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ENTRADA EN FASE NACIONAL

21 **EXPEDIENTE No** 05-53780

54 **TITULO** METODO DE PROTEGER SEMILLAS TRATADAS CON UN AGENTE FITOTOXICO

51 **CLASIFICACION INTERNACIONAL**

71 **SOLICITANTE** MONSANTO TECHNOLOGY LLC

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FORMULARIO ÚNICO DE SOLICITUD DE PATENTE

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1 SOLICITUD DE:

☒ Patente de Invención. ☐ Patente de Modelo de Utilidad.

☐ Capítulo I. ☒ Capítulo II.

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10 ANEXOS

- [x] Comprobante de pago de la tasa de presentación de la solicitud. $443.000
- [x] Documento que acredita la existencia y representación legal cuando el solicitante sea persona jurídica.
- [x] Poderes, si fuere el caso **Fotocopia autenticada**
- [ ] Documento de cesión del inventor al solicitante o a su causante.
- [ ] Declaraciones
- [x] Copia de la solicitud internacional. (Resumen, descripción, reivindicaciones, dibujos)
- [x] Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicaciones, dibujos)
- [x] Copia del examen preliminar efectuado por la IPEA.
- [x] Traducción del examen preliminar efectuado por la IPEA.
- [ ] De ser el caso, copia del contrato de acceso
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- [ ] De ser el caso, certificado de depósito del material biológico
- [ ] Arte final 12x12.
- [ ] De ser el caso, información sobre otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionadas parcial o totalmente con la invención de esta solicitud
- [x] Reivindicaciones Modificadas

Otros Tarjeta de Propietarios
Documento de Prioridad

11 FIGURA CARACTERÍSTICA:

12 Solicito la concesión de la patente,

NOMBRE: JUAN PABLO CADENA SARMIENTO

FIRMA:

C.C. 80.410.337 de Usaquén T.P. 57492 del C.S.J.

Instrucciones para la presentación de los anexos, ver reverso de esta página

3

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WO 2004/049778 A1

(54) Title: METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

(57) Abstract: A method of improving germination rate in pesticide-treated plant seeds involves forming a pesticide-free polymer coating on a plant seed before treating the seed with a pesticide, where the type of polymer and the coating thickness are designed to block phytotoxic contact of the pesticide with the seed while allowing sufficient transfer of oxygen to maintain the seed s viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination, and then treating the coated plant seed with a pesticide. Seeds that have been treated by this method, and plants that are grown from the treated seeds are also described.

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

BACKGROUND OF THE INVENTION

CROSS REFERENCE TO RELATED PATENTS AND PATENT APPLICATIONS

[0001] This application claims the benefit of U S Provisional Patent Application Serial No 60/430,572, filed December 3, 2002, which is incorporated by reference herein in its entirety

(1) Field of the Invention

[0002] The present invention relates to a method of protecting seeds that are to be treated with a phytotoxic agent, and in particular, to a method for improving the germination rate of phytotoxic agent-treated seeds Also included are seeds that have been treated by the subject method, and plants that grow from such seeds

(2) Description of the Related Art:

[0003] A significant fraction of plant seed is now treated with one or more agrochemicals, such as pesticides, inoculants, growth factors, and fertilizers, in order to control pests and diseases, to provide nutrients, stimulate germination, and enhance the growth of the seedling Some of the agrochemicals that are useful in controlling pests and diseases can also be toxic to the seed and to the plant that sprouts from the seed Such phytotoxic activity limits the amount of these agrochemicals that can safely be applied to the seed

[0004] One undesirable effect of phytotoxicity is the reduction of the germination rate of seeds that have been treated Typically, the germination rate of seeds that are treated with a phytotoxic agent decreases with time after the agent has been applied, thereby limiting the shelf life of the treated seeds Sometimes extraordinary measures, such as in-field seed treatment, or treatment immediately before planting, are required to avoid serious damage to the crop It has also been recognized that phytotoxic damage to seed by agrochemical agents may be

exacerbated by exposure of the seed to environmental stresses, such as cold, drought, and the like

[0005] Phytotoxicity of agrochemicals has been dealt with in several ways. The inclusion of safeners – chemicals which ameliorate the phytotoxic affects of agrochemicals, such as herbicides – along with the seed, is widely used, but this requires the application of an additional, often expensive, chemical component to the seed

[0006] Another way to overcome the phytotoxic effect is to encapsulate the agrochemical agent in a matrix, often a polymer, which limits the movement of the agent See, *e g*, U S Patent 6,329,319 to Puglisi *et al* This method can limit the contact of the agent with the seed and the emerging seedling, while permitting the agent to become available later during germination and initial plant growth as the agent is released from the polymer matrix. The proper operation of encapsulation technology depends on careful matching of the physical and chemical properties of the agrochemical and the encapsulating matrix. Neither one polymer matrix, nor one encapsulation process, is suitable for encapsulation of all agrochemical agents now in use for seed treatment

[0007] Agrochemical agents can also be included in seed coatings, which can limit the mobility of the agent. See, *e g*, U.S Patent No 6,199,318 to Stewart *et al*, U.S Patent No 5,129,180 to Stewart, U.S Patent No 5,127,185 to Kojimoto *et al*, U S Patent No 5,044,116 to Gago *et al*, and U S Patent No 3,947,906 to Watts However, because the active agent is distributed throughout the coating, some finite amount of the agent, by necessity, comes in contact with the surface of the seed Moreover, like encapsulation, the chemical and physical parameters of the matrix material must be matched with the properties of the active agent in order to obtain the proper homogeneity for the coating and to avoid cracking

[0008] It is known to apply polymer coatings to seeds for the purpose of reducing imbibitional chilling injury See, Nl, B-R, Alleviation of seed imbitional chilling injury using polymer film coating, *British Crop Protection*

Council Symposium Proceedings, No 76, Pp 73-82 (2001), also, Taylor, A G , *Bean Improvement Cooperative, 30*:30-31 (1987), Taylor *et al* , *J Horticultural Sci* , *62*:183-189 (1987), Taylor, A. G and J Kwiatkowski, Polymer film coatings decrease water uptake and water vapor movement into seeds and reduce imbibitional chilling injury, West *et al* , *Crop Science, 25*:941-944 (1985) But the combination of such coatings with subsequent seed treatment with phytotoxic agrochemicals was not described

[0009] It would be useful, therefore, to provide a method for reducing phytotoxic injury to seeds from phytotoxic seed treatment agents, which method can be used with a broad range of agrochemical agents and applied to a broad range of seed types.

