
-----5	Florida Weed Control Guide ($8.00)
DH-88-054	Turfgrass Weed Control Guide for Lawn Care Professionals
DH-88-074	Commercial Bermudagrass Weed Control Guide

SM-445	Aquatic and Wetland Plants of Florida ($11.00)
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SP-375	Weeds in Florida ($7.00)
	Florida Weeds Part II ($1.00)
SP-795	Weeds of Southern Turfgrasses ($8.00)
SP-242	Control of Non-native Plants in Natural Areas of Florida

State: GEORGIA

Prepared by: Stanley Culpepper, Tim R. Murphy, and Eric Prostko

Internet URL: http://pubs.caes.uga.edu/caespubs/pubs/html (use for print-on-demand publications
http://www.gaweed.com/ (contains weed science slide presentations, some publications, etc.)
http://www.georgiaturf.com (contains weed science popular articles related to turfgrasses, weed identification, etc.)

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[2]HADSS, c/o AgRenaissance Software LLC, P.O. Box 68007, Raleigh, NC 27613

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Number	Title
LEAFLETS	
263	Renovation of Home Lawns
400	Musk Thistle and Its Control
418	Use of Sterile Grass Carp to Control Aquatic Weeds
425	Florida Betony Control in Turfgrass and Ornamentals
CIRCULARS	
713	Commercial Blueberry Culture
796	Roadside Vegetation Management
823	Controlling Moss and Algae in Turf
855	Wild Poinsettia Identification and Control*
865	Tropic Croton Identification and Control in Cotton and Peanut
EXTENSION BULLETINS	
654	Weed Control in Noncropland
829	Principles and Practices of Weed Control in Cotton
978	Weed Control in Home Lawns
984	Turfgrass Pest Control Recommendations for Professionals
986	Forest Site Preparation Alternatives
996	Commercial Watermelon Production
998	Conservation Tillage Crop Production in Georgia
1004	Herbicide Use in Forestry
1005	Georgia Handbook of Cotton Herbicides
1006	Weed Control in Ponds and Small Lakes
1008	Weed Facts: Texas Panicum
1009	Weed Facts: Morningglory Complex
1010	Weed Facts: Sicklepod and Coffee Senna
1019	Cotton Defoliation and Crop Maturity
1023	Herbicide Incorporation
1032	Forestry on a Budget
1043	Weed Facts: Yellow and Purple Nutsedge
1049	Perennial Weed Identification and Control in Georgia
1069	How to Set Up a Post-Emergence Directed Herbicide Sprayer for Cotton
1070	Forage Weed Management

1072	Weed Facts: Florida Beggarweed
1093	Guide to Field Crop Troubleshooting
1100	Peanut Herbicides for Georgia
1118	Non-Commercial Weed Control Methods
1125	Weed Management in Conservation Tillage Cotton
1135	Intensive Wheat Management in Georgia
1138	Conservation Tillage for Peanut Production
1144	Commercial Production of Vegetable Transplants

SPECIAL BULLETINS

281	Georgia Pest Control Handbook ($15.00)*

MISCELLANEOUS

Pub. 46	2009 Georgia Peach Spray and Production Guide
Pub. 377	2009 Georgia Tobacco Growers Guide
Pub. 380	2009 Cotton Production Package
Hdbk. No. 11	Peach Growers Handbook ($25.00)
1	Pecan Pest Management Handbook ($20.00)
1	Weeds of Southern Turfgrasses ($8.00)
1	Poisonous Plants of the Southeastern United States ($4.00)
7611	Weeds of the Southern United States ($3.00)
8391	Identification and Control of Weeds in Southern Ponds ($3.00)*
-----2	Georgia HADSS ($95)

State: KENTUCKY

Prepared by: J.D. Green

Internet URL: http://www.ca.uky.edu/agc/pubs/pubs.htm

Order from: Dr. J.D. Green, Extension Weed Control Specialist, Plant and Soil Sciences Department, 413 Plant Science Building, University of Kentucky, Lexington, KY 40546-0312

Dr. James R. Martin, Extension Weed Control Specialist, University of Kentucky Research and Education center, P. O. Box 469, Princeton, KY 42445

