

Señor

SUPERINTENDENTE DE INDUSTRIA Y COMERCIO

DIVISIÓN DE NUEVAS CREACIONES

E. _____ S. _____

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
Rad 06-119679- -00002-0000
Fec. 2007-03-15 16:39:58 Dep 2020 NUECREACIONES
Tra 11 PATENTEIYI
Evo 379 FASENACIONALI
Act 444 RESPUESTAREQUE Folios 79

Re P1.-VALENT BIOSCIENCES CORPORATION.-Solicitud de Patente de Invención Fase Nacional PCT para "COMPOSICIONES LÍQUIDAS REGULADORAS DEL CRECIMIENTO DE PLANTA ESTABLES Y SOLUBLES EN AGUA Y MÉTODOS PARA USO DE LAS MISMAS".- Clase A01N 25/04.-Expediente numero 06-119.679.-

1 Me refiero al auto dictado por ese Despacho notificado por fijación en lista el 26 de Enero de 2007

2 Atentamente me permito presentar a ese Despacho los documentos que acreditan el traspaso que los autores del invento de la referencia, hacen a favor de mi representado de sus derechos sobre el mismo, debidamente apostillados y junto con su Traducción Oficial No 2006-12-14-845 debidamente legalizada hasta por el Ministerio de Relaciones Exteriores bajo los numeros 502153 de 15 de Diciembre de 2006, 544596, 544597, 544599, 544600 y 544601 todos estos de 18 de Diciembre de 2006

3 Adicionalmente y por medio del presente escrito me permito presentar a usted copia autentica debidamente certificada de la Solicitud de Patente presentada para el invento arriba nombrado **respecto de la cual reclamo prioridad**, a saber, la Solicitud de Patente **Estadounidense** numero **60/574 354** de 24 de Mayo de 2004, junto con su Traducción Oficial No 2007-01-23-037

4 Ruego a usted tomar atenta nota de lo anterior y proceder de conformidad

Señor Superintendente,



ALICIA LLOREDA RICAURTE

**TRADUCCION OFICIAL No 2006-12-14-845
DE UN DOCUMENTO ESCRITO EN INGLÉS**

Traspaso de la invención llamada COMPOSICIONES LIQUIDAS REGULADORAS DEL CRECIMIENTO DE PLANTA ESTABLES Y SOLUBLES EN AGUA Y METODOS PARA USO DE LAS MISMAS, documento escrito en inglés y en español

Estado de Illinois
Secretario de Estado
Springfield, Illinois

APOSTILLA

(Convención de La Haya del 5 de Octubre de 1961)

- 1 País Estados Unidos de América**
Este documento público
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3 actuando como Secretario del Condado, Condado de Lake
4 lleva el sello/estampilla del Estado de Illinois

Certificado

- | | | | |
|---|---|----|--------------------------------|
| 5 | en Chicago, Illinois | 6 | el día 30 de noviembre de 2006 |
| 7 | por el Secretario de Estado, Estado de Illinois | | |
| 8 | No C06TJ26684 | | |
| 9 | Sello/Estampilla | 10 | Firma (ilegible) |
| | Sello del Estado de Illinois | | Jesse White |
| | | | Secretario de Estado |
| | | | Estado de Illinois |

TRANSDUCTORA OFICIAL
(ES. 2177/MS MINJUSTICIA)
DESA
-NITA MCCORDDETAMAYO

MINISTERIO DE RELACIONES
EXTERIORES

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Anta Escobar
COTAFIAMA APARECE EN EL
DOCUMENTO (ESEMPEÑA
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RESPONSABILIDAD DEL TEXTO

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JEFE DE LEGALIZACIONES
SECRETARÍA DE LEGISLACIÓN

Condado de Lake

William Rooks Helander
 Secretario del Condado de Lake

18 North County Street, Room 101
 Waukegan, Illinois 60085-4364
 Teléfono 847 377 2400
 Fax 847 360 3608
[http //www co lake il us/cntyck](http://www.co.lake.il.us/cntyck)

Estado de Illinois)
) ss
 Condado de Lake)

CERTIFICADO DE AUTORIDAD

Yo, William R Helander, Secretario del Condado del Condado de Lake en el
 Estado de Illinois, cuya oficina es una oficina de registro que tiene un sello,
 certifico que

PENNY L PETITCLAIR

por quien el documento anterior o adjunto fue notarizado, fue, el

día 19 de mayo de 2004

nombrada Notario Público en y para el Condado de Lake, Estado de Illinois y es
 válido hasta el

día 19 de mayo de 2008

y que como tal, plena fe y crédito es y se le debe dar a las atestaciones de este
Notario oficial En testimonio de lo cual, he colocado mi firma y el sello de esta
oficina este

día 29 de noviembre de 2006

La certificación no es válida a menos que se le
coloque el sello del Condado de Lake, Illinois

(firma ilegible)
William R. Helander
Secretario del Condado de
Lake

Certificado Notarial, documento escrito en inglés y en español

Sello Oficial PENNY L. PETITCLAIR Notario Público - Estado de Illinois Mi Comisión Expira el 05/19/06
--

**Estado de Illinois
Secretario de Estado
Springfield, Illinois**

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9 Sello/Estampilla 10 Firma (ilegible)
Sello del Estado de Illinois Jesse White

Secretano de Estado
Estado de Illinois

TRADUCTORA OFICIAL
RES. 8177/89 MINJUSTICIA

ANITA ESCOBAR DE TAMAYO

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| 7 | por el Secretario de Estado, Estado de Illinois | | |
| 8 | No C06TJ26682 | | |
| 9 | Sello/Estampilla | 10 | Firma (ilegible) |
| | Sello del Estado de Illinois | | Jesse White |
| | | | Secretario de Estado |
| | | | Estado de Illinois |

TRANSDUCTORA OFICIAL
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NITA ESCOBAR DE TAMAYO

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MINISTERIO DE
RELACIONES EXTERIORES

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NO SE ASUME
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2006 DIC : 8 A 10:31
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BOGOTÁ D.C.

Condado de Lake

**William Rooks Helander
Secretano del Condado de Lake**

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Condado de Lake)**

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- Sello del Estado de Illinois
- 10 Firma (ilegible)
- Jesse White
- Secretario de Estado
- Estado de Illinois

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RES. 2177/89 MINJUSTICIA
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MINISTERIO DE
RELACIONES EXTERIORES

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11

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(firma ilegible)
William R Helander
Secretario del Condado de Lake

Certificado Notarial, documento escrito en inglés y en español

Sello Oficial
PENNY L PETITCLAIR
Notario Público - Estado de Illinois
Mi Comisión Expira el 05/19/06

**Estado de Illinois
Secretario de Estado
Springfield, Illinois**

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- 8 No C06TJ26680
- 9 Sello/Estampilla
- 10 Firma (ilegible)
- Sello del Estado de Illinois
- Jesse White

**Secretario de Estado
Estado de Illinois**

**TRADUCTORA OFICIAL
RES. 2177/99 MINJUECIA
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JULIA ESCOBAR DE TAMAYO**

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MINISTERIO DE
RELACIONES EXTERIORES

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Ana María Escobar
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Condado de Lake

William Rooks Helander
Secretario del Condado de Lake

18 North County Street, Room 101
Waukegan, Illinois 60085-4364
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Estado de Illinois)
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76

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William R Helander

Secretario del Condado de Lake

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PENNY L PETITCLAIR
Notario Publico - Estado de Illinois
Mi Comisión Expira el 05/19/06

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8	No C06TJ26679		
9	Sello/Estampilla	10	Firma (ilegible)
	Sello del Estado de Illinois		Jesse White
			Secretario de Estado
			Estado de Illinois

TRADUCTORA OFICIAL.
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LINTA ESCOBAR DE TAMAYO

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MINISTERIO DE
RELACIONES EXTERIORES

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DOCUMENTO DESEMPENA
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Condado de Lake

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Secretario del Condado de Lake

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**(firma ilegible)
William R Helander
Secretario del Condado de
Lake**

Certificado Notarial, documento escrito en inglés y en español

Sello Oficial PENNY L PETITCLAIR Notario Público - Estado de Illinois Mi Comisión Expira el 05/19/06
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**Estado de Illinois
Secretario de Estado
Springfield, Illinois**

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| 7 por el Secretario de Estado, Estado de Illinois | |
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| 9 Sello/Estampilla | 10 Firma (ilegible) |
| Sello del Estado de Illinois | Jesse White |
| | Secretario de Estado |
| | Estado de Illinois |

TRADUCTORA OFICIAL
RES. 2177/00 MIN. JUSTICIA

ANITA ESCOBAR DE TAMAYO

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2006 DIC 18 A 03 33
JEFES DE LEGALIZACIONES
BOGOTÁ D.C.