SUMMARY OF THE INVENTION

[00010] Briefly, therefore the present invention is directed to a novel method of improving the germination rate of plant seeds which are treated with a phytotoxic agent, the method comprising forming a polymer coating on the plant seed before treating the seed with the phytotoxic agent, where the coating is free of the phytotoxic agent and where the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination, and treating the coated plant seed with the phytotoxic agent

[00011] The present invention is also directed to a novel phytotoxic agent-treated plant seed having an improved germination rate, each seed comprising a plant seed having a phytotoxic agent deposited thereupon, and having a polymer coating which is free of the phytotoxic agent located between the seed and the phytotoxic agent, wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the

seed after planting to maintain the seed's viability and enable its germination

[00012] The present invention is also directed to a novel plant that is grown from a seed that is treated by the method described above

[00013] The present invention is also directed to a novel method of producing an agronomic crop, the method comprising the steps

a. providing plant seeds of the agronomic crop that have been treated by the method described above,

b planting the seeds, and

c cultivating the planted seeds and plants that sprout from the seeds

[00014] Among the several advantages found to be achieved by the present invention, therefore, may be noted the provision of a method for reducing phytotoxic injury to seeds from phytotoxic seed treatment agents, which can be used with a broad range of agrochemical agents and applied to a broad range of seed types

BRIEF DESCRIPTION OF THE DRAWINGS

[00015] Figure 1 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 10μ and 50μ coatings of Vinac XX-210 polymer followed by treatment with a Concep III safener and with imidacloprid at levels of 0, 250 g, 500 g, and 750 g per 100 kg of seeds,

[00016] Figure 2 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment, for seeds having no coating and having 10μ and 50μ coatings of Vinac XX-210 polymer followed by treatment with a Concep III safener and with imidacloprid at levels of 0, 250 g, 500 g, and 750 g per 100 kg of seeds,

[00017] Figure 3 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 5μ coatings of three different Methocel polymers, where the coatings were followed by treatment with a

Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds,

[00018] Figure 4 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment, for seeds having no coating and having 5µ coatings of three different Methocel polymers, where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds,

[00019] Figure 5 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 10µ coatings of either SB-2000 polymer, Vinac XX-210, Maltrin MO40, Airflex 500, or Flexbond 289 polymers, where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds,

[00020] Figure 6 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 5µ coatings of Maltrin MO40, Methocel E3LV, Methocel E50LV, Methocel A15LV, Airflex 500 + 1% talc, Flexbond 289, and 5µ, 10µ, 20µ and 50µ coatings of Vinac XX-210, where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds, and

[00021] Figure 7 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment, for seeds having no coating and having 5µ coatings of Maltrin MO40, Methocel E3LV, Methocel E50LV, Methocel A15LV, Airflex 500 + 1% talc, Flexbond 289, and 5µ, 10µ, 20µ and 50µ coatings of Vinac XX-210, where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00022] In accordance with the present invention, it has been discovered that the germination rate of seeds that are to be treated with a phytotoxic agent can be improved by forming a polymer coating, which is free of the phytotoxic agent, on a plant seed, and then treating the seeds with the agent It is important that the type of polymer that is employed for the coating, and the coating thickness, are designed to block phytotoxic contact of the agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination

[00023] In the present method, the terms "phytotoxic agent" refer to an agricultural active ingredient that is phytotoxic As used herein, the terms "agricultural active ingredient" mean any chemical element, molecule, or compound, or mixture thereof, which has a biological activity in a seed, a plant, or a disease or pest of a seed or plant Such agricultural active ingredients include, but are not limited to, pesticides, herbicides, fertilizers, plant growth regulators, drugs, dyes, biological attractants, scents and pheromones. Therefore, pesticides, herbicides, fertilizers, plant growth regulators, drugs, dyes, biological attractants, scents and pheromones that are phytotoxic are to be included as the phytotoxic agents of the present invention

[00024] As used herein, an agent is "phytotoxic" if it causes harm or damage to a plant or seed with which it comes in contact. Plant and seed damage or harm includes, for example, stunting, chemical burning, yield depression, malformation, discoloration, lack of germination, reduction in germination rate, death, and the like

[00025] The subject method has been found to be especially useful when the phytotoxic agent is a plant growth regulator, a pesticide, or a herbicide Examples of pesticides that can be used as the phytotoxic agent in the present invention are acaricides, miticides, insecticides, insect repellants, fungicides, fungistats, molluscicides, rodenticides, nematicides, and bactericides

[00026] It is known that many of the most useful pesticides, herbicides and plant growth regulators can be phytotoxic if they are allowed to contact plants or seeds, and particularly if they are present in high concentrations Nonetheless, it is often more effective, if not necessary, to provide such agents at high concentrations in order to obtain the maximum benefits that they can offer Consequently, it has been particularly difficult to supply these phytotoxic agents in concentrated form, such as in controlled release granules, coatings, or pellets, due to the harmful effect that the agent can have upon the very seed or plant that it is designed to protect An important property of the present invention is that it permits the use of highly effective actives that are also phytotoxic Moreover, the actives can be used at concentrations that are higher than would be possible without the use of the phytotoxic agent -free polymer coating

[00027] One function of the polymer coating is to reduce phytotoxic contact of the phytotoxic agent with the seed As used herein, the terms "phytotoxic contact" means contact of an amount of an agent with a seed that is sufficient to cause a phytotoxic effect. Because the phytotoxic agent-free polymer coating reduces phytotoxic contact of the agent with the seed, it extends the time that treated seed can be stored Also, the treatment can be carried out at a time well before the seed is planted, preferably at a time that is economically attractive and convenient for the person applying the treatment. By way of example, when seeds are to be treated with a pesticide, the present method can extend the shelf life of pesticide-treated seeds by a factor of three times, or even more Furthermore, the present method makes it possible to treat seeds with significantly higher levels of pesticides than can normally be used without incurring unacceptably low germination rates This can enhance the effectiveness of the pesticide, and extend the time that the pesticide remains active after planting For example, the present method permits the use of two-times, three times, or even higher levels of pesticide, without incurring additional reduction in germination rates for treated seeds

[00028] It is another advantage of the present method that it can be used with a broad range of agrochemical agents, irrespective of their chemical or physical compatibility with the coating polymer The aspect of applying a phytotoxic agent-free polymer coating to the seed before applying a phytotoxic agent eliminates the need for careful matching of the properties of the polymer and the agent

[00029] In the present method, when it is said that a purpose is "improving the germination rate" of plant seed, it is meant that plant seed that have been treated by the present method have a higher germination rate than similar plant seed that have been treated with the same amount and type of phytotoxic agent, but lack the phytotoxic agent-free polymer coating that is a feature of the present method, when both types of seeds are exposed to the same environmental conditions and tested under the same protocol for the measurement of germination rate Methods for the measurement of germination rate are well known to those having skill in the art of seed science, and are described in more detail below

[00030] In the present method, a phytotoxic agent-free polymer coating is formed on a plant seed before treating the seed with the phytotoxic agent. The type of polymer and the coating thickness are designed to reduce phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination After th polymer coating has been formed, the coated seed is treated with a phytotoxic agent. In preferred embodiments, the phytotoxic agent is a pesticide

[00031] Although the subject method can be used to treat the seed of any type of plant, it is preferred that the seed is the seed of an agronomic plant As those terms are used herein, "agronomic plant" refers to any plant that is cultivated by man, or from which is harvested parts or products that are used by man Agronomic plants can be a gymnosperm, a dicotyledon, or a monocotyledon

[00032] Examples of agronomic plants which are useful in the present invention include, without limitation, cereals (wheat, barley, rye, oats, rice, sorghum, related crops, *etc*), beet, pear-like fruits, stone fruits, and soft fruits (apple, pear, plum, peach, Japanese apricot, prune, almond, cherry, strawberry, raspberry, black berry, tomato, pepper, etc), legumes (kidney bean, lentil, pea, soybean), oil plants (rape, canola, mustard, poppy, olive, sunflower, coconut, castor, cocoa bean, peanut, soybean, corn, *etc*), Cucurbitaceae (pumpkin, cucumber, melon, etc), citrus (orange, lemon, grape fruit, mandarin, Watson pomelo (citrus natsudaidai), etc), vegetables (lettuce, cabbage, celery cabbage, Chinese radish, carrot, onion, potato, etc), camphor trees (avocado, cinnamon, camphor, *etc*), corn, tobacco, nuts, coffee, sugar cane, tea, grapevine, hop and banana.