Number	Title
AGR-6	Chemical Control of Weeds in Kentucky Farm Crops
AGR-12	Weeds of Kentucky Turf
AGR-78	Weed Control Recommendations for Kentucky Bluegrass and Tall Fescue Lawns and Recreational Turf
AGR-139	Herbicide Persistence and Carryover in Kentucky
AGR-140	Herbicides with Potential to Carryover and Injure Rotational Crops in Kentucky
AGR-148	Weed Control Strategies for Alfalfa and Other Forage Legume Crops
AGR-172	Weed Management in Grass Pastures, Hayfields, and Fencerows
ID-2	Some Plants of Kentucky Poisonous to Livestock
ID-36	Commercial Vegetable Crop Recommendations
ID-125	A Comprehensive Guide to Wheat Management in Kentucky ($10.00)
ID-139	Comprehensive Guide to Corn Management in Kentucky ($10.00)

State: LOUISIANA

Prepared by: Dearl Sanders

Internet URL: http://www.lsuagcenter.com/nav/publications/pubs.asp

Order from: LSU AgCenter Communications, Publications Office, P.O. Box 25100, Baton Rouge, LA 70894

Number	Title
PUBLICATIONS	
1565	Louisiana's Suggested Chemical Weed Control Guide for 2004 ($4.00)
1618	Prescribed Burning in Louisiana Pinelands ($1.00)
2314	Controlling Weeds in Sugarcane ($0.50)
2398	Aquatic Weed Management Herbicides ($0.50)
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2500	Herbicide Application for the Small Landowner ($0.50)
2740	Control Weeds in Soybeans with Pre and Postemergence Chemicals in 2004 ($1.00)
2746	2009 Controlling Weeds in Cotton ($1.00)
2778	Nonchemical Weed Control for Home Landscapes ($0.50)
2820	Louisiana Sugarcane Burning ($1.00)
8909	Conservation Tillage Systems for Energy Reduction – Preplant Weed Control in Cotton ($0.50)
RIS 105	Guidelines for Managing Winter Vegetation in Northeast Louisiana

State: MISSISSIPPI

Prepared by: John D. Byrd, Jr.

Internet URL: http://www.msucares.com/pubs/index.html

Order from: Dr. John Byrd, Plant & Soil Sciences, Box 9555, Mississippi State, MS 39762-9555
Dr. Andy Londo, Forestry Department, Box 9681, Mississippi State, MS 39762-9632
Mr. Herb Willcutt, Agric. & Bio. Engineering, Box 9632, Mississippi State, MS 39762-9632
Dr. Nathan Buehring, Delta Research & Extension Center, P.O. Box 68, Stoneville, MS 38776
HADSS, c/o AgRenaissance Software LLC, P.O. Box 68007, Raleigh, NC 27613

Number	Title
INFORMATION SHEETS	
6731	Control of Fish Diseases and Aquatic Weeds
803	Grain and Forage Sorghum Weed Control
875	Cotton Postemergence and Layby Herbicides
945	Forages Weed Control in Pastures
962	Soybean Preplant Foliar and Preplant Incorporated
963	Soybean Preemergence Weed Control
1024	Soybean- Management Strategies for Sicklepod
1025	Aquatic Weed Identification and Control—Bushy Pondweed and Coontail
1026	Aquatic Weed Identification and Control—Willows and Arrowhead
1027	Aquatic Weed Identification and Control—Cattail and Spikerush
1028	Aquatic Weed Identification and Control—Pondweed and Bladderwort
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1030	Aquatic Weed Identification and Control—Frogbit and Watershield
1031	Aquatic Weed Identification and Control—Burreed and Bulrush
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1619	Cotton Preplant and Preemergence Weed Control
-----	Tropical Soda Apple in Mississippi
-----	Tropical Soda Apple in the United States
-----	Management Strategies for Tropical Soda Apple in Mississippi
PUBLICATIONS	
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553	Weed Science for 4-H'ers
10053	Christmas Tree Production in Mississippi
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1100	Soybeans Postemergence Weed Control
12175	Rice Weed Control