MINISTERIO DE
RELACIONES EXTERIORES
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Copia que aparece en el
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Condado de Lake

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82

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(firma ilegible)

William R Helander

Secretario del Condado de Lake

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Sello Oficial
PENNY L PETITCLAIR
Notario Público - Estado de Illinois
Mi Comisión Expira el 05/19/06

Traducido según mi mejor saber y entender, este día 14 de diciembre de 2006, en la ciudad de Bogotá, D C , por Anita Escobar de Tamayo, Traductora Oficial, Res 2177 de 1989, Ministerio de Justicia, República de Colombia

TRADUCTORA OFICIAL
RES. 2177/89 MIN. JUSTICIA

ANITA ESCOBAR DE TAMAYO

ASSIGNMENT

TRASPASO

83

The undersign

Los abajo firmados

1 Yueh WANG, 2 Mark BEACH
3 Bruce KIRKPATRICK, 4 Gregory CLARKE,
5 John LOPEZ, 6 Prem WARRIOR, 7 Bruce BALDI
domiciled in

1 1315 N Salem Blvd , Arlington Hghts, IL
2 972 Tylerton Circle, Grayslake, IL
3 402 Jennifer Lane, Grayslake, IL
4 7 Pheasant View Dr , Dillsburg, PA
5 7239 Buchanan Dr , Gurnee, IL
6 14584 N Somerset, Green Oaks, IL
7 148 W Lincoln, Libertyville, IL

hereby state under oath to be sole and true inventors
of STABLE AND WATER--SOLUBLE PLANT
GROWTH REGULATOR LIQUID COMPOSITIONS
AND METHODS FOR USE OF SAME

State, as well that assign without reservations or
limitation, in favor of

VALENT BIOSCIENCES CORPORATION

A corporation organized and existing under the laws
of

domiciled at

870 Technology Way, Libertyville, IL

all rights inherent to said invention, and that the
above mentioned corporation hereby is enabled to
apply, in its name, for the corresponding patent in the
Republic of Colombia

4 Yueh WANG, 2 Mark BEACH, 3 Bruce
KIRKPATRICK, 4 Gregory CLARKE, 5 John
LOPEZ, 6 Prem WARRIOR, 7 Bruce BALDI

Domiciliado en

4 1315 N Salem Blvd , Arlington Hghts, IL
2 972 Tylerton Circle, Grayslake, IL
3 402 Jennifer Lane, Grayslake, IL
4 7 Pheasant View Dr , Dillsburg PA
5 7239 Buchanan Dr , Gurnee, IL
6 14584 N Somerset, Green Oaks, IL
7 148 W Lincoln, Libertyville, IL

declaramos bajo juramento ser únicos y verdaderos

inventores de
COMPOSICIONES LÍQUIDAS REGULADORAS
DEL CRECIMIENTO DE PLANTA ESTABLES Y
SOLUBLES EN AGUA Y MÉTODOS PARA USO
DE LAS MISMAS

Declaramos así mismo que cedemos y transferimos
sin reserva ni limitación, a favor de

VALENT BIOSCIENCES CORPORATION

Una sociedad organizada y existente de conformidad
con las leyes de
Estado de Illinois, Estados Unidos de América

domiciliada en

870 Technology Way, Libertyville, Illinois
Estados Unidos de América

todos los derechos inherentes a dicha invención y
que la citada sociedad queda facultada para solicitar
en su nombre la patente correspondiente en la
República de Colombia



84

SPRINGFIELD, ILLINOIS
APOSTILLE
APOSTILLE

(Convention de La Haye du 5 Octobre 1961)

1 Country United States of America

This public document

2 has been signed by WILLARD R HELANDER

3 acting in the capacity of COUNTY CLERK, LAKE COUNTY

4 bears the seal/stamp of STATE OF ILLINOIS

Certified

5 Chicago, Illinois

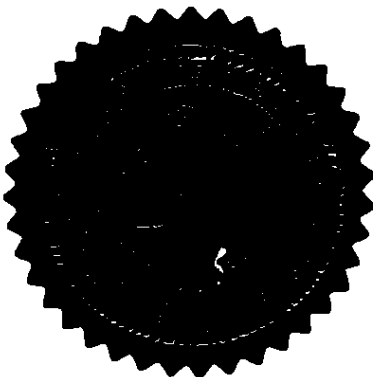
6 NOVEMBER 30, 2006

7 by the Secretary of State, State of Illinois

8 No C06TJ26684

9 Seal/Stamp

10 Signature



Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS

State of Illinois)
) SS
County of Lake)

CERTIFICATE OF AUTHORITY

I, Willard R Helander, County Clerk of Lake County in the State of Illinois, which office is an office of record having a seal, certify that

PENNY L PETITCLAIR

by whom the foregoing or annexed document was notarized, was, on the

19th day of May, 2004

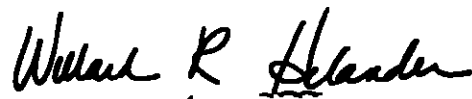
appointed a Notary Public in and for the County of Lake, State of Illinois and is valid until the

19th day of May, 2008

and that as such, full faith and credit is and ought to be given to this Notary's official attestations In testimony whereof I have affixed my signature and the seal of this office this

29th day of November, 2006

Certification not valid unless the seal of
Lake County Illinois is affixed



Willard R Helander
Lake County Clerk



CERTIFICADO NOTARIAL

A los dias del mes de
de 200 , compareció personalmente ante
mi Notario Público

NOTARIAL CERTIFICATE

On this 27th day of *November*
200 6 , personally appeared before me a Notary
Public,

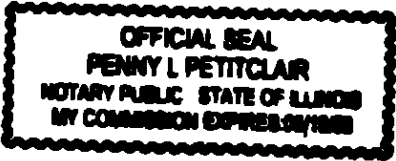

Yueh Wang

a quien doy fé de conocer y me consta que
la persona descrita y firmante
del documento que precede, declarando ante mí que
otorga el mismo para los fines y propósitos que
en él se expresan

Notario Público

to me known and known to me to be the person
described in and who executed the foregoing
document, and duly acknowledged to
me that executed the same for
the uses and purposes therein expressed

Notary Public *Penny L. Petitclair*





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5 Chicago, Illinois

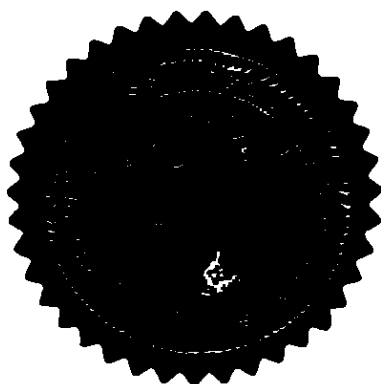
6 NOVEMBER 30, 2006

7 by the Secretary of State, State of Illinois

8 No C06TJ26683

9 Seal/Stamp

10 Signature



Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS



Willard Rooks Helander
Lake County Clerk

88

18 North County Street, Room 101
Waukegan Illinois 60085-4384
Phone 847 377 2400
Fax 847 380 3808
<http://www.co.lake.il.us/cntyclk>

State of Illinois)
) SS
County of Lake)

CERTIFICATE OF AUTHORITY

I, Willard R Helander, County Clerk of Lake County in the State of Illinois, which office is an office of record having a seal, certify that

PENNY L PETITCLAIR

by whom the foregoing or annexed document was notanized, was, on the

19th day of May, 2004

appointed a Notary Public in and for the County of Lake, State of Illinois and is valid until the

19th day of May, 2008

and that as such, full faith and credit is and ought to be given to this Notary's official attestations In testimony whereof I have affixed my signature and the seal of this office this

29th day of November, 2006

Certification not valid unless the seal of
Lake County Illinois is affixed

Willard R Helander
Lake County Clerk

11

CERTIFICADO NOTARIAL

NOTARIAL CERTIFICATE

A los días del mes de
de 200 , compareció personalmente ante
mi Notario Público

On this *27th* day of *November*
200 *6* , personally appeared before me a Notary
Public,

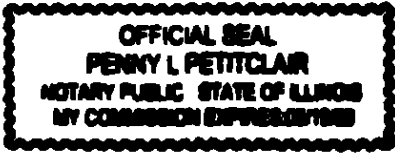

Mark Beach

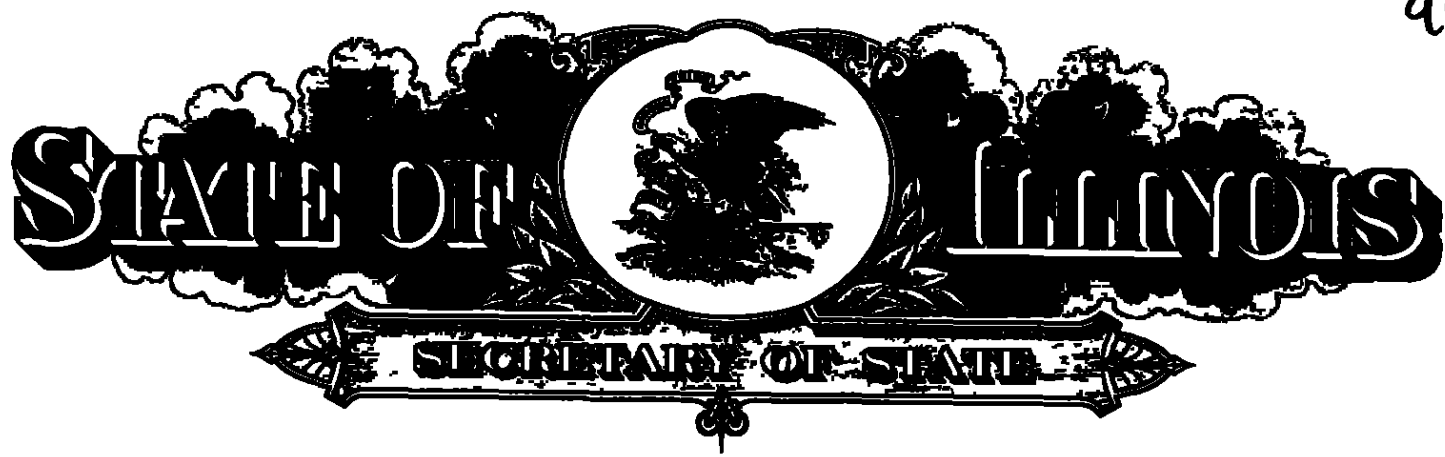
a quien doy fé de conocer y me consta que
la persona descrita y firmante
del documento que precede, declarando ante mí que
otorga el mismo para los fines y propósitos que
en él se expresan

Notario Público

to me known and known to me to be the person
described in and who executed the foregoing
document, and duly acknowledged to
me that executed the same for
the uses and purposes therein expressed

Notary Public 





SPRINGFIELD, ILLINOIS
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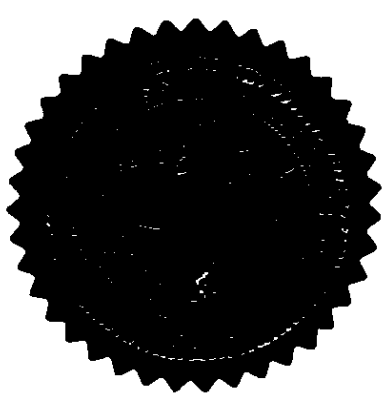
(Convention de La Haye du 5 Octobre 1961)