[00033] In preferred embodiments, the agronomic plant can be rice, wheat, barley, rye, corn, potato, carrot, sweet potato, sugar beet, bean, pea, chicory, lettuce, cabbage, cauliflower, broccoli, turnip, radish, spinach, asparagus, onion, garlic, eggplant, pepper, celery, carot, squash, pumpkin, zucchini, cucumber, apple, pear, quince, melon, plum, cherry, peach, nectarine, apricot, strawberry, grape, raspberry, blackberry, pineapple, avocado, papaya, mango, banana, soybean, tomato, sorghum and raspberries, banana and other such edible varieties It is more preferred that the agronomic plant is selected from corn, soybeans, cotton, sorghum, rape (canola), rice, wheat, barley, and rye It is even more preferred that the agronomic plant is corn, soybeans, or cotton

[00034] An initial step in the present method is forming a phytotoxic agent-free polymer coating on a seed Any method that is known in the art of polymer science can be used to accomplish the formation of the coating on the seed In one preferred method, the coating can be formed by providing a seed, and contacting the seed with a polymer The contacting can be carried out in any one of several ways For example, if the polymer is water soluble, a water solution of the polymer can be prepared and the polymer solution can be applied to the seed -- such as by spraying, dipping, misting, or the like For non-water soluble polymers, a

liquid/polymer emulsion of the polymer can be formed, and the emulsion can be applied to the seed It is preferred that the liquid in which the emulsion is formed is water, and, in that case, the emulsion can be referred to as a polymer latex. It is an important feature of the present method that the polymer-containing medium that is used for the application of the polymer to the seed is free of a phytotoxic agent in order that the application of the polymer to the seed results in the formation of a phytotoxic agent-free polymer coating on the seed

[00035] When it is said that the polymer-containing medium, or the polymer coating, are "free of a phytotoxic agent", it is meant that any phytotoxic agent that might be present in the medium or the coating is present at a concentration that is below a phytotoxic level The concentration of a phytotoxic agent is considered to be "below a phytotoxic level" if seed coated with a polymer coating containing the phytotoxic agent provide a warm-germ test germination rate at 30 days (as that test is described below) that is not more than 5% lower than the warm-germ test germination rate of similar seed having a similar polymer coating in which the concentration of the phytotoxic agent is zero

[00036] In preferred embodiments, the polymer coating is applied directly to the seed without intervening material between the coating and the seed.

[00037] It is preferred that the polymer of the subject coating be applied to the seed in the form of a film of a liquid suspension, dispersion or emulsion As used herein, when describing the coating the term "emulsion" will be understood to include all suspensions, dispersions and emulsions. When the liquid in which the polymer is distributed is water, the emulsion can be termed a latex. It will be understood that when the term "film" is used in this specification, it generally applies to the film of the polymer emulsion in liquid form after application to the seed, unless the context suggests otherwise Likewise, the term "coating" applies to the coating on the seed that is formed from the curing of the film When a film containing the polymer is applied to the seed, it is preferred that the film

substantially covers the surface of the seed However, while preferable, such substantial coverage is not required in order to obtain the advantages of the invention

[00038] The polymer is added to the liquid under conditions that an emulsion is formed This can be done by the addition of finely milled particles of the polymer to the liquid, or a liquid/ polymer mixture can be subjected to high shear to form the emulsion Such emulsion-forming techniques are well-known in the art.

[00039] The polymer can be added to the liquid in any amount, but the concentration of the polymer in the emulsion that is used to form the film should be low enough to permit easy handling and application of the emulsion to the seed – such as by spraying – and thorough distribution of the film among the seeds so that the outer surface of each seed is substantially covered However, the concentration should be high enough, when used in combination with the other parameters of seed treatment, to avoid the loss of polymer from the seeds by dripping or pooling of the emulsion It is preferred that the concentration of polymer in the emulsion at the time that a film of the emulsion is applied to the seeds is about 0.5% to about 50%, by weight, more preferred is a concentration of about 0.5% to about 20%, by weight, even more preferred is a concentration of about 2% to about 20%, yet more preferred is a concentration of about 4% to about 15%, by weight, and even more preferred is a concentration of about 5% to about 11%, by weight

[00040] The amount of the polymer emulsion or polymer solution that is added to the seeds is an amount that is sufficient to provide a coating of the desired thickness After the film of the polymer emulsion or solution has been applied to the seed, it is cured to form the polymer coating When it is said that the film is "cured", or when "curing the film" is referred to, what is meant is that a solid coating of the polymer is formed from the polymer in the film Curing is often the result of drying of the liquid from the film, but can also be carried out by chemical reaction, adsorption, sequestration, or other forms of polymer curing that are known in the art

[00041] The subject coating is insoluble in water, as described above, and is present on at least some part of the outer surface of each seed It is preferred that the coating completely cover the outer surface of each seed

[00042] It is preferred that the polymer coating that is formed on the seed comprises a substantial amount of the polymer It is preferred that – after the coating is cured – the polymer coating contains a polymer, or blend of polymers, in an amount of over 10% by weight. An amount of 50% by weight is more preferred, 70% by weight is yet more preferred, and 80% by weight is even more preferred In some instances, it is preferred that the coating consists essentially of the polymer

[00043] If it is desirable, the coating can contain non-phytotoxic materials other than the polymer in order to serve as plasticizers, emulsifiers, stabilizers, fillers, dyes, safeners, and the like Such materials are well known in the art

[00044] A feature of the phytotoxic agent-free polymer coating is that the type of polymer and the coating thickness are designed to reduce phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination

[00045] The types of polymer that are useful for the present coating include polymers that can be processed into an aqueous solution and polymers that can be processed into an aqueous latex emulsion Polymers that form aqueous latex emulsions are preferred It is preferred that the polymers that are used in the present coating can form a film that has good adhesion to the surface of the seed – that is, the cured film adheres sufficiently tightly to the surface of the seed that it does not detach or abrade away during normal processing, storage and handling It is further preferred that the polymers form films that are water insoluble, but have sufficient permeability to moisture and oxygen to maintain seed viability and permit germination when the seed is planted