12773	Forest Management Alternatives for Private Landowners
1322	Establish and Manage Your Home Lawn
1344	Weed Control in Small Grain Crops
1532	2009 Weed Control Guidelines for Mississippi ($7.00)
1664	Disease, Insect and Weed Control Guide for Commercial Peach Orchards
1744	Weed Control in Home Lawns
1907	Herbicide Resistance Prevention and Detection
1934	Weed Response to Selected Herbicides
1962	Pesticides – Benefits and Risks
2036	Organic Vegetable IPM Guide
2166	Poisonous Plants of the Southeastern United States

TECHNICAL NOTES

MTN-SG3	Weed Control in Christmas Tree Plantations
MTN-7F3	An Overview of Herbicide Alternatives for the Private Forest Landowner
MTN-8F3	Tree Injection: Equipment, Methods, Effective Herbicides, Productivity, and Costs
MTN-11F3	Effective Kudzu Control

COMPUTER SOFTWARE

-----6	Mississippi HADSS ($95.00)

State: MISSOURI

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MP171	Missouri Pest Management Guide: Corn, Soybean, Wheat
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MP686	Using Reduced Herbicide Rates for Weed Control in Soybeans ($1.00)
G4251	Cotton Weed Control ($0.75)
G4851	Waterhemp Management Practices and Alternatives in Missouri ($0.75)
G4872	Johnsongrass Control
G4875	Control of Perennial Broadleaf Weeds in Missouri Field Crops ($0.75)
NCR614	Early Spring Weeds of No-Till Production

State: NORTH CAROLINA

Prepared by: Joe Neal, David Ritchie, and Fred Yelverton

Internet URL: http://ipm.ncsu.edu/ncpmip
http://www.turffiles.ncsu.edu/AllPublications.aspx

Order from: Dr. Fred Yelverton, Department, Box 7620, North Carolina State University, Raleigh, NC 27695-7620

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HADSS, c/o AgRenaissance Software LLC, P.O. Box 68007, Raleigh, NC 27613

Number	Title
PUBLICATIONS	
AG-1	2009 North Carolina Agricultural Chemicals Manual ($24.00)
AG-187	2009 Flue-Cured Tobacco Guide
AG-208	Identifying Seedling and Mature Weeds in Southeastern United States ($7.00)
AG-331	2009 Peanut Information
AG-348	Turfgrass Pest Management Manual: A Guide to Major Turfgrass Pests and Turfgrasses ($12.00)
AG-367	Tall Fescue Lawn Maintenance Calendar
AG-371	Agricultural Chemicals for North Carolina Apples
AG-376	2009 Burley Tobacco Guide
AG-381	Centipedegrass Lawn Maintenance Calendar
AG-408	2009 Pest Control for Professional Turfgrass Managers
AG-417	2009 Cotton Information
AG-429	Bermudagrass Athletic Field Maintenance Calendar
AG-430	Tall Fescue and Kentucky Bluegrass Athletic Field Maintenance Calendar
AG-431	Bermudagrass Lawn Maintenance Calendar
AG-432	Zoysiagrass Lawn Maintenance Calendar
AG-437	Weed Management in Small Ponds
AG-438	Weed Control in Irrigation Water Supplies
AG-442	Using Activated Charcoal to Inactivate Agricultural Chemical Spills
AG-449	Hydrilla, A Rapidly Spreading Aquatic Weed in North Carolina
AG-456	Using Grass Carp for Aquatic Weed Management
AG-540	St. Augustinegrass Lawn Maintenance Calendar
AG-541	Carpetgrass Lawn Maintenance Calendar
AG-562	Organic Lawn Care: A Guide to Lawn Maintenance and Pest Management for North Carolina
AG-580	Small Grain Production Guide
AG-594	North Carolina Corn Production Guide
AG-1461	Peach and Nectarine Spray Schedule
AG-5722	Integrated Orchard Management Guide for Commercial Apples in the Southeast

B-414	Stock-Poisoning Plants of North Carolina ($5.00)
-----3	Southern Peach, Nectarine, and Plum Pest Management and Cultural Guide