1 Country United States of America
This public document
2 has been signed by WILLARD R HELANDER
3 acting in the capacity of COUNTY CLERK, LAKE COUNTY
4 bears the seal/stamp of STATE OF ILLINOIS

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5 Chicago, Illinois
6 NOVEMBER 30, 2006
7 by the Secretary of State, State of Illinois
8 No C06TJ26682
9 Seal/Stamp

10 Signature



Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS



Willard Rooks Helander
Lake County Clerk

18 North County Street, Room 101
Waukegan Illinois 60085-4384
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Willard R Helander
Lake County Clerk

9L

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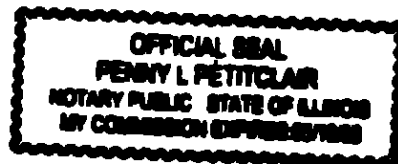
Bruce Kirkpatrick

a quien doy fé de conocer y me consta que
la persona descrita y firmante
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Notario Público

Notary Public *Penny L. Pettitclair*





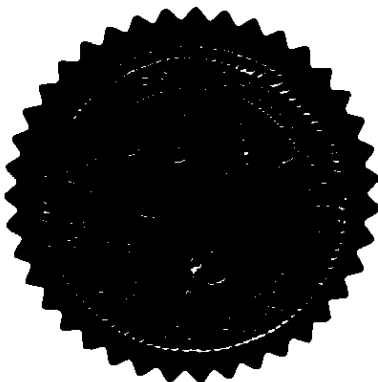
SPRINGFIELD, ILLINOIS
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(Convention de La Haye du 5 Octobre 1961)

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6 NOVEMBER 30, 2006
7 by the Secretary of State, State of Illinois
8 No C06TJ26681
9 Seal/Stamp 10 Signature



Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS

State of Illinois)
) SS
County of Lake)

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Willard R Helander ~
Lake County Clerk



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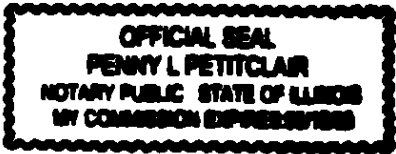
Gregory Clarke

a quien doy fé de conocer y me consta que
la persona descrita y firmante
del documento que precede, declarando ante mí que
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Notario Público

Notary Public Penny L. Petitclair





SPRINGFIELD, ILLINOIS
APOSTILLE
APOSTILLE

(Convention de La Haye du 5 Octobre 1961)

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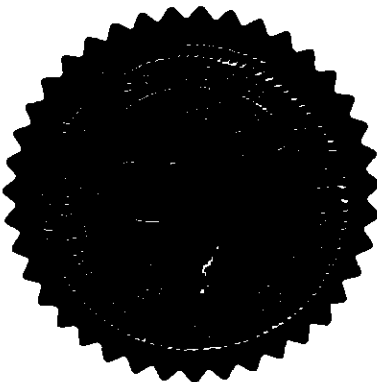
6 NOVEMBER 30, 2006

7 by the Secretary of State, State of Illinois

8 No C06TJ26680

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10 Signature



Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS



Willard Rooks Helander
Lake County Clerk

97

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Waukegan Illinois 60085-4364
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Fax 847 380 3808
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State of Illinois)
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Willard R Helander
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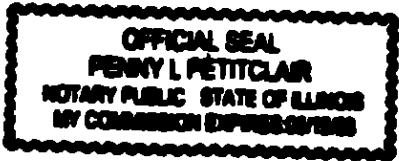
John Lopez
John Lopez

a quien doy fé de conocer y me consta que
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Notary Public *Penny L. Pettitclair*





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APOSTILLE

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6 NOVEMBER 30, 2006

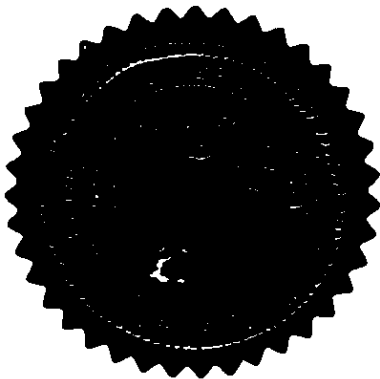
7 by the Secretary of State, State of Illinois

8 No C06TJ26679

9 Seal/Stamp

10 Signature

Jesse White



JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS



Willard Rooks Helander
Lake County Clerk

18 North County Street, Room 101
Waukegan, Illinois 60085-4384
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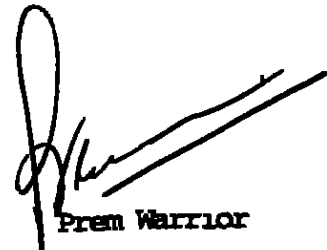
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Notario Público

NOTARIAL CERTIFICATE

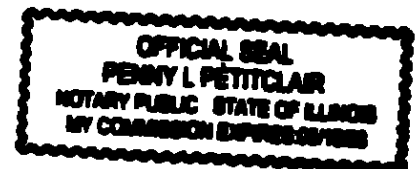
On this *17th* day of *November*
200*6* , personally appeared before me a Notary
Public,


Prem Warrior

to me known and known to me to be the person
described in and who executed the foregoing
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me that executed the same for
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Notary Public

Penny L. Pettitclair





SPRINGFIELD, ILLINOIS
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APOSTILLE

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Certified

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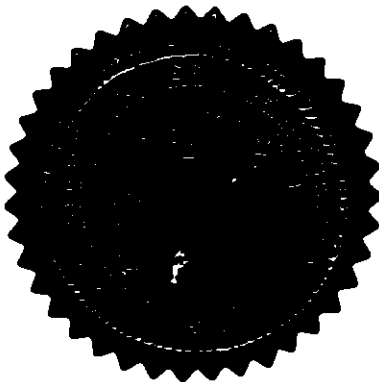
6 NOVEMBER 30, 2006

7 by the Secretary of State, State of Illinois

8 No C06TJ26678

9 Seal/Stamp

10 Signature



Jesse White

JESSE WHITE
SECRETARY OF STATE
STATE OF ILLINOIS



Willard Rooks Helander
Lake County Clerk

103

18 North County Street, Room 101
Waukegan Illinois 60085-4384
Phone 847 377 2400
Fax 847 360 3608
<http://www.co.lake.il.us/cntryclk>

State of Illinois)
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County of Lake)

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Lake County Clerk

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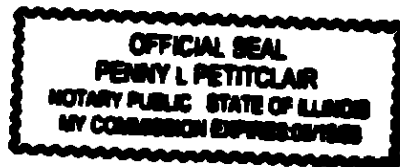
Bruce Baldi
Bruce Baldi

a quien doy fé de conocer y me consta que
la persona descrita y firmante
del documento que precede, declarando ante mí que
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Notario Público

Notary Public *Penny L Petitclair*



**TRADUCCION OFICIAL No 2007-01-23-037
DE UN DOCUMENTO ESCRITO EN INGLES**

**LOS ESTADOS UNIDOS DE AMERICA
A TODOS AQUELLOS QUE VIEREN ESTOS PRESENTES
DEPARTAMENTO DE COMERCIO DE LOS ESTADOS UNIDOS
Oficina de Patentes y Marcas de los Estados Unidos**

21 de noviembre de 2006

**EL PRESENTE ES PARA CERTIFICAR QUE ANEXA AL PRESENTE SE
ENCUENTRA UNA COPIA FIEL DE LOS REGISTROS DE LA OFICINA DE
PATENTES Y MARCAS DE LOS ESTADOS UNIDOS DE AQUELLOS
DOCUMENTOS DE LA SOLICITUD DE PATENTE IDENTIFICADA MAS
ADELANTE QUE CUMPLIO CON LOS REQUERIMIENTOS PARA QUE SE LE
OTORQUE UNA FECHA DE PRESENTACIÓN BAJO 35 USC 111**

**NUMERO DE SOLICITUD 60/574 354
FECHA DE PRESENTACION 24 de mayo de 2004**

**EL CODIGO DEL PAIS Y EL NUMERO DE SU SOLICITUD DE PRIORIDAD,
PARA SER USADO PARA PRESENTACION EN EL EXTERIOR BAJO LA
CONVENCION DE PARIS, ES US60/574 354**

Sello del Departamento de Comercio de la Oficina de Patentes y Marcas	Por Autoridad del Subsecretario de Comercio para Propiedad Intelectual y Director de la Oficina de Patentes y Marcas (firma ilegible) M TARVER Funcionario que Certifica
--	---

Reivindicaciones

Reivindicamos

1 Una composición que comprende un regulador de crecimiento de planta y un ácido solubilizante seleccionado a partir del grupo que consiste de ácido cítrico, ácido tartárico y ácido glicólico

2 La composición de acuerdo con la reivindicación 1 en donde el regulador de crecimiento de planta se selecciona a partir de un grupo que consiste de giberelinas, auxinas, citoquininas, ácidos orgánicos, inhibidores de biosíntesis de etileno y combinaciones de los mismos

3 La composición de acuerdo con la reivindicación 2 en donde el regulador de crecimiento de planta es citoquinina o combinaciones de citoquinina y giberelina

4 La composición de acuerdo con la reivindicación 3 en donde la citoquinina se selecciona de un grupo que consiste de 6-bencil adenina y forclorfenuron y la giberelina es GA₃ o GA₄A₇

5 La composición de acuerdo con la reivindicación 1 que comprende adicionalmente un solvente

6 La composición de acuerdo con la reivindicación 5 en donde el solvente es un propilen glicol

7 La composición de acuerdo con la reivindicación 1 que comprende adicionalmente un antioxidante

8 La composición de acuerdo con la reivindicación 7 en donde el antioxidante se selecciona del grupo que consiste de galato de propilo, etoxiquina, hidroxianisol butilado, hidroxitolueno butilado y butilhidroquinona terciaria