[00046] Furthermore, it is preferred that the polymer that is used for th present coating be one having a minimum film-forming temperature (MFT) that is lower than a temperature that would harm the seeds being coated It is preferred that the polymer have a MTF of lower than 55°C, more preferred of lower than 30°C, and even more preferred of lower than 25°C Minimum film-forming temperature can be determined according to ASTM procedure No D-2354 See, *e.g*, U S Patent No 6,235,916 B1 In a preferred embodiment, the present method of coating the seed includes exposing the seed to a temperature that is higher than the MTF of the coating polymer in order to obtain an adherent and uniform film having few or no pinholes

[00047] Examples of the types of polymers that can be used in the present invention include water soluble polymers, such as maltodextrins, methylcellulose, ethylcellulose, hydroxypropylcellulose, and hydroxypropyl/methylcellulose, and water dispersible polymers, such as vinyl acetate - ethylene polymers, ethylene-vinyl chloride polymers, vinyl acetate polymers, vinyl-acrylic polymers, starch-based polymers (such as SB-2000), polyvinyl acetate -vinyl chloride polymers, vinyl chloride/ vinyl acetate/ ethylene copolymers, and the like

[00048] A polymer that is useful in the present method is SB 2000, a starch-based functional polymer (available from Seedbiotics, Caldwell, ID), which has been reported to reduce imbibitional chilling injury to seeds when used as a seed coating prior to planting (See, *e g*, Taylor, A. G , *et al*, Polymer film coatings decrease water uptake and water vapour movement into seeds and reduce imbibitional chilling injury, *British Crop Protection Council Symposium Proceedings* No 76 p 215-220 (2001), and Ni, B-R, pp 73-82, in *British Crop Protection Council Symposium Proceedings*, No 76 (2001))

[00049] Other polymers that are suitable for use in the subject method include polymers that can provide temperature-sensitive water permeability, of the type described in U S Patent Nos. 5,120,349, 5,129,180, and 5,387,450

[00050] As described above, the thickness of the phytotoxic agent-free polymer coating, in combination with the type of polymer that is used, is designed to restrict the contact of the phytotoxic agent with the seed, but to permit a certain level of moisture and oxygen transfer The thickness of the phytotoxic agent-free polymer coating refers to the thickness of the polymer coating after it has been cured or dried to form a film In other words, it refers to the thickness of the final coating, rather than to the coating of the polymer-containing solution or emulsion that is applied to the seed

[00051] It has been found that the thickness of the polymer coating in the present invention should be less than about 500 microns It is preferred that the coating thickness is between about 1 micron and about 500 microns, more preferred is between about 1 micron and about 480 microns, yet more preferred is between about 2 microns and about 400 microns, even more preferred is a coating thickness of between about 3 microns and about 300 microns, yet more preferred is between about 5 microns and about 200 microns, even more preferred is a coating thickness of between about 8 microns and about 100 microns, and yet more preferred is between about 10 microns and about 50 microns

[00052] After a polymer coating has been formed on the seed, the coated seed is then treated with a phytotoxic agent. In the present invention, the phytotoxic agent can be any phytotoxic material that is applied to a seed, including, but not limited to, pesticides, fertilizers, growth factors, dyes, and combinations thereof

[00053] In preferred embodiments, the phytotoxic agent comprises one or more pesticides

[00054] Examples of pesticides that are useful in the present method include herbicides, molluscicides, insecticides, nematocides, acaricides, fungicides, bactericides, and mixtures thereof

[00055] The pesticide can be selected from pyrethrins, synthetic pyrethroids, azoles, oxadizine insecticides, neonicotinoids, diazoles, triazoles, strobilurin derivatives, organophosphates, pyrrols, pyrazoles,

phenyl pyrazoles, diacylhydrazines, biological/fermentation products, carbamates, and mixtures thereof

[00056] Examples of the types of materials that are useful as pesticides in the present method include

a a pyrethroid or synthetic pyrethrin Examples of pyrethrins that are useful include 2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of 2,2-dimethyl-3-(2-methylpropenyl)-cyclopropane carboxylic acid, (2-methyl-1-propenyl)-2 methoxy-4-oxo-3-(2-propenyl)-2-cyclopenten-1-yl ester and mixtures of cis and trans isomers thereof Examples of pyrethroids that are useful include (s)-cyano(3-phenoxyphenyl)methyl-4-chloro alpha (1-methylethyl)benzeneacetate (fenvalerate, CAS RN 51630-58-1), (S)-cyano-(3-phenoxyphenyl)methyl (S)-4-chloro-alpha-(1-methylethyl)benzeneacetate (esfenvalerate, CAS RN 66230-04-4), (3-phenoxyphenyl)-methyl(+)cis-trans-3-(2,2-dichoroethenyl)-2,2-dimethylcyclopropanecarboxylate (permethrin, CAS RN 52645-53-1), (±) alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis,trans-3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropane carboxylate (cypermethrin, CAS RN 52315-07-8), (beta-cypermethrin, CAS RN 65731-84-2), (theta cypermethrin, CAS RN 71697-59-1), S-cyano (3-phenoxyphenyl)methyl (±) cis/trans 3-(2,2-dichloroethenyl) 2,2.dimethylcyclopropane carboxylate (zeta-cypermethrin, CAS RN 52315-07-8), (s)-alpha-cyano-3 phenoxybenzyl (1R,3R)-3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate (deltamethrin, CAS RN 52918-63-5), alpha-cyano-3-phenoxybenzyl 2,2,3,3,-tetramethyl cyclopropoanecarboxylate (fenpropathrin, CAS RN 64257-84-7), (RS)-alpha-cyano-3-phenoxybenzyl(R)-2-[2-chloro-4-(trifluoromethyl)anilino]-3-methylbutanoate (tau fluvalinate, CAS RN 102851-06-9), (2,3,5,6-tetrafluoro-4-methylphenyl)methyl-(1-alpha, 3-alpha)-(Z)-(±)-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (tefluthrin, CAS RN 79538-32-2), (±)-cyano (3-phenoxyphenyl)methyl (±)-4-(difluoromethoxy)-alpha-(1-methyl ethyl)benzeneacetate (flucythrinate, CAS RN 70124-77-5), cyano(4-fluoro-3-phenoxyphenyl)methyl 3-[2-chloro-2 (4-chlorophenyl)ethenyl]-2,2-dimethylcyclopropanecarboxylate