INFORMATION LEAFLETS (http://www.ces.ncsu.edu/depts/hort/hil/index.html)

HIL205B1	Weed Control Options for Strawberries on Plastic
HIL3251	Peach Orchard Weed Management
HIL380	Orchard Floor Management in Pecans
HIL449	Weed Management in Conifer Seedbeds and Transplant Beds
HIL570	Greenhouse Weed Management
HIL644	Weed Management in Annual Color Beds
HIL647	Controlling Yellow Nutsedge in Landscape Plantings
HIL648	Postemergence, Nonselective Herbicides for Landscapes and Nurseries
HIL81011	Weed Control in Vegetable Gardens
HIL900	Musk Thistle
HIL901	Canada Thistle
HIL902	Mugwort
HIL903	Mulberry Weed
HIL904	Florida Betony
4	North Carolina HADSS ($95)

State: OKLAHOMA

Prepared by:

Internet URL: http://agweb.okstate.edu/pearl/

Videotapes: Agricultural Communications, Room 111, Public Information Building, Oklahoma State University, Stillwater, OK 74078

Publications: Central Mailing Services, Publishing and Printing, Oklahoma State University, Stillwater, OK 78078

Number	Title
CIRCULAR	
E-832	OSU Extension Agent's Handbook of Insect, Plant Disease, and Weed Control
E-943	Alfalfa Harvest Management Discussions with Cost-Benefit Analysis
E-948	Aerial pesticide Drift Management
E-949	Alfalfa Stand Establishment Questions and Answers
B-812	Hogpotato: Its Biology, Competition, and Control
F-2089	Alfalfa Stand Establishment
F-2586	Wheat for Pasture
F-2587	Bermudagrass for Grazing or Hay
F-2850	Eastern Redcedar and Its Control
F-2868	Eastern Redcedar Ecology and Management
F-2873	Ecology and Management of Western Ragweed on Rangeland
F-2874	Ecology and Management of Sericea Lespedeza
F-2776	Thistles in Oklahoma and Their Identification
F-2869	Management Strategies for Rangeland and Introduced Pastures
F-2875	Intensive Early Stocking
F-7318	Integrated Control of Musk Thistle in Oklahoma
FS-2774	Cheat Control in Winter Wheat
FS-9998	Clearfield Wheat Production Systems in Oklahoma

State: SOUTH CAROLINA

Prepared by: Bert McCarty

Internet URL: http://www.clemson.edu/public/

Order from: Dr. E.C. Murdock, Pee Dee Res. & Ext. Center, 2200 Pocket Road, Florence, SC 29501-9706

Bulletin Room, Room 82, Poole Agricultural Center, Clemson University, Clemson, SC 29634-0311

Number	Title
CIRCULAR	
463	Small Grain Production Guidelines for South Carolina
569	South Carolina Tobacco Grower's Guide
588	Peanut Production Guide for South Carolina
669	Canola Production in South Carolina
697	Turf Herbicide Families and Their Characteristics
698	Designing and Maintaining Bermudagrass Sports Fields in the United States
699	2004 Pest Control Recommendations for Professional Turfgrass Managers
702	Sod Production in the Southern United States
707	Southern Lawns
-----1	2009 Pest Management Handbook ($25.00)
BULLETINS	
150	Weeds of Southern Turfgrasses
LEAFLETS	
Forage No. 6	Weed Control in Bermudagrass
Forage No. 9	Weed Control in Tall Fescue
Forage No. 17	Weed Management in Perennial Pastures and Hay Fields

State: TENNESSEE

Prepared by: Neil Rhodes and Larry Steckel

Internet URL: http://www.utextension.utk.edu/weedcontrol/weedcontrol.html

Order from: Extension Mailing Room, P.O. Box 1071, University of Tennessee, Knoxville, TN 37901

Number	Title
PUBLICATIONS	
956	Managing Lawn Weeds: A Guide for Tennessee Homeowners
1197	Commercial Fruit Spray Schedules
1226	Weed Management in Ornamental Nursery Crops
1282	Commercial Vegetable Disease, Insect and Weed Control
1521	Hay Crop and Pasture Weed Management
1538	Chemical Vegetation Management on Noncropland
1539	Weed Management Recommendations for Professional Turfgrass Managers
1580	2009 Weed Control Manual for Tennessee Field Crops
1659	Weed Management in Annuals, Perennials and Herbaceous Ground Covers: Nursery Production and Professional Grounds Maintenance