9 La composición de acuerdo con la reivindicación 1 que comprende adicionalmente al menos un surfactante

10 La composición de acuerdo con la reivindicación 9 en donde el surfactante se selecciona del grupo que consiste de alcoholes alquilo etoxilado, dioctil sulfosuccinatos de sodio, ácidos grasos etoxilados, aceites vegetales etoxilados, ésteres de glicol, ésteres de ácido graso de sorbitan, ésteres de ácido graso de sorbitan etoxilados y combinaciones de los mismos

11 La composición de acuerdo con la reivindicación 1 en donde el regulador de crecimiento de planta es benciadenina y el solubilizante es ácido cítrico anhidro

12 La composición de acuerdo con la reivindicación 1 en donde dicha composición se diluye en agua

13 Una composición que comprende benciadenina, ácido cítrico anhidro, alcoholes etoxilados, galato de propilo y propilenglicol

14 La composición de acuerdo con la reivindicación 13 que tiene desde aproximadamente 1.5 hasta aproximadamente 3.0 por ciento en peso de 6-benciadenina, desde aproximadamente 1.5 hasta aproximadamente 3.0 por ciento en peso de ácido cítrico anhidro, desde aproximadamente 3.5 hasta aproximadamente 5.5 por ciento en peso de alcoholes etoxilados, desde aproximadamente 0.05 hasta aproximadamente 0.20 por ciento en peso de

galato de propilo y desde aproximadamente 91 00 hasta aproximadamente 93 00 por ciento en peso de propilenglicol

15 La composición de acuerdo con la reivindicación 14 que tiene aproximadamente 1 93 por ciento en peso de 6-benciladenina, aproximadamente 2 0 por ciento en peso de ácido cítrico anhidro, aproximadamente 4 0 por ciento en peso de alcoholes alquil etoxilados, aproximadamente 0 1 por ciento en peso de galato de propilo y aproximadamente 91 97 por ciento en peso de propilenglicol

16 Una formulación lista para mezclar que comprende una composición inerte que comprende la composición de acuerdo con la reivindicación 15

17 La formulación lista para mezclar de acuerdo con la reivindicación 16 que comprende adicionalmente un insecticida, un herbicida, un fungicida, o combinaciones de los mismos

18 Un método de regulación de crecimiento de planta que comprende la etapa de tratar una semilla, suelo o una planta con una cantidad reguladora del crecimiento efectiva de una composición de acuerdo con la reivindicación 1

19 El método de acuerdo con la reivindicación 18 en donde dicha planta es una planta que produce fruto

20 El método de acuerdo con la reivindicación 19 en donde dicha planta que produce fruto se selecciona del grupo que consiste de uvas, manzanas, pistachos, cerezas, limones, limas, naranjas y mandannas

21 El método de acuerdo con la reivindicación 18 en donde dicha composición se diluye con agua y se aplica por rociado

22 El método de acuerdo con la reivindicación 21 en donde dicha composición se diluye con agua y se aplica por rociado

23 Un método para la preparación de una formulación de regulador de crecimiento de planta líquida soluble que comprende las etapas de mezclar un regulador de crecimiento de planta con un ácido solubilizante seleccionado del grupo que consiste de ácido cítrico, ácido tartárico y ácido glicólico, un antioxidante y solvente para producir una mezcla homogénea

24 Una composición que comprende un regulador de crecimiento de planta y un surfactante de alcohol etoxilado y un solvente

25 La composición de acuerdo con la reivindicación 24 en donde el regulador de crecimiento de planta es forclorfenuron y el surfactante alcohol etoxilado es alcohol alquilo C₁₂₋₁₅ y el solvente es propilen glicol

26 La composición de acuerdo con la reivindicación 25 que comprende adicionalmente ácido cítrico anhidro

27 La composición de acuerdo con la reivindicación 26, en donde el forclorfenuron está desde aproximadamente 0.5 hasta 2.0 por ciento en peso, el ácido cítrico anhidro está desde aproximadamente 0.5 hasta aproximadamente 2.0 por ciento en peso, el alcohol alquilo C₁₂₋₁₅ está desde aproximadamente 1.0 hasta aproximadamente 3.0 por ciento en peso y el propilen glicol está desde aproximadamente 93.0 hasta aproximadamente 98.0 por ciento en peso

28 La composición de acuerdo con la reivindicación 27, en donde el forclorfenuron es aproximadamente 0.84 por ciento en peso, el ácido cítrico anhidro es aproximadamente 0.5 por ciento en peso, el alcohol alquilo C₁₂₋₁₅ es aproximadamente 1.0 por ciento en peso y el propilenglicol es aproximadamente 97.66 por ciento en peso

Traducido según mi mejor saber y entender, este día 23 de enero de 2007, en la ciudad de Bogotá, D.C., por Anita Escobar de Tamayo, Traductora Oficial, Res 2177 de 1989, Ministerio de Justicia, República de Colombia

TRADUCTORA OFICIAL
RES. 2177/89 MINISTERIO DE JUSTICIA
Anita Escobar de Tamayo
ANITA ESCOBAR DE TAMAYO

PA 1943841



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

November 21, 2006

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111

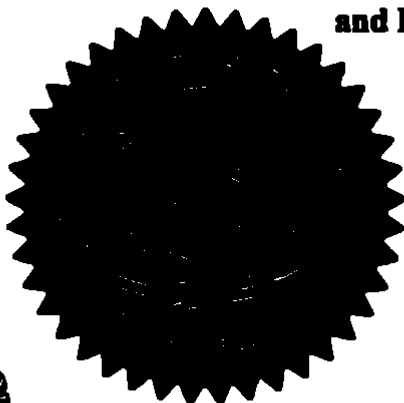
APPLICATION NUMBER 60/574,354

FILING DATE May 24, 2004

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS US60/574,354

By Authority of the

**Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office**



**M TARVER
Certifying Officer**

112

15866 U.S. PTO

PROVISIONAL APPLICATION FOR PATENT COVER SHEET
This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(e)

Attorney Docket No:

VAL6131P0780US

INVENTOR(S)/APPLICANT(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Yueh	Wang	1315 N Salem Blvd., Arlington Heights, IL 60004
Mark	Beach	972 Tylerston Circle, Grayslake, IL 60030
Bruce	Kirkpatrick	402 Jennifer Lane, Grayslake, IL 60030
Gregory	Clarke	7 Pheasant View Drive, Dillsburg, PA 17019
John	Lopez	7239 Buchanan Drive, Gurnee, IL 60031

☐ Additional inventors are being named on the separately numbered sheets attached hereto.

TITLE OF THE INVENTION (280 characters maximum)

Stable and Water-Soluble Plant Growth Regulator Liquid Compositions and Methods of Use of Same

CORRESPONDENCE ADDRESS

Direct all correspondence to
WOOD, PHILLIPS, KATZ,
CLARK & MORTIMER
Citicorp Center, Suite 3800
500 West Madison Street
Chicago, Illinois 60661-2511
(312) 876-1800 (phone)
(312) 876-2020 (facsimile)

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Respectfully submitted,

Signature

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Aldah Abdallah

Stable and Water-Soluble Plant Growth Regulator Liquid Compositions and Methods for Use of Same

Field of the Invention

The present invention is directed to soluble and stable liquid compositions including at least one plant growth regulator, at least one acid solubilizer, at least one surfactant adjuvant, and at least one solvent, as well as methods for making and using the compositions. The soluble liquid composition advantageously improves the preparation, the storage stability, the handler safety and the performance of a plant growth regulator formulation for spray application, as such composition is highly soluble in use dilutions, is easily metered, can be more highly concentrated and is dust-free. A presently preferred soluble liquid composition includes at least one plant growth regulator selected from the group consisting of an adenine cytokinin, an acid solubilizer selected from the group consisting of citric acid, tartaric acid and glycolic acid, a dilution solubilizer comprising a nonionic and/or anionic surfactant blend and a solvent comprising propylene glycol. The growth regulator is preferably 6-benzyladenine (6-BA).

The present invention is also directed to soluble and stable liquid compositions comprising at least one plant growth regulator selected from the group consisting of a phenylurea cytokinin, a dilution solubilizer comprising nonionic and/or anionic surfactant blend and a solvent comprising propylene glycol. The growth regulator is preferably forchlorfenuron (CPPU) and the nonionic surfactant is preferably ethoxylated C12-15 alkyl alcohols.

The present invention is also directed to obtaining a synergistic effect by combining cytokinin and gibberellin plant growth regulators such as 6-BA and/or CPPU with GA₃ or GA₄A₇.

Background of the Invention

Plant growth regulators are useful for influencing a range of plant developmental processes including stem elongation, germination, dormancy, flowering, sex expression, enzyme induction, fruit size and quality, as well as leaf and fruit senescence. Plant growth regulators may be formulated in at least five different types of formulations. 1)

solutions, 2) wettable powders, 3) soluble powders, 4) tablets, and 5) water-soluble or dispersible granules. In order to use such formulations, they must be diluted in an aqueous solution prior to conventional spray application. Each of the conventional types of formulations has disadvantages, so research to provide improved plant growth regulator formulations continues. The disadvantages of the conventional formulations will be discussed with reference to two important plant growth regulator classes, the gibberellins and the cytokinins, as representative of conventional formulations of plant growth regulators in general.

Gibberellins are one class of plant growth regulators which are diterpenoid acids. Gibberellins are commercially produced by fermentation of a natural fungus, *Gibberella fujikuroi*. Gibberellins are marketed under various trade names and are commercially used on a variety of fruit orchards, vegetable crops, row crops, and ornamental crops. The predominantly used gibberellic acid is GA_3 , formulated in any of the five forms described above. The other commonly used gibberellins are a combination of two, (GA_{4+7}) which are primarily formulated as solutions in isopropyl alcohol, tetrahydrofurfuryl alcohol (THFA) or propylene glycol. Due to diterpenoid structure of gibberellins containing double bonds and cyclic lactone, they are less stable in liquid form, especially in water.