(flumethrin, CAS RN 69770-45-2), cyano(4-fluoro-3-phenoxyphenyl) methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanedarboxylate (cyfluthrin, CAS RN 68359-37-5), (beta cyfluthrin, CAS RN 68359-37-5), (transfluthrin, CAS RN 118712-89-3), (S)-alpha-cyano-3-phenoxybenzyl(Z)-(1R-cis)-2,2-dimethyl-3-[2-(2,2,2-trifluoro-trifluoromethyl-ethoxycarbonyl)vinyl]cyclopropane carboxylate (acrinathrin, CAS RN 101007-06-1), (1R cis) S and (1S cis) R enantiomer isomer pair of alpha-cyano-3-phenoxybenzyl-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylate (alpha-cypermethrin, CAS RN 67375-30-8), [1R,3S)3(1'RS)(1',2',2',2'-tetrabromoethyl)]-2,2-dimethylcyclopropanecarboxylic acid (s)-alpha-cyano-3-phenoxybenzyl ester (tralomethrin, CAS RN 66841-25-6), cyano-(3-phenoxyphenyl)methyl 2,2-dichloro-1-(4-ethoxyphenyl)cyclopropane carboxylate (cycloprothrin, CAS RN 63935-38-6), [1α, 3α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl 3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (cyhalothrin, CAS RN 68085-85-8), [1-alpha (s), 3-alpha(z)]-cyano(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (lambda cyhalothrin, CAS RN 91465-08-6), (2-methyl-[1,1'-biphenyl]-3-yl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-cyclopropanecarboxylate (bifenthrin, CAS RN 82657-04-3), 5-1-benzyl-3-furylmethyl-d-cis(1R,3S,E)2,2-dimethyl-3-(2-oxo,-2,2,4,5 tetrahydro thiophenylidenemethyl)cyclopropanecarboxylate (kadethrin, RU15525, CAS RN 58769-20-3), [5-(phenylmethyl)-3-furanyl]-3-furanyl-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropane carboxylate (resmethrin, CAS RN 10453-86-8), (1R-trans)-[5-(phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate (bioresmethrin, CAS RN 28434-01-7), 3,4,5,6-tetrahydro-phthalimidomethyl-(1RS)-cis-trans-chrysanthemate (tetramethrin, CAS RN 7696-12-0), 3-phenoxybenzyl-d,l-cis,trans 2,2-dimethyl-3-(2-methylpropenyl)cyclopropane carboxylate (phenothrin, CAS RN 26002-80-2), (empenthrin, CAS RN 54406-48-3), (cyphenothrin, CAS RN 39515-40-7), (prallethrin, CAS RN 23031-36-9), (imiprothrin, CAS RN

72963-72-5), (RS)-3-allyl-2-methyl-4-oxcyclopent-2-enyl-(1S,3R, 1R,3S)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (allethrin, CAS RN 584-79-2), (bioallethrin, CAS RN 584-79-2), and (ZXI8901, CAS RN 160791-64-0) In preferred embodiments the pyrethroid comprises tefluthrin, lambda cyhalothrin, bifenthrin, permethrin, or cyfluthrin

b an oxidiazine insecticide, such as 5-(2-chloropyrid-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 5-(2-chlorothiazol-5-ylmethyl)-3-methyl-4 nitroiminoperhydro-1,3,5-oxadiazine, 3-methyl-4-nitroimino-5-(1-oxido-3-pyridinomethyl)perhydro-1,3,5-oxadiazine, 5-(2-chloro-1-oxido-5-pyridiniomethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxidiazine, or 3-methyl-5-(2-methylpyrid-5-ylmethyl)-4-nitroiminoperhydro-1,3,5-oxadiazine

c. a neonicotinoid Examples of useful neonicotinoid pesticides include thiamethoxam (CAS RN 153719-23-4), acetamiprid ((E)-N-[(6-chloro-3-pyridinyl)methyl]-N'-cyano-N-methyleneimidamide, CAS RN 135410-20-7), imidacloprid (1-[(6-chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimine, CAS RN 138261-41-3), nitenpyram (N-[(6-chloro-3-pyridinyl)methyl]-N-ethyl-N'-methyl-2-nitro-1,1-ethenediamine, CAS RN 120738-89-8), clothianidin (TI-435 (N-[(2-chloro-5-thiazoyl)methyl]-N'-methyl-N"-nitro,[C(E)]-(9Cl)-guanidine, CAS RN 210880-92-5) In other preferred embodiments, the pesticide comprises a neonicotinoid insecticide, such as imidacloprid, thiamethoxam, clothianidin, dinotefuran, flonicamid, nithiazine, or thiacloprid

d a pyrrol, pyrazole, or phenyl pyrazole, such as chlorfenapyr (4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-trifluoromethylpyrrole-3-carbonitrile, CAS RN 122453-73-0), fenpyroximate ((E)-1,1-dimethylethyl-4[[[(1,3-dimethyl-5-phenoxy-1H pyrazole-4-yl)methylene]amino]oxy]methyl]benzoate, CAS RN 111812-58-9), tebufenpyrad (4-chloro-N[[4-1,1-dimethylethyl)phenyl]methyl]-3-ethyl 1-methyl-1H-pyrazole-5-carboxamide, CAS RN 119168-77-3), or fipronil (5-amino-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4-[(1R,S)-(trifluoromethyl)sulfinyl]-1H-pyrazole-3-carbonitrile, CAS RN 120068-37-3)

e a diacylhydrazine, such as halofenozide (4-chlorobenzoate-2-benzoyl-2-(1,1-dimethylethyl)-hydrazide, CAS RN 112226-61-6), methoxyfenozide (RH-2485, N-tert-butyl-N'-(3-methoxy-o-toluoyl)-3,5-xylohydrazide, CAS RN 161050-58-4), or tebufenozide (3,5-dimethylbenzoic acid 1-(1,1-dimethylethyl)-2-(4-ethylbenzoyl)hydrazide, CAS RN 112410-23-8)

f a triazole, such as amitrole (CAS RN 61-82-5) and triazamate (ethyl-[[1-[(dimethylamino)carbonyl]-3-(1,1-dimethylethyl)-1H-1,2,4-triazol-5-yl]thio]acetate, CAS RN 112143-82-5)

g a biological/fermentation products selected from the group consisting of avermectin (abamectin, CAS RN 71751-41-2) and spinosad (XDE-105, CAS RN 131929-60-7)

h an organophosphate insecticide selected from the group consisting of acephate (CAS RN 30560-19-1), chlorpyrifos (CAS RN 2921-88-2), chlorpyrifos-methyl (CAS RN 5598-13-0), diazinon (CAS RN 333-41-5), fenamiphos (CAS RN 22224-92-6), and malathion (CAS RN 121-75-5)

i a carbamate insecticide selected from the group consisting of aldicarb (CAS RN 116-06-3), carbaryl (CAS RN 63-25-2), carbofuran (CAS RN 1563-66-2), oxamyl (CAS RN 23135-22-0) and thiodicarb (CAS RN 59669-26-0)

j a fungicide, such as a triazole fungicide selected from the group consisting of amitrol, azaconazole, bitertanol, bromuconazole, climbazole, clotrimazole, cyproconazole, diclobutrazol, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, fluotrimazole, flusilazole, flutriafol, furconazole, furconazole-cis, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, paclobutrazol, penconazole, propiconazole, quinconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triazbutil, triticonazole, 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone, and mixtures thereof

k. a fungicide, such as fluquinconazole, simeconazole, tebuconazole, tetraconazole, triticonazole, 1 (4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone, or mixtures thereof In particular, the fungicide can be fluquinconazole, simeconazole, tebuconazole, tetraconazole, triticonazole, or 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone

l a fungicide, such as a diazole selected from the group consisting of imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, and mixtures thereof

m a strobilurin type fungicide, such as azoxystrobin, dimoxystrobin, famoxadone, kresoxim-methyl, metominostrobin, picoxystrobin, pyraclostrobin, trifloxystrobin, or mixtures thereof