State: TEXAS

Prepared by: Dr. Paul A. Baumann

Internet URL: http://tcebookstore.org/

Order from: Dr. Paul A. Baumann, Extension Weed Specialist, 349 Soil & Crop Sciences, Texas A&M University, College Station, TX 77843-2474

Number	Title
B-1466	Chemical Weed and Bush Control – Suggestions for Rangeland
B-5038	Suggestions for Weed Control in Pastures and Forage Crops
B-5039	Suggestions for Weed Control in Cotton
B-5042	Suggestions for Weed Control in Corn
B-5045	Suggestions for Weed Control in Sorghum
B-6010	Suggestions for Weed Control in Peanuts
B-6139	Weed Control Recommendations in Wheat
L-1708	Wild Oat Control in Texas
L-2254	Common Weeds in Corn and Grain Sorghum
L-2301	Common Weeds in Cotton
L-2302	Common Weeds in West Texas Cotton
L-2339	Field Bindweed Control in the Texas High Plains
L-2436	Silverleaf Nightshade Control in Cotton in West Texas
L-5102	Perennial Weed Control During Fallow Periods in the Texas High Plains
B-6081	Herbicides: How They Work and The Symptoms They Cause
B-6079S	Como identificar malezas: Las estruccturas de la planta son la clave
B-6079	Weed Identification: Using Plant Structures as a Key
L-5205	Reducing Herbicides in Surface Waters- Best Management Practices
L-5204	Some Facts About Atrazina
L-5324	Protecting the Environment- Using Integrated Weed Management in Lawns

State: VIRGINIA

Prepared by: Scott Hagood and Shawn Askew

Internet URL: gopher://ext.vt.edu:70/11/vce-data

Order from: Virginia Polytechnic Institute and State University, Extension Distribution Center, Landsdowne St., Blacksburg, VA 24061

Number	Title
PUBLICATIONS	
456-016	Pest Management Guide for Field Crops
456-017	Pest Management Guide for Horticultural and Forest Crops
456-018	Pest Management Guide for Home Grounds and Animals

HERBICIDE NAMES AND MANUFACTURERS

Common or Code Name	Trade Name	Manufacturer
A		
acetochlor	Harness	Monsanto
	Surpass	Dow AgroSciences
acifluorfen	Ultra Blazer	BASF
acifluorfen + bentazon	Conclude Xact	BASF
alachlor	Micro-Tech	Monsanto
ametryn	Evik	Syngenta
amicarbazone		Bayer
aminopyralid	Milestone	Dow AgroSciences
asulam	Asulox	Bayer
atrazine	AAtrex / others	Syngenta / others
Atrazine + s-metolachlor + glyphosate	Expert	Syngenta
azafenidin		DuPont Ag Products
B		
BAS 625H	Aura	BASF
BAS 654		BASF
BAY FOE5043	Axiom	Bayer
benefin	Balan	Dow AgroSciences
bensulfuron	Londax	DuPont Ag Products
bentazon	Basagran	BASF, Micro Flo
bispyribac-sodium	Regiment, Velocity	Valent USA
bromacil	Hyvar X	DuPont Ag Products
bromoxynil	Buctril, Bronate	Bayer Crop Science
butroxydim	Falcon	
C		
carfentrazone	Aim, Shark	FMC
CGA-362622	Envoke, Monument	Syngenta
chlorimuron	Classic	DuPont Ag Products
Chlorimuron + metribuzin	Canopy XL	DuPont Ag Products
chlorimuron + sulfentrazone	Canopy Extra	DuPont Ag Products
chlorimuron + thifensulfuron	Synchrony	DuPont Ag Products
chlorsulfuron	Glean, Telar	DuPont Ag Products
chlorsulfuron + metsulfuron	Finesse	DuPont Ag Products
clethodium	Select, Envoy, Prism	Valent USA
clomazone	Command	FMC
clopyralid	Lontrel	Dow AgroSciences
	Stinger	

cloransulam	FirstRate	Dow AgroSciences
	Amplify	Monsanto
cyhalofop	Clincher	Dow AgroSciences