Cytokinins are another class of plant growth regulators which are generally defined as N6-substituted adenine derivatives such as trans-zeatin, 6-benzyladenine and kinetin. Recently, a new class of cytokinins has been identified and they possess N-phenylurea substituted structure such as forchlorfenuron (CPPU) and thidiazuron (TDZ). Cytokinins are of extreme importance in regulating plant growth and development, especially cell division. They are marketed under various trade names and are commercially used in fruit thinning and sizing as well as pre- and post-harvest treatments of ornamental plants and flowers. Cytokinins have low solubility in water or solvent and solubility improvement in formulation and in use dilution are important for obtaining their biological effectiveness.

Solution Formulations

Gibberellin and cytokinin solution formulations are disadvantageous in several respects. The solutions, such as those of 6-BA in propylene glycol or THFA, are less

concentrated due to low solubility of actives, and GA4+A7 have limited stability due to oxidation or chemical degradation. The result is that current GA4+A7 products have a limited shelf life due to 10-15% loss per year. Overformulation and rework are then required for aged product in order to meet label claim. Of the currently used solvents, isopropyl alcohol and methyl alcohol offer severe disadvantages such as flammability and toxicity, which lead to restrictions in manufacturing, packaging, labeling, transportation, and warehousing of such solutions. A more powerful THFA solvent has to be used in some of the 6-BA formulations, however, THFA is considered corrosive to the eye and skin. Moreover, low solubility of cytokinins in propylene glycol does not permit preparation of high potency solution formulations. These low strength solution formulations also require larger packaging, more storage space, and higher associated transportation, warehousing, and container disposal costs. Due to very low solubility and undesirable hydrolysis, it has not been possible to formulate gibberellins or cytokinins in aqueous systems. Some examples of solution formulations of gibberellins include PROGIBB 4%®, PROVIDE®, PROCONE®, RALEX®, RELEASE LC® and RYZUP®, cytokinins include ACCEL®, and REGULEX®, and gibberellin and cytokinin combinations include PROMALIN®, all available from Valent BioSciences Corp.

Powder Formulations

A soluble powder formulation is one which, when mixed with water, dissolves readily in water and forms a true solution. Once the solution is formed, no further mixing or agitation of the tank-mix is required. Mixing is a process of combining different materials, usually to a homogeneous state. Agitation aids the process of mixing, and is a mechanical process involving rotating shafts of blades in the bottom of the spray tank.

An example of a powder gibberellin formulation is PROGIBB 2X®, available from Valent BioSciences Corp., which contains 20% by weight of the active ingredient, gibberellin. A wettable powder formulation is a dry, finely ground formulation. In this formulation, the active ingredient is combined with a finely ground dry carrier, usually a mineral clay, along with other ingredients that enhance the ability of the powder to be suspended in water. Upon mixing the wettable powder with water, a suspension is formed, which is then applied by a spray technique. Examples of a wettable powder

gibberellin formulation include PROGIBB PLUS®, ACTIVOL 10%® and RELEASE®, all available from Valent BioSciences Corp

The primary disadvantage of wettable powder and soluble powder formulations is that they tend to produce dust upon handling, such as when pouring, transferring or measuring them. This dust may pose health hazards. Further, powder formulations tend to wet poorly and also solubilize slowly upon addition to water. Powder formulations thus take longer times to wet, disperse and solubilize in the tank-mix. Formation of lumps or partially solubilized spray solutions will lead to uneven distribution of the plant growth regulator in the tank-mix with potential for reduced field performance. Sometimes, foam in the spray tank caused by spray tank adjuvants can also affect wetting and solubility of wettable and soluble powders. Wettable powder formulations will also leave undesirable insoluble residues both in the tank and on the sprayed foliage and fruit. For insoluble cytokinins, the wettable powder formulations of large particle size are ineffective as plant growth regulators.

Tablet Formulations

Tablet formulations are pre-measured dosage delivery systems. They are useful in small areas, or for ornamental purposes. Tablet formulations may be effervescent, which dissolve in water over a period of two to ten minutes depending upon the type and size of the tablet. However, tablets deliver only between 0.1 -1 gram of active ingredient per tablet. They are not ideal for large-scale field operations. Moreover, effervescent tablets are highly susceptible to humidity, may be slow to dissolve and are expensive.

Water-Soluble or Dispersible Granules

Water-soluble or water-dispersible granules are also known as soluble or wettable granules. This type of formulation is similar to a wettable powder, except that the active ingredient is formulated as granular particles of 100 to 300 micron size. To prepare the water-soluble or dispersible granules for spray application, they are completely soluble or dispersible in water upon agitation. Many different water-soluble or water-dispersible granular formulations are known for agricultural chemicals. For example, EP 0 252 897 and U.S. Patent No. 4,936,901 disclose encapsulated plant growth regulators. In water dispersible granular formulations, U.S. Patent No. 6,387,388

B1 and U S Patent Application Publication US 2002/0114821 A1 disclose an extruded water-soluble insecticide, and U S Patent No 5,622,658 discloses an extrudable composition for preparing water-dispersible granules. An example of a granular gibberellin formulation containing 3.1% active ingredient is Gibberellin Kyowa Soluble Powder, available from Kyowa Fermentation Industry of Japan.

Water-soluble or dispersible granules usually have no greater than eight percent moisture content, and form solution or suspensions when added to aqueous solutions. The quality of water-soluble or water-dispersible granules is highly process- and active-ingredient-dependent, and can result in low yield recoveries, poor attrition resistance leading to dust potential, high manufacturing cost and poor dispersion. Generally, sprays of dissolved water-dispersible granular formulations leave undesirable insoluble residues on the treated foliage and fruit.

For plant growth regulators such as gibberellins or cytokinins to be efficacious, the active ingredient must be solubilized in the tank-mixes prior to application. In addition, water-soluble or -dispersible granules can become hardened over time and thus result in poor solubility or dispersibility of the active ingredient. Dust and caking may be problems with certain water-soluble or water-dispersible granules and powder formulations.

Even with liquid formulations, due to poor water and solvent solubility of plant growth regulators such as 6-benzyl adenine and forchlorfenuron (CPPU), THFA is required to be used as a solvent and precipitation or crystallization of active ingredients can occur in field-tank mixing, which will have an adverse effect on the plant growth regulator activity and the handling of a toxic THFA product.

Therefore, a plant growth regulator formulation which provides high potency, product safety, stability and solubility, and avoids the problems associated with conventional formulations, would be advantageous.

Brief Description of the Drawings

FIG 1 shows the improved 6-BA uptake of representative compositions of the present invention in comparison with other compositions.

Brief Summary of the Invention

The present invention is directed to a novel plant growth regulator composition in a concentrated liquid form, as well as methods for making and using the composition. The invention improves a plant growth regulator that is normally insoluble such as 6-benzyladenine (6-BA) or forchlorfenuron (CPPU) by making it more soluble, as well as utilizing its synergistic characteristics by combining it with gibberellins such as GA₃ and less stable GA₄A₇ (GA₄₊₇). The composition comprises at least one plant growth regulator and at least one acid solubilizer selected from the group consisting of citric acid, tartaric acid and glycolic acid. The composition preferably includes at least one solvent and one surfactant. The liquid composition advantageously improves handler safety, preparation, penetration and storage stability of a plant growth regulator formulation for spray application, as such composition swiftly dissolves or is highly soluble, is easily metered, can be more highly concentrated and is dust-free for handling. Preferably the plant growth regulator is selected from the group consisting of gibberellins, auxins, cytokinins, organic acids, ethylene biosynthesis inhibitors, and combinations thereof. More preferably, the plant growth regulator is a cytokinin and/or a gibberellin. Most preferably, the plant growth regulator is 6-benzyl adenine or forchlorfenuron (CPPU).

In another embodiment, the composition comprises at least one plant growth regulator and an ethoxylated alkyl alcohol surfactant. The growth regulator is preferably forchlorfenuron (CPPU) and the ethoxylated alkyl alcohol surfactant is a C12-15 alcohol in propylene glycol solvent.

Additionally, the composition may further comprise an antioxidant. The antioxidant may be propyl gallate, ethoxyquin, butylated hydroxyanisole, butylated hydroxytoluene, tertiary butylhydroquinone and combinations thereof. The surfactant may be ethoxylated alcohols, dioctyl sodium sulfosuccinates, ethoxylated fatty acids, ethoxylated vegetable oils, glycol esters, sorbitan fatty acid esters, and ethoxylated sorbitan fatty acid esters and combinations thereof.

The composition may also contain at least one additional component such as a cosolvent (ethyl lactate, butyl lactate, methyl fatty ester or acetyltributyl citrate, all EPA list 4 inerts), a sticker, a spreader sticker, a systemic acquired resistance inducer, an

anti-foaming agent, a preservative, a humectant, a dye, a U V protectant, a buffer, , a carrier or a combination thereof

The preferred formulation of the composition comprises benzyadenine, anhydrous citric acid, ethoxylated C12-15 alcohols, propyl gallate and propylene glycol. The preferred weight range of the formulation is from about 1.5 to about 3.0 weight percent 6-benzyladenine, from about 1.5 to about 3.0 weight percent anhydrous citric acid, from about 3.5 to about 5.5 weight percent ethoxylated C12-15 alcohols, from about 0.05 to about 0.20 weight percent propyl gallate and from about 91.00 to about 93.00 weight percent propylene glycol.

The invention is also directed to a method of regulating plant growth comprising the step of treating soil, a seed or a plant with an effective growth-regulating amount of the composition described above. The composition of the present invention may be formulated as a ready-to-mix formulation that is diluted in water and spray-applied in order to improve plant growth, yield, fruit thinning, fruit sizing, flowering and quality. The plant is preferably a fruit bearing plant, as for example one that produces grapes, apples, pears, peaches, cherries, lemons, limes, oranges, pistachio or tangerines.