In preferred embodiments, the fungicide can be tebuconazole, simeconazole, fludioxonil, fluquinconazole, difenoconazole, 4,5-dimethyl-N-(2-propenyl)-2-(trimethylsilyl)-3-thiophenecarboxamide (silthiofam), hexaconazole, etaconazole, propiconazole, triticonazole, flutriafol, epoxiconazole, fenbuconazole, bromuconazole, penconazole, imazalil, tetraconazole, flusilazole, metconazole, diniconazole, myclobutanil, triadimenol, bitertanol, pyremethanil, cyprodinil, tridemorph, fenpropimorph, kresoxim-methyl, azoxystrobin, ZEN90160, fenpiclonil, benalaxyl, furalaxyl, metalaxyl, R-metalaxyl, ofurace, oxadixyl, carboxin, prochloraz, triflumizole, pyrifenox, acibenzolar-S-methyl, chlorothalonil, cymoaxnil, dimethomorph, famoxadone, quinoxyfen, fenpropidine, spiroxamine, triazoxide, BAS50001F, hymexazole, pencycuron, fenamidone, guazatine, or cyproconazole In more preferred embodiments, the fungicide comprises silthiofam

[00057] When a pesticide is described herein, it is to be understood that the description is intended to include salt forms of the pesticide as well as any isomeric and/or tautomeric form of the pesticide that exhibits the same activity as the form of the pesticide that is described

[00058] The pesticides that are useful in the present method can be of any grade or purity that pass in the trade as such pesticide Other materials that accompany the pesticides in commercial preparations as

impurities can be tolerated in the subject methods and compositions, as long as such other materials do not destabilize the composition or significantly reduce or destroy the activity of any of the pesticide components against a target pest(s) One of ordinary skill in the art of the production of pesticides would be able to readily identify those impurities that can be tolerated and those that cannot

[00059] The phytotoxic agents that are useful in the present invention can be provided in solid or liquid form, and can be provided as emulsions, dispersions, solutions, or in particulate form The phytotoxic agents can be alone or can be in combination with other materials, as long as such other materials do not destabilize, or significantly reduce or destroy the activity of the agent.

[00060] The phytotoxic agent-free polymer coated seed can be treated with the phytotoxic agent, such as a pesticide, by any method that is commonly known or used for treating seeds with a pesticide

[00061] When the phytotoxic agent is a pesticide, the amount of the pesticide that is applied to the seed can be any amount, but is preferably between about 0 5 gm of the pesticide active ingredient / 100 kg of seed and about 2,000 gm / 100 kg of seed, more preferably between about 25 gm and about 1,000 gm / 100 kg of seed, and even more preferably between about 100 gm and about 800 gm / 100 kg of seed

[00062] The phytotoxic agent can be applied to the seed in any form and such forms as capsule suspensions (CS), emulsifiable concentrates (EC), emulsions in oil or water (EO and EW), granules (GR),suspension concentrates (SC), soluble granules (SG), soluble concentrates (SL), soluble powders (SP), and water dispersible granules (WG) are suitable It is preferred to apply the agent to the seed in the form of a flowable liquid The agent can be in a true solution in the liquid, or it can be present as small droplets or particles to form a suspension, dispersion or emulsion Since many pesticides have low water solubility, it is preferred that when water is the liquid, an aqueous dispersion, suspension, or emulsion of the pesticide be used, and that the pesticide be present in the dispersion,

suspension, or emulsion in the form of small particles or droplets As used herein, the term "suspension" will be considered to include any form of liquid containing small particles, and to include the terms dispersion and emulsion

[00063] The particles of pesticide in the liquid suspension can be of any size that permits the suspension to be applied to the seed by any means, such as, for example, by spraying It is preferred that the particles of pesticide in the suspension have a number average nominal size of less than about 10 microns, more preferably of less than about 5 microns, even more preferably of less than about 2 microns, and even more preferably of less than about 1 micron (be "sub-micron" in size) It is believed that the use of such small particles causes the pesticide to form a more stable and homogenous suspension – thereby allowing a more even distribution of the pesticide over the surface of the seed, and that the small particles are less subject to abrasion from the treated seed after the pesticide treatment has been applied

[00064] The phytotoxic agent can be applied to the seed in any type of conventional seed treatment or coating equipment Application in a seed treating machine having the characteristics of a CMS seed coating machine (Vector Corporation, Marion, IA), for example, has been found to be suitable One method that has been found to be successful for applying a phytotoxic agent to seed, is to mill the solid agent to 1 – 2 micron, or to sub-micron, size and then to add the small particles of the agent to water to form an aqueous suspension A mill that is capable of reducing solids to fine particles, such as a Mirco-Jet Pulverizer air mill, available from Fluid Energy Processing and Equipment Company, Hatfield, PA, can be used for the size reduction

[00065] When the phytotoxic agent is a pesticide, the concentration of the pesticide in the suspension should be low enough to permit easy handling and application of the suspension to the coated seed – such as by spraying – and thorough distribution of the pesticide among the coated seeds so that the outer surface of each seed is substantially covered

However, the concentration should be high enough that, when used in combination with the other parameters of seed treatment, to avoid the loss of pesticide from the seeds by dripping or pooling of the treating liquid suspension Pesticide concentrations of between about 0 1% and about 50%, by weight, are useful for such suspensions, preferred are concentrations between about 0.5% and 15%, by weight, even more preferred are concentrations between about 0 6% and about 5%, and yet more preferred are concentrations of the pesticide between about 1% and 3%, by weight of the suspension Sticking agents and dyes can also be added to the pesticide suspension to promote the adherence of the suspension to the coated seeds and to identify the seeds as having been treated

[00066] A desired amount of the suspension of the pesticide can be sprayed onto the seed in, for example, a CMS seed treater, over a period of time that is long enough to permit thorough distribution of the suspension over the seed, but short enough so that the treated seed do not completely dry It is believed that if the treated seed are allowed to remain in a heated seed treater until the suspension is completely dry, the danger of loss of the pesticide by abrasion increases By way of example, when the exit temperature of the heated air circulating through the CMS machine is held to about 95 °F, and the aqueous suspension contains about 1 6% by weight imidacloprid and 8% by weight of a sticking agent, an application time of between about 3 minutes and about 20 minutes is suitable, and an application time of between about 5 and about 15 minutes is preferred

[00067] Seeds that have been treated by the subject method can be stored, handled and planted like any other seeds Similar methods and conditions can be used as are used with any other treated, or non-treated seeds and the same handling and planting equipment can be used that is used for conventional seeds

[00068] The coated and treated seeds of the present invention can be overcoated with one or more coatings applied after the seeds have been

treated with the phytotoxic agent These later coatings can contain dyes, binders, absorbents, and other useful materials, and can be applied for the purpose of safety, protection, abrasion resistance, or the like

[00069] The following examples describe preferred embodiments of the invention Other embodiments within the scope of the claims herein will be apparent to one skilled in the art from consideration of the specification or practice of the invention as disclosed herein It is intended that the specification, together with the examples, be considered to be exemplary only, with the scope and spirit of the invention being indicated by the claims which follow the examples In the examples all percentages are given on a weight basis unless otherwise indicated

GENERAL PROCEDURES

Method of coating seed with a polymer:

[00070] Seeds were coated with polymers in a CMS Seed Treater model PSC-0 5 In the normal procedure, 750 g of corn seed, or 500g of sorghum seed, was added to the revolving drum of the CMS Treater Water soluble polymers that were to be used for the coating were placed into solution in water Non-water soluble polymers were dispersed into water to form a polymer latex dispersion Polymer solutions and polymer latexes that are obtained directly from a supplier can also be used with or without further modification A measured amount of the polymer solution or latex dispersion was sprayed onto the seeds to provide a polymer coating of the thickness that was desired The polymer coating was dried by hot air blowing through the tumbling seed bed to form a cured polymer coating having a certain pre-determined thickness All machine settings were according to the manufacturer's recommendations and within normal limits as would be understood by one having skill in the art of seed coating

Method of treating seed with a pesticide.