D

2,4-D	Several	Several
2,4-D + MCPP + dicamba	Trimec Classic	PBI Gordon
2,4-DB	Butoxone	Bayer Crop Science
	Butyrac	
DCPA	Dacthal	Amvac
dicamba	Banvel	Micro Flo
	Clarity Vanquish	BASF
		Syngenta
dicamba + diflufenzopyr	Distinct, Overdrive	BASF
dicamba + diflufenzopyr + nicosulfuron	Celebrity Plus	BASF
dicamba + 2,4-D	Weedmaster	BASF
dichlobenil	Casoron	Uniroyal
dichlorprop (2,4-DP)	Several	Bayer Crop Science
diclofop	Hoelon	Bayer Crop Science
diclosulam	Strongarm	Dow AgroSciences
dimethenamid	Frontier	BASF
dimethenamid-P	Outlook	BASF
diquat	Reglone, Reward	Syngenta
dithiopyr	Dimension	Rohm & Haas
diuron	Karmex	Griffin
	Direx	Griffin

E

endothall	Endothal	Pennwalt
ethalfluralin	Sonalan, Curbit	Dow AgroSciences
ethofumesate	Prograss	Bayer Crop Science

F

fenoxaprop	Puma, Ricestar, Whip	Bayer Crop Science
Flazasulfuon	Katana	ISK Bioscience
fluazifop-P	Fusilade DX	Syngenta
fluazifop + fenoxaprop	Fusion	Syngenta
flufenacet	Define	Bayer
flufenacet + metribuzin + atrazine	Axiom, Domain	Bayer Crop Science
flumetsulam	Python	Dow AgroSciences
flumetsulam + clorpyralid	Hornet	Dow AgroSciences

flumetsulam + clopyralid +2,4-D	Scorpion III	Dow AgroSciences
flumetsulam + metolachlor	Broadstrike SF + Dual	Dow AgroSciences
flumiclorac	Resource	Valent USA
flumioxazin	Valor	Valent USA
fluometuron	Cotoran,	Griffin
	Meturon	Griffin
Fluoroxypyr	Vista	Dow AgroSciences
Fluroxypyr + aminopyralid	Cleanweave	Dow AgroSciences
fluthiacet methyl	Action	Syngenta
	Appeal	KI USA
Fomesafen	Reflex	Syngenta
Fomesafen + metolachlor	Prefix	Syngenta
foramsulfuron + iodosulfuron		
	Equip	Bayer
fosamine	Krenite	DuPont Ag Products

G

glufosinate	Liberty	Bayer Crop Science
	Rely	Bayer Crop Science
	Ignite	Bayer Crop Science
glyphosate	Many	many

H

halosulfuron	Permit, Sempra	Monsanto
hexazinone	Velpar	DuPont Ag Products

I

imazamethabenz	Assert	BASF
imazamox	Beyond, Raptor	BASF
imazapic	Cadre, Plateau	BASF
imazapyr	Arsenal,	BASF
	Chopper,	BASF
	Stalker, Habitat	BASF
imazaquin	Scepter	BASF
	Image	BASF
imazethapyr	Pursuit	BASF
	NewPath	BASF
imazethapyr + imazapyr	Lightning	BASF
	Event	
isoxaben	Gallery	Dow AgroSciences
isoxaflutole	Balance	Bayer Crop Science