The invention is also directed to a method of preparing a soluble liquid plant growth regulator formulation comprising the steps of mixing the plant growth regulator, acid solubilizer, surfactant, antioxidant and solvent to produce a final soluble liquid composition. In the method, preparation of the formulation for spray application can be enhanced, since the solubilizer and the surfactant produce clear spray solution of micro- or nano-particle size and prevent the crystallization of insoluble active ingredient in use dilution, and accurate metering and rapid dissolution of the composition can be attained. The formulation of the present invention is high in product solubility, handling safety, storage stability, and improves plant growth, yield, fruit thinning or sizing and quality. The ready-to-mix compositions can be used for liquid insecticide, herbicide and fungicide formulations.

Detailed Description of the Invention

We have now surprisingly discovered that highly concentrated, soluble and stable liquid formulations of plant growth regulators are improved if organic acid solubilizers such as citric acid, tartaric acid or glycolic acid are added to the composition and dilution solubility is improved if an ethoxylated alkyl alcohol surfactant is added to the composition. The composition having improved dilution solubility preferably comprises 6-BA or CPPU as the plant growth regulator and propylene glycol as the solvent and the ethoxylated C12-15 alcohol as the surfactant. The acid solubilizer prevents crystallization of the active ingredient at ambient or cold storage temperature thereby resulting in a more concentrated liquid formulation. The soluble liquid formulation is still safe, stable and effective.

The phrase "plant growth regulator" as used herein connotes a product which serves to modify the growth and the development of a treated plant to agricultural maturity without killing the plant. Such modification may result from the effect of the material on the physiological processes of the plant, or from the effect of said material on the morphology of the plant. These modifications may also result from any combination or sequence of physiological or morphological factors.

The plant growth regulator may be a gibberellin, an auxin, an organic acid, a cytokinin, an ethylene biosynthesis inhibitor, or a combination thereof. Suitable ethylene biosynthesis inhibitors include aminoethoxyvinylglycine, suitable auxins include indole-3-acetic acid and indole butyric acid, suitable organic acids include α -naphthyl acetic acid and suitable cytokinins include 6-benzyladenine or 6-benzylaminopurine (6-BA), forchlorfenuron (CPPU), thidiazuron (TDZ) and 6-furfurylaminopurine (kinetin).

In the formulation of the present invention, a surfactant may be used as a wetting, solubilizing and penetrating agent for certain plant growth regulators. Suitable surfactants include non-ionic surfactants, anionic surfactants and amphoteric surfactants. Non-ionic surfactants include ethoxylated alkyl alcohols such as TOMADOLS®, ethoxylated vegetable oils such as AGNIQUE SBO® (soybean), CSO (castor) and RSO (rapeseed), ethoxylated sorbitan esters such as EMSORB®, TWEEN®, and T-MAZE®; sorbitan fatty acid esters such as SPAN® and ALKAMUL®; sucrose and glucose esters and derivatives thereof such as MAZON®, RHEOZAN®.

and GLUCOPON®; ethoxylated alcohols such as TRYCOL®, BRIJ®, ARMIX®, TERGITOL® and PLURAFAC®; ethoxylated alkylphenols such as IGEPAL®, MACOL® and TRITON®; ethoxylated fatty amines such as TRYMEEN® and ETHOMEEN®; ethoxylated fatty acids such as EMEREST®, ALKAMUL® and TRYDET®; ethoxylated fatty esters such as ALKAMUL® and ATLAS G®, fatty acids such as ATLAS G-1550®; glycerol esters such as MAZOL GMO®; glycol esters such as GLYCOL SEG®; lanolin-based derivatives such as AMERCHOL CAB®; methyl esters such as OLEOCAL ME®, monoglycerides and derivatives such as ETHOSPERSE G-26®, propoxylated and ethoxylated fatty acids such as ANTAROX AA-60®; block copolymers of ethylene oxide and propylene oxide such as PLURONIC® or SURFONIC®, silicone-based surfactants such as SILWET®, BREAKTHRU® and mixtures of organosilicon surfactant with non-ionic or ionic surfactants, polysaccharides, copolymers of acrylamide and acrylic acid, and acetylenic diol derivatives such as SURFYNOL 104® or tristerylphenols such as SOPROPHOR® among others

A presently preferred nonionic surfactant family is the ethoxylated alkyl alcohols of C9 to C15 chains (TOMADOL 25-7, 1-7 or 91-6®) Non-ionic surfactants such as natural ethoxylated alcohols (BRIJ®) and vegetable oils (AGNIQUE®) are presently also preferred Suitable anionic surfactants include phosphate esters such as EMPHOS® and RHODAFAC®; dialkyl sulfosuccinates such as MONAWET®, N-acyl ED3A chelating surfactant (Hampshire) and N-Acyl Sarcosines (Hamposyl) among others

The tradenames used above of surfactants often are common to a class or series of surfactants Therefore, where a tradename is mentioned, any surfactant in the family including that tradename will be suitable

Other components of the formulation may include additional surface active agents, cosolvent, dyes, U V (ultra-violet) protectants, antioxidants, antifoams or other components which facilitate product handling and application

It is also contemplated that the ready-to-mix compositions of this invention may be used in other active ingredients, such as herbicides, fungicides, insecticides, nematocides, biochemical pesticides, plant produced pesticides (botanicals) or plant nutrients

A presently preferred composition contains technical grade active ingredient gibberellin. A preferred technical grade active ingredient gibberellin is GA₃, since it is the most widely used plant growth regulator for agriculture, although other gibberellins, including but not limited to GA₄, or GA₇, GA₄GA₇, and combinations of GA₃ or GA₄GA₇ with 6-BA or CPPU.

A presently preferred composition includes from about 1.5 to about 3.0 weight percent 6-benzyladenine, from about 1.5 to about 3.0 weight percent anhydrous citric acid, from about 3.5 to about 5.5 weight percent ethoxylated C12-15 alcohols, from about 0.05 to about 0.20 weight percent propyl gallate and from about 91.00 to about 93.00 weight percent propylene glycol.

A presently preferred composition includes from about 0.5 to about 2.0 weight percent CPPU, from about 0.5 to about 2.0 weight percent anhydrous citric acid, from about 1.0 to 3.0 weight percent ethoxylated C12-15 alcohols and from about 93.0 to 98.0 weight percent propylene glycol.

The Methods of Use

Gibberellins are known plant growth regulators. For example, U.S. Patent No. 4,242,120 discloses a non-spray combination of a gibberellin with a low molecular weight carbohydrate such as saccharide, glucose, fructose or maltose to stimulate fructification, and U.S. Patent No. 5,163,993 discloses a combination of gibberellin and a surfactant for thinning grape clusters.

The formulations described above may be used to regulate plant growth of fruit-producing plants, vegetable-producing plants, row crops, vegetable crops, grasses or trees. The benefits of the use of the formulation vary, according to the type of fruit treated. For example, in grapes, treatment with the formulation can lead to cluster elongation, thinning and larger grapes. In oranges, lemons, limes and tangerines, the formulation can lead to a delay the aging of the rind and reduce disorders such as rind staining, water spotting, sticky or tacky surface, puffy rind or rupture under pressure. In cherries, the formulation may advantageously be used to produce larger, brighter colored and/or firmer fruit.

The formulation is preferably diluted in water and sprayed on the plant or tree to be treated. The spraying may be by conventional ground or aerial application.

equipment. Spray volumes are variable depending upon the orchard or crop, growth stage and climatic conditions. The range may be 5 gallons to 300 gallons/acre or higher. A presently preferred range is between 100 to 250 gallons per acre by pressurized spray application equipment. To prepare a formulation for application, a tank is half-filled with water, followed by spray addition of adjuvant, and then addition of plant growth regulator, followed by addition of more water and mixing for at least 15 minutes prior to actual spraying.

Alternatively, the formulation may be directly applied to the soil (in which the plant will be grown or is growing) with or without granular fertilizers for the improved growth and maintenance of crops.

Moreover, the formulation may be applied to seeds to achieve the same effect. The seed may be rice or paddy, alfalfa, cotton, sorghum, soybeans, corn or other vegetables, ornamental or turf and pasture grass seed, among others.

The concentration of the plant growth regulator will vary depending upon the type of fruit to be treated, the peculiarities of the locale, and the desired result. In general, the composition may be applied at a field rate of from about 0.01 to about 1.0 lb per acre, preferably at a rate of from about 0.02 to about 5 lbs per acre and most preferably at a rate of from about 0.02 to about 2 lb/acre. For example, the field spray rates for apples using 6-BA can be about 38-75 g/100 gallon per acre and for grapes using CPPU can be about 4-8 g/250 gallon per acre.

A single application may be enough, though depending upon the particular fruit and desired results, multiple applications may be made.

As used herein the term "plant" includes fruit-producing plants, vegetable-producing plants, row crops, vegetable crops, grasses and trees.