[00071] Agrochemical agents, normally a pesticide with a herbicide safener, were applied to polymer-coated seeds in a Hege Model 11 seed treater When a herbicide safener was applied as a part of the seed

treatment regimen, Concep III (having 74 3% fluxofenin as its active ingredient; available from Novartis Crop Protection, Inc , Greensboro, NC) was used

[00072] Seeds to be treated were placed in the bowl of the Hege 11 machine, the Hege motor was turned on and the premixed Concep III and pesticide were applied into the bed of tumbling seed via syringe Mixing was allowed to continue for about 40 sec

Warm germination test:

[00073] This test was used to determine the maximum germination potential of untreated seeds and seeds that were subjected to treatment.

[00074] 50 sheets of regular weight, size 12 in X 18 in, germination testing towels were soaked overnight in 840 ml of tap water 50 seeds were placed on a wet sheet using Hoffman Manufacturing germination trays The sheet with seeds was covered with a second towel and rolled up Four replicates were run for each sample

[00075] The rolled towels were placed in an upright position in a 1000 ml beaker, which was covered with a polyethylene bag to prevent drying The container was placed in an alternating temperature germination incubator set for providing cycles of 20°C for 16 hrs followed by 30°C for 8 hrs

[00076] Final count of germinated seeds was made after 7 days Percent germination was determined as the average number of seeds which had germinated within the test period minus any abnormal seeds, divided by the total number of original seeds, times 100

Cold germination test:

[00077] This test was designed to measure the ability of seeds to germinate under adverse condition associated with high soil moisture, low soil temperature and microbial activity

[00078] A soil mixture was prepared by thoroughly mixing 6 liters of medium grade sand, 6 liter of sifted peat moss, and 1 liter of water One-half inch of the soil mixture was placed in th bottom of a tray and leveled One hundred (100) seeds were placed on top of the soil, and an additional

1/2 in of soil is placed over the seeds and leveled Four replicates, each having 100 seeds were run for each sample

[00079] The containers were placed in a cold (10°C) dark room for 7 days After 7 days containers were moved to a warm (25°C) dark room for 3 days Emerging seedlings were evaluated as either normal or abnormal and counted Germination rate was determined as described above

COMPARATIVE EXAMPLE 1

[00080] This example illustrates the properties of coatings of several polymers formed on corn seeds

[00081] Coatings of 21 different polymers and one wax emulsion were formed on corn seeds by the method described above Table 1 lists the different polymers that were tested and describes the chemical makeup of the polymer the pH of the polymer emulsion, the average particle size of the solids in the emulsion, the glass transition temperature of the polymer (T_g), the minimum film-forming temperature of the polymer (MFT), and the type of surfactant (if any) that was provided with the emulsion by the manufacturer It was noticed that the MFT was roughly related to the T_g for the polymers for which this data was available, but that these values did not always correlate precisely

[00082] Table 2 shows the physical properties of coatings on corn seed that were formed from the polymer emulsions described in Table 1 The moisture content of the seeds after treatment (Water %) was reported, and the quality of the film was analyzed according to three parameters

[00083] The integrity of the coating coverage of the seed was estimated by visual inspection (under magnification if needed) Coverage was rated according to the following scale

+++++ = No visual holes are observed

++++ = There are some small holes on the coating and the size of the holes is about 1 mm or above

+++ = 70-95% of the seed surface is covered with the coating

++ = 50-70% of the seed surface is covered with the coating

+ = <50% of the seed surface is covered with the coating

[00084] The adhesion of the coating to the seed was tested by adhering a piece of Scotch® brand adhesive tape to a part of a seed that was covered by a coating, and then peeling off the tape and determining how much of the coating was removed from the seed The degree of adhesion was described according to the following scale

+++++ = No coating comes off

++++ = 10-20% of the coating from taped area comes off

+++ = 30-50% of the coating from taped area comes off

++ = >50% of the coating from taped area comes off

[00085] The quality of the film (Film) was evaluated by the appearance of the coating on the surface of the seed according to visual inspection (under magnification as needed) The quality was expressed according to the following scale

+++++ = Coherent film having no unfused polymer particles

++++ = Less than 5% of unfused polymer particles

+++ = Unfused polymer particles (20-5%)+ film (80-95%)for the coating covered area.

++ = Unfused polymer particles(50-80%) + film (50-20%) for the coating covered area

+ = Unfused polymer particles on the surface of the seed

[00086] In general, coatings that were formed from Polymer 208, Vinamul 6975, Mowilith LDM2110, Mowilith DM778, Premafresh 50-V, Airflex 4514, Flexbond 381, CP620NA S/B Latex, PB 6820 NA S/A Latex, FC 1040 S/B Latex, and CP 6810 NA S/B Latex provided coating properties that were superior to the other polymers tested

EXAMPLE 1

[00087] This example illustrates the coating of sorghum seeds with polyvinylacetate followed by treatment with different levels of Imidacloprid and fluxofenin safener

[00088] Sorghum seeds were coated with 10 micron and 50 micron thick coatings of polyvinylacetate (Vinac XX-210, available from Air Products as a 55% d s emulsion in water), and then treated with three

different rates of fluxofenin (Concep III, available from Novartis Crop Protection, Inc) and imidacloprid (available as Gaucho 600, containing 48 7% imidacloprid, from Gustafson LLC, Plano, TX) Concep III/ Gaucho rates used were 50 / 250 gram, 100 / 500 gram, and 150 / 750 grams per 100 kg of seeds The germination rate of the seeds was tested by cold germination and warm germination tests on the day that the treatment was administered (T0), and the seeds were then stored at a temperature of 35°C to simulate accelerated aging In the warm germination test, treated seeds and untreated controls were again tested for germination rate after 8 days, (T8), 14 days (T14), 33 days (T33), 120 days (T120), and 161 days (T161) Germination rates obtained from the warm germination test are shown in Figure 1 Germination rates for the cold germination test were determined at approximately the same time intervals and are shown in Figure 2

[00089] Figures 1 and 2 show the effects of time-after-treatment, pesticide treatment rate, and coating thickness on germination in warm and cold germination tests, respectively It was seen that the presence of pesticide on the seed reduced the germination rate in both warm and cold germ tests, and that, without a polymer coating, the reduction in germination rate was more pronounced for cold germination For both warm and cold germination, it was found that increasing pesticide rates markedly reduced the germination rate Seeds having either a 10µ or a 50µ polymer coating prior to pesticide treatment had improved germination rates compared to seeds without any polymer coating Also, the germination rate was increased as the coating thickness was increased from 10µ to 50µ.