J-L

KIH-485		Kumiai
lactofen	Cobra	Valent USA

M

MON 3539		Monsanto
MCPA	Several	Several

mecoprop	Several	Several
mesosulfuron	Osprey	Bayer
mesotrione	Callisto, Tenacity	Syngenta
mesotrione + metolachlor	Camix	Syngenta
mesotrione + metolachlor + atrazine	Lumax	Syngenta
mesotrione + glyphosate	Halex GT	Syngenta
metham	Vapam	Amvac
methyl bromide	Bromo-gas	Great Lakes
metolachlor	Dual Magnum	Syngenta
	Pennant	Syngenta
metolachlor + atrazine	Bicep	Syngenta
metribuzin	Sencor	Bayer Crop Science
metribuzin + metolachlor	Turbo	Bayer Crop Science
metribuzin + trifluralin	Salute	Bayer Crop Science
metsulfuron	Ally, Escort	DuPont Ag Products
molinate	Ordram	Syngenta
MSMA	Several	Several

N

napropamide	Devrinol	Syngenta
nicosulfuron	Accent	DuPont Ag Products
nicosulfuron + rimsulfuron + atrazine	Basis Gold	DuPont Ag Products
nicosulfuron + rimsulfuron	Steadfast	DuPont Ag Products
norflurazon	Zorial, Solicam, Evital	Syngenta Syngenta

O

oryzalin	Surflan	Dow AgroSciences
oxadiazon	Ronstar	Bayer Crop Science
oxadiazon + prodiamine	Regalstar	Regal Chemical Company
oxasulfuron		Syngenta
oxyfluorfen	Goal	Dow
oxyfluorfen + oryzalin	Rout	The Scotts Company
oxyfluorfen + oxadiazon	Regal	Regal Chemical Company
oxyfluorfen + pendimethalin	Ornamental Herbicide II	The Scotts Company

P

paraquat	Gramoxone Max, Gramoxone Extra, Gramoxone Inteon, Starfire, Cyclone	Syngenta
pelargonic acid	Scythe	Mycogen

pendimethalin	Prowl,	BASF
	Prowl H2O	BASF
	Pendulum	BASF
	Pentagon	Lesco
	Lesco PRE-M	The Scotts Company
	Corral	
penoxsulam	Grasp, Granite	Dow AgroSciences
picloram	Tordon	Dow AgroSciences
picloram + 2,4-D	Grazon P+D	Dow AgroSciences
picloram + fluoroxypyr	Surmount	Dow AgroSciences
pinoxaden	Axial	Syngenta
primisulfuron	Beacon	Syngenta
primisulforon + dicamba	NorthStar	Syngenta
prodiamine	Barricade, Factor	Syngenta
prohexadione	Apogee	BASF
prometryn	Caparol	Syngenta
	Cotton Pro	Griffin
propanil	Stam, Stampede	Dow
prosulfuron	Peak	Syngenta
prosulfuron + primisulfuron	Exceed	Syngenta
	Spirit	Syngenta
pyridate	Tough	Syngenta
pyrithiobac	Staple	DuPont
pyrithiobac + glyphosate	Staple Plus	DuPont

Q

quinclorac	Facet, Drive	BASF
	Paramount	BASF
quizalofop	Assure II	DuPont

R

rimsulfuron	Titus, Matrix	DuPont
rimsulfuron + thifensulfuron	Basis	DuPont

S

sethoxydim	Poast, Poast Plus, Vantage	BASF
simazine	Princep	Syngenta
sulfentrazone	Authority, Spartan	FMC
sulfentrazone + clomazone	Authority	FMC
	One-Pass	
sulfometuron	Oust	DuPont
sulfosulfuron	Monitor, Maverick, Outrider, Certainity	Monsanto

T-Z

tebuthiuron	Spike	Dow
tembotrione + safener	Laudis	Bayer
terbacil	Sinbar	DuPont
thiafluamide + V-1014270 + metribuzin	Axiom	Bayer

thiazopyr	Dimension Spindle, Visor	Dow
thifensulfuron	Harmony GT	DuPont
thifensulfuron + tribenuron	Harmony Extra	DuPont
topremazone	Impact	AmVac
triasulfuron	Amber	Syngenta
triasulfuron + dicamba	Rave	Syngenta
tribenuron	Express	DuPont
triclopyr	Garlon Grandstand	Dow
triclopyr +clopyralid	Redeem R&P	Dow
trifloxysulfuron	Envoke , Monument	Syngenta
trifluralin	Treflan Trifluralin	Dow Dow /
trinexapac-ethyl	Primo Palisade	Syngenta

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