The fruit may be grapes, cherries, lemons, limes, oranges, grapefruit, strawberries, pineapples, stone fruits, apples, pears, peaches, blueberries, pistachio or tangerines. The row crop may be cotton, soybeans, corn, sugar cane or rice, among others. The vegetable crops may be lettuce, artichokes, celery or peppers among others. The grasses may be Bahai grass (*Paspalum notatum* Flugge), Bent grass (*Agrostis* L.), Bermudagrass (*Cynodon dactylon* L.), Carpet grass (*Axonopus affinis* Chase), Kentucky bluegrass (*Poa pratensis* L.), Canada Bluegrass (*Poa compressa* L.),

Buffalograss (*Buchloe dactyloides* (Nutt) Englem), Fescue grasses (*Festuca*), annual Rye grass (*Lolium L. multiflorum* Lam), perennial Rye grass (*Lolium perenne* L.), Saint augustinegrass (*Stenotaphrum secundatum* Kuntze), Japanese lawngress (*Zoysia japonica* Steud), Centipedegrass (*Eremochloa ophiuroides* (Munro) Hack, other turf grasses for residential or commercial establishments, among others

The invention will be understood more clearly from the following non-limiting representative examples Of course, the present invention is not limited to the particular embodiments and modes of operation described herein and it is possible to imagine a number of variations in the details without departing from the scope of this invention

The examples below are presented to describe preferred embodiments and utilities of the invention and are not meant to limit the invention unless otherwise stated in the claims appended hereto

Example 1

In 500 liter batch size (523 kg by weight), 480.9 kg of propylene glycol solvent is transferred through a heat exchanger to a mixing tank and the solvent is heated to 40°C - 45°C While in the mixing tank, 10.1 kg of 6-BA tech powder (98.5% active ingredient), 10.5 kg of citric acid powder and 0.5 kg of propyl gallate powder (TENOX PG®) are added The mixture is agitated until all of the powders are completely dissolved 21 kg of ethoxylated C12-15 alcohol surfactant (TOMADOL 25-7®) is then added Everything is mixed for additional 10-20 minutes to complete the formulation

Example 2

Example 2 demonstrates increased solvent solubility of 6-BA (N6-benzyladenine) by adding soluble organic acids in propylene glycol, and improved water dilution stability of 6-BA and CPPU (Forchlorfenuron or N-(2-chloro-4-pyridinyl)-N-phenylurea) in formulations with low irritating (skin and eyes) surfactants (alkyl alcohol ethoxylates or/ and dioctyl sodium sulfosuccinate) and citric acid solubilizer Soluble, stable, safe and ready-to-mix formulations were achieved with 6-BA or CPPU and acid / surfactant combinations as shown in Table 1 below

Table 1
Solvent Solubility of 6-BA and CPPU at 20 C

100 g Solvent	Organic Acid	6-BA	CPPU
Propylene Glycol	-	15 g	-
Propylene Glycol	2 g Citric	24 g	-
Propylene Glycol	2 g Tartaric	25 g	-
Propylene Glycol	-	-	7 g
Propylene Carbonate	-	-	6 g
Propylene Glycol-n-Propyl Ether	-	-	10 g

**Composition, Storage and Dilution Stability of
VBC-30001 and ABG-3207 Cytokinin Products**

Ingredients, wt%	VBC-30001	ABG-3207	Function
6-Benzyladenine (98.5%)	1.93	-	Active
Forchlorfenuron (98.9%)	-	0.84	Active
Citric acid, anhydrous	2.0	0.5	Solubilizer
Alkyl alcohol ethoxylate	4.0	1.0	Solubilizer
Propyl gallate	0.1	-	Antioxidant
Propylene glycol	91.97	97.66	Solvent

*VBC-30001 is 1.9% 6-BA Liquid and ABG-3207 is 8% CPPU Liquid

Storage Stability	65-022-VB lot	51-004-VB lot
Initial	1.90% 6-BA	87% CPPU
12 mo./25 C	1.89	84
12 mo./25-40 C	1.88	89

Dilution stability in 342 ppm hard water at ~ 23 C

Formulation	Initial	24 hr
VBC-30001		
2.5% (450 ppm 6-BA)	soluble (clear)	soluble (clear)
ABG-3207		
2.5% (200 ppm CPPU)	soluble (light blue)	soluble (light blue)

*Reported solubility of 6-BA and CPPU in 25 C water are 60 and 39 ppm, respectively. Complete solubilization or submicron suspension (light blue color) of cytokinin is important for obtaining optimal PGR activity in applications.

Table 1 shows the solvent solubility of 6-benzyl adenine (6-BA) and CPPU (forchlorfenuron or N-(2-chloro-4-pyridinyl)-N-phenylurea) at 20 degrees C. 100 g of solvent are used. The solvent is either propylene glycol, propylene carbonate or propylene glycol-n-propyl ether. Only 1.5 g of 6-BA remains soluble in propylene glycol alone. 2.4 g 6-BA remains soluble if 2 g of citric acid is added to propylene glycol. 2.5 g of 6-BA remains soluble if 2 g of tartaric acid is added to propylene glycol. CPPU remains soluble at 7 g, 6 g and 10 g in propylene glycol, propylene carbonate and propylene glycol-n-propyl ether, respectively. Thus, 6-BA solubility is increased by adding citric acid or tartaric acid in propylene glycol. Formulations designated VBC-30001 and ABG-3207 contain 6-BA and Forchlorfenuron, respectively, and citric acid, C12-15 alkyl alcohol ethoxylate, propyl gallate and propylene glycol. The weight percent of each component is shown. Storage stability for both formulations (65-022-VB lot for VBC-30001 and 51-004-VB lot for ABG-3207) is high after 12 months at 25 degree C or 25-40 degree C tropical conditions. The dilution stability data for both formulations shows that in 342 ppm hard water at about 23 degrees C, 450 ppm of 6-BA, 200 ppm of CPPU remain soluble after 24 hr standing.

Low skin, eye, sensitization or inhalation toxicity are shown for ABG-3207 (Category IV) and VBC-30001 (mild skin & eye irritation, Category III). Both formulations employ EPA list 3 or 4 inert. No flammable IPA nor toxic THFA solvent is used in these studies.

Table 1 also shows a preferred formulation of plant growth regulator compositions of the present invention. Formulation designated VBC-30001 contains 1.93 weight percent of benzyladenine technical (98.5% active ingredient), 2.00 weight percent of citric acid (solubilizer), 4.00 weight percent ethoxylated alcohols (surfactant adjuvant), 0.10 weight percent propyl gallate (antioxidant) and 91.97 weight percent propylene glycol (solvent). A presently preferred composition includes from about 1.5 to about 3.0 weight percent 6-benzyladenine, from about 1.5 to about 3.0 weight percent anhydrous citric acid, from about 3.5 to about 5.5 weight percent ethoxylated

alcohols, from about 0.05 to about 0.20 weight percent propyl gallate and from about 91.00 to about 93.00 weight percent propylene glycol. Formulation designated ABG-3207 contains 0.84 weight percent CPPU technical (98.9% active ingredient), 0.5 weight percent anhydrous citric acid, 1.0 weight percent ethoxylated alcohols, and 97.66 weight percent propylene glycol.

Example 3

Table 2		
Activity Improvement: 100-150 ppm 6-BA sprays improved apple thinning/sizing without Carbaryl insecticide (2000 field trials)		
VBC-30001 Rate	Average % Thinning	Average % Increase in Size
100 ppm	25.4	18.5
150 ppm	29.6	18.1

Table 2 shows the activity improvement of 100 ppm or 150 ppm 6-BA sprays. Both formulations improved apple thinning and sizing without, SEVIN® (Carbaryl) insecticides as shown in 2000 field trials. In a similar study, better grape sizing using formulation ABG-3207 than other formulations (CPPU technical/IPA) is found.

Example 4

Figure 1 shows C14 radiolabelled 6-BA uptake from compositions of the present invention (formulation VBC-30001 is designated as "B") in apple leaves, was superior to other compositions designated "A" and "C".

Equal amounts of composition A, B or C (containing radiolabelled 6-BA) were individually applied to apple leaves and the amount uptake was determined from sections of the leaves such as from discs and strips cut from the leaves after a 24 hour period of absorption. A control was also compared to compositions A, B and C. The leaves were rinsed with water and the amount of radiolabelled 6-BA not absorbed in the leaves were determined and quantified (left bar designated "Rinses"). The amount of radiolabelled 6-BA absorbed in the leaves determined from the discs and strips cut from the leaves were determined and quantified (right bar designated "Non-Rinse"). Six trials were taken for each compositions and the control and averaged (except one trial was dropped from "C" and three trials were dropped from "B"). Figure 1 shows that the 6-BA of the composition of the present invention, "B", was absorbed (Non-Rinse) at a

significant higher level compared to that of compositions "A" and "C" The amount of 6-BA of the composition of the present invention that was not absorbed (Rinses) was significantly lower than that of the other compositions

It is believed that solubilization of the plant growth regulator, such as 6-BA and CPPU, with the organic acid, such as citric acid in conjunction with a surfactant in use dilutions will generate small particle size (microparticles or nanoparticles) for improving uptake or penetration Small particle size of high dissolution rate is important for activity of water insoluble active ingredients or drugs

Example 5

Table 3 below shows potential ready-to-mix plant growth formulations which including at least a plant growth regulator, an acid, a surfactant and an antioxidant Formulation VBC-30009 contains 1.9% 6-BA, 2.0% GA₄A₇ and 0.45% CPPU Formulation YW-16-7 contains 4.5% GA₃ and 0.42% CPPU Formulation YW-16-9 contains 2.1% GA₃ and 1.9% 6-BA. Formulations YW-26-1 and YW-26-5 contain 2.1% CPPU Formulation YW-16-4 contains 9% GA₃ Additional adjuvants are shown These formulations show the synergistic effect of combining 6-BA and CPPU with GA₃ and GA₄A₇ as well as the composition comprises an ethoxylated alkyl alcohol surfactant, organic acid and an antioxidant adjuvants in propylene glycol solvent

Table 3
Ready-to-mix PGR formulations and Combinations

Ingredients, Wt%	VBC-30009	YW-16-7	YW-16-9	YW-16-4	YW-26-1	YW-26-5
6-BA tech	1.9		1.9			
CPPU tech	45	42			2.1	2.1
GA ₄ A ₇ tech	2.0					
GA ₃ tech		4.5	2.1	9.0		
Citric acid	5	5	5		1.0	1.0
Propyl gallate	0.5	1	1	2	0.5	0.5
Alcohol ethoxylate						
C12-15	7.5					
C11		5.0	5.0	5.0	5.0	3.5
Monawet MO-84R2W						1.5
Propylene Glycol UPS				Balance		

Adjuvants

- Nonionic surfactants C12-15 and C11 Alkyl alcohol ethoxylates (TOMADOL® or NEODOL 25-7 and 1-7®)
- Anionic surfactant: Dioctyl sodium sulfosuccinate (MONAWET MO-84R2W®)
- Antioxidants Propyl gallate (TENOX PG®) or Ethoxyquin
- Organic acids Citric, tartaric or glycolic

Example 6

Table 4 below shows stability improvement of formulations containing GA₄ and GA₇ with ethoxyquin or propyl gallate antioxidant in GA4A7 or GA4A7/6-BA or/and CPPU liquid formulations Components for the formulations are shown Storage stability data shows most formulations containing antioxidant have excellent storage stability Significant stability improvement of GA4 and GA7 were achieved by adding 05- 1% propyl gallate or 5% ethoxyquin antioxidant in 4% GA4A7 and 6-BA/CPPU plus 2% GA4A7 liquid formulations

Table 4
Stability Improvement of GA4A7 Liquid Formulations

Ingredients, wt%	YW-28-1	-2	-3	-4	YW-24-1	-4	-5
GA4A7 (88.9%) (55-412-CD lot)	4.5	4.5	4.5	4.5	2.0	2.0	2.0
6-Benzyladenine (88.5%)					1.9	1.9	1.9
Forchlorfenuron (88.8%)					.45	.45	.45
Citric acid, Anhydrous		5			.5	5	.5
Propyl gallate							
TENOX 33® (20%+ Citric acid)			.5				
TENOX PG® (88.2%)						.05	.05
Ethoxyquin							
Butoxyquin (98%)				5			
Alcohol ethoxylate							
TOMADOL 25-7®						7.5	5.25
Dioctyl sulfosuccinate							
MONAWET MO-84R2W® (84%)							2.25
Propylene glycol				Balance			
Storage Stability							
Initial assays (wt%)							
GA4	-	-	-	2.9	1.2		-
GA7	-	-	-	1.1	.48		-
8.5 mo. (25-40C)							
GA4	2.58	2.80	2.81	2.87	1.04	1.27	1.28
Remaining	88%	90%	97%	98%	83%	102%	101%
GA7	.84	.83	.89	1.03	.38	.48	.45
Remaining	78%	87%	81%	83%	77%	100%	87%

All references cited are hereby incorporated by reference

The present invention is illustrated by way of the foregoing description and examples. The foregoing description is intended as a non-limiting illustration, since many variations will become apparent to those skilled in the art in view thereof. It is intended that all such variations within the scope and spirit of the appended claims be embraced thereby.

Changes can be made in the composition, operation and arrangement of the method of the present invention described herein without departing from the concept and scope of the invention as defined in the following claims.

Claims

We claim

1 A composition comprising a plant growth regulator and an acid solubilizer selected from the group consisting of citric acid, tartaric acid and glycolic acid

2 The composition of claim 1 wherein the plant growth regulator is selected from the group consisting of gibberellins, auxins, cytokinins, organic acids, ethylene biosynthesis inhibitors and combinations thereof

3 The composition of claim 2 wherein the plant growth regulator is cytokinin or cytokinin and gibberellin combinations

4 The composition of claim 3 wherein the cytokinin is selected from the group consisting of 6-benzyl adenine and forchlorfenuron and the gibberellin is GA3 or GA4A7

5 The composition of claim 1 further comprising a solvent.

6 The composition of claim 5 wherein the solvent is a propylene glycol

7 The composition of claim 1 further comprising an antioxidant

8 The composition of claim 7 wherein the antioxidant is selected from the group consisting of propyl gallate, ethoxyquin, butylated hydroxyanisole, butylated hydroxytoluene and tertiary butylhydroquinone

9 The composition of claim 1 further comprising at least one surfactant.

10 The composition of claim 9 wherein the surfactant is selected from the group consisting of ethoxylated alkyl alcohols, dioctyl sodium sulfosuccinates, ethoxylated fatty acids, ethoxylated vegetable oils, glycol esters, sorbitan fatty acid esters, ethoxylated sorbitan fatty acid esters and combinations thereof

11 The composition of claim 1 wherein the plant growth regulator is benzyadenine and the solubilizer is anhydrous citric acid

12 The composition of claim 1 wherein said composition is diluted in water

13 A composition comprising benzyadenine, anhydrous citric acid, ethoxylated alcohols, propyl gallate and propylene glycol

14 The composition of claim 13 having from about 1.5 to about 3.0 weight percent 6-benzyladenine, from about 1.5 to about 3.0 weight percent anhydrous citric acid, from about 3.5 to about 5.5 weight percent ethoxylated alcohols, from about 0.05 to about 0.20 weight percent propyl gallate and from about 91.00 to about 93.00 weight percent propylene glycol

15 The composition of claim 14 having about 1.93 weight percent 6-benzyladenine, about 2.0 weight percent anhydrous citric acid, about 4.0 weight percent ethoxylated alkyl alcohols, about 0.1 weight percent propyl gallate and about 91.97 weight percent propylene glycol

16 A ready-to-mix formulation comprising the an inert composition comprising the composition of claim 15

17 The ready-to-mix formulation of claim 16 further comprising an insecticide, a herbicide, a fungicide, or combinations thereof

18 A method of regulating plant growth comprising the step of treating a

seed, soil or a plant with an effective growth-regulating amount of a composition of claim 1

19 The method of claim 18 wherein said plant is a fruit-producing plant

20 The method of claim 19 wherein said fruit-producing plant is selected from the group consisting of grapes, apples, pistachio, cherries, lemons, limes, oranges and tangerines

21 The method of claim 18 wherein said composition is diluted with water and spray applied

22 The method of claim 21 wherein said composition is diluted with water and spray applied

23 A method of preparing a soluble liquid plant growth regulator formulation comprising the step of mixing a plant growth regulator with a acid solubilizer selected from the group consisting of citric acid, tartaric acid and glycolic acid, an antioxidant and solvent to produce a homogeneous mixture

24 A composition comprising a plant growth regulator and an ethoxylated alcohol surfactant and a solvent

25 The composition of claim 24 wherein the plant growth regulator is forchlorfenuron and the ethoxylated alcohol surfactant is C12-15 alkyl alcohol and the solvent is propylene glycol

26 The composition of claim 25 further comprising anhydrous citric acid

27 The composition of claim 26, wherein the forchlorfenuron is from about 0.5 to 2.0 weight percent, the anhydrous citric acid is from about 0.5 to about 2.0 weight

percent, the C12-15 alkyl alcohol is from about 1.0 to about 3.0 weight percent and the propylene glycol is from about 93.0 to about 98.0 weight percent

28 The composition of claim 27, wherein the forchlorfenuron is about 0.84 weight percent, the anhydrous citric acid is about 0.5 weight percent, the C12-15 alkyl alcohol is about 1.0 weight percent and the propylene glycol is about 97.66 weight percent

percent, the C12-15 alkyl alcohol is from about 1.0 to about 3.0 weight percent and the propylene glycol is from about 93.0 to about 98.0 weight percent.

28 The composition of claim 27, wherein the forchlorfenuron is about 0.84 weight percent, the anhydrous citric acid is about 0.5 weight percent, the C12-15 alkyl alcohol is about 1.0 weight percent and the propylene glycol is about 97.66 weight percent.

Abstract

Soluble and stable liquid compositions containing a plant growth regulator selected from the group consisting of cytokinin and a gibberellin, an acid solubilizer such as citric acid, tartaric acid or glycolic acid and a solvent, as well as methods for making and using the composition are disclosed. The compositions improve solubility, handling, stability, safety, as well as activity improvements such as improved plant growth, yield, fruit thinning or sizing and quality. The compositions are soluble and stable by adding an ethoxylated alkyl alcohol wherein the growth regulator is 6-benzyladenine (6-BA) or forchlorfenuron (CPPU) and the ethoxylated alcohol surfactant is C12-15 alkyl alcohol in propylene glycol. The compositions may also contain a cytokinin such as 6-benzyladenine (6-BA) or forchlorfenuron (CPPU) that is increased in solubility and activity and by synergistically combined with GA₃ or GA₄A₇ as well as in storage stability by adding an antioxidant. The compositions are formulated in a ready-to-mix formulation.

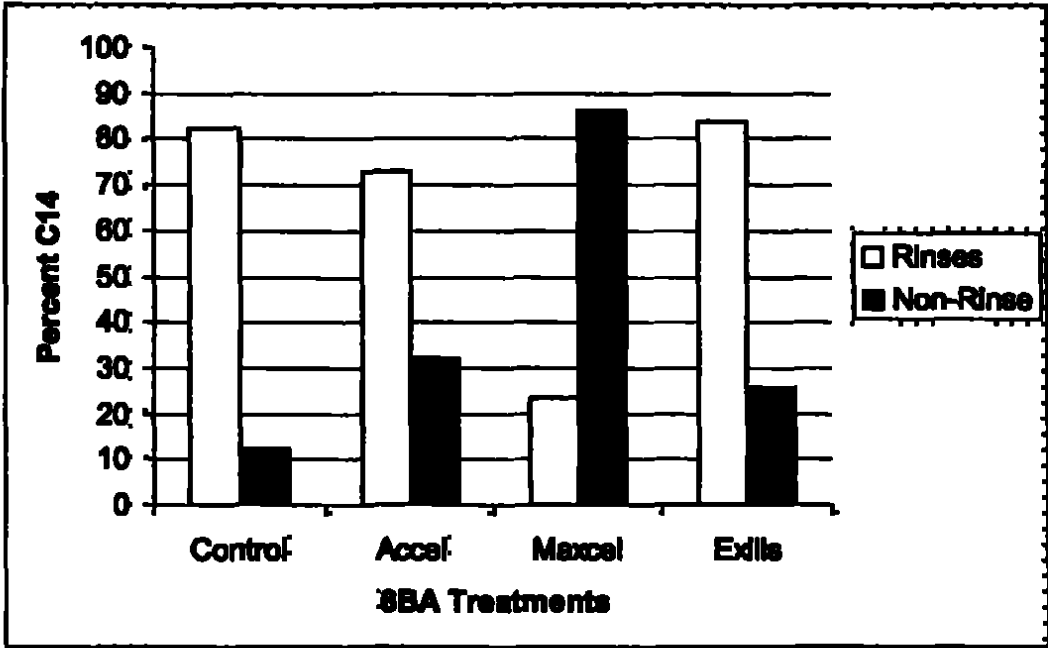


Figure 1