[00090] In the warm germination test, at the highest level of pesticide treatment, after 14 days of aging at 35°C, seeds having 50µ coatings had a germination rate of 70% vs 40% for uncoated seeds with the same rate of pesticide treatment In the cold germination test for similar seeds and similar conditions, coated seeds showed germination rates of 60% vs 30% for uncoated seeds

EXAMPLE 2

[00091] This example illustrates the effect of the properties of the polymer coating upon seed germination rate

[00092] Sorghum seeds were first coated as described above with a 5 micron thick coating of different blends of hydroxypropyl cellulose and methyl cellulose, which contained different ratios of hydroxypropyl and methyl groups The polymers used were Methocel E50LV (a 2% w/w solution in water having a viscosity of 40 - 60 mPa at 25°C), Methocel E3LV (a 2% w/w solution in water having a viscosity of 2 4 - 3 6 mPa at 25°C), and Methocel A15LV (a 2% w/w solution in water having a viscosity of 12 - 18 mPa at 25°C) (all available from Dow Chemical Co , Midland, MI, and used as 5% d.s emulsions in water) Coated seeds were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed After treatment, untreated and treated seeds were tested for warm germination and cold germination on the same day as the treatment (T0), and again after accelerated aging at 35°C for 7 days, (T7), 14 days (T14) and 33 days (T33) The resulting data are shown in Figure 3 for the warm germination test, and in Figure 4 for the cold germination test.

[00093] The data for both warm and cold germination tests show that the presence of the pesticide on uncoated seeds reduces the germination rate significantly compared with seeds having no pesticide treatment. At 31 days, for example, the addition of the pesticide causes the warm germination rate to drop from about 86% to about 60%, and the cold germination rate to drop from about 75% to about 49%. The addition of any of the three polymer coatings provided significant protection to the seeds. The coating comprising Methocel E3 LV performed best, while the coating comprising Methocel A15LV performed next best, and the coating comprising Methocel E50LV performed least well of the three, but still provided significant protection over pesticide treated seeds having no polymer coating This order of performance was the same for both the warm germination and the cold germination tests

[00094] Without being bound by this or any other theory, it is believed that the viscosity of the water solutions of these polymers had an effect on the integrity of the films that were produced on the seeds It appeared that coating solutions having lower viscosities provided coatings that performed better than coating solutions that had higher viscosities

EXAMPLE 3

[00095] This example illustrates the effect of the type of polymer used for the coating and the rate of pesticide application upon seed germination rate

[00096] Sorghum seeds (DK40Y 1752 KXM, from DeKalb Genetics) were coated as described above with a 10 micron thick coating of one of five different polymers Control seeds were prepared without any polymer coating The polymers used were SB-2000 (a proprietary, starch-based polymer available from Seedbiotics, Inc , Caldwell, ID), Vinac XX-210 (polyvinlyacetate m polyvinylalcohol-protected emulsion, available from Air Products and Chemicals, Inc , Allentown, PA), Maltrin MO40 (maltodextrin, available from GPC, Inc , Muscatine, IA), Airflex 500 (polyvinylacetate/ethylene copolymer, available from Air Products and Chemicals, Inc , Allentown, PA), and Flexbond 289 (vinylacrylate polymer, available from Air Products and Chemicals, Inc , Allentown, PA) All polymers were used as water emulsions Coated seeds were either left untreated (0x treatment), or were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed (1x treatment) After treatment, untreated and treated seeds were tested for warm germination rate on the same day as the treatment (T0), and again after accelerated aging at 35°C for 7 days, (T7), 15 days (T15), 36 days (T36), 61 days (T61), 93 days (T93, and 124 days (T124) The resulting data are shown in Figure 5

[00097] The data for the warm germination rate test showed that the presence of any of the polymer coatings reduced the germination rate for seeds having no pesticide treatment. The reduction was either negligible (less than about 5% below the germination rate for no coating at 124 days, Flexbond 289, Vinac XX-210), moderate (less than about 8% reduction,

Maltrin MO40), or higher (less than about 10% reduction, SB 2000, Airflex 500) When seeds were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed, the warm germination rate of uncoated seed was reduced from about 87% at 124 days (for non-pesticide treated seed) to just under 70% Seeds coated with 10µ coatings of Vinac XX-210 (having an MTF of about 35°C) and Maltrin MO40 had higher germination rates than uncoated seed, indicating that the polymer coating provided protection for the seed Seeds coated with Airflex 500 (MFT of < 0°C) or Flexbond 289 performed at about the same germination level as uncoated seeds Germination rate of seeds coated with 10µ coatings of SB-2000 (having an MFT of about 50°C) was almost 10% lower than uncoated seeds

[00098] This data indicated that different types of polymers differed in their ability to protect seeds from phytotoxicity of overcoated pesticides when applied to the untreated seed as 10µ coatings

EXAMPLE 4

[00099] This illustrates the effect the thickness and the type of polymer used for seed coating on the warm germination rate of seeds to be treated with a pesticide

[000100] Sorghum seeds (DeKalb DK40Y 1752KXM) were coated as described above with 5µ coatings of one of seven different polymers One of the polymers was used to form three additional coatings of increasing thicknesses – 10µ, 20µ, and 50µ) Control seeds were prepared without any polymer coating (control 1) The polymers used (and the coating thickness) were Maltrin MO40 (5µ), Methocel E3LV (5µ), Methocel E50LV (5µ), Methocel A15LV (5µ), Airflex 500 (5µ + 1% talc), Flexbond 289 (5µ), and Vinac XX-210 (at 5µ, 10µ, 20µ, and 50µ) All polymers were used as water emulsions Coated seeds were either left untreated (control 2), or were treated with Concep III / Gaucho 600 at the rate of 50/250 grams per 100 kg of seed After treatment, untreated and treated seeds were tested for warm germination rate on the same day as the treatment (T0), and

again after accelerated aging at 35°C for 7 days, (T7), 14 days (T14), 31 days (T31), 61 days (T61), and 95 days (T95) The resulting data are shown in Figure 6

[000101] The data for the germination rate test showed that after 95 days of aging, the germination rate of uncoated seeds that were treated with pesticide had dropped to almost 24%, vs about 85% for uncoated and untreated seeds All coated/treated seeds having 5μ polymer coatings had higher germination rates at 95 days than uncoated/treated seeds. In order of improving germination rate at 95 days were coated/treated seeds having coatings of Vinac XX-210 (28% germination), Methocel E50LV (31%), Flexbond 289 (33%), Maltrin MO40 (41%), Methocel A15LV (44%), Airflex 500 + 1% talc (50%), and Methocel E3LV (64 5%) These data illustrated that different types of polymers provided different levels of protections when used at the same coating thickness In general, it appeared that polymers that provided a coating solution or latex having low viscosity and having a low MFT gave better protection that did polymers having a high solution or latex viscosity and a high MFT

[000102] For seeds that had been treated with different coating thicknesses of Vinac XX-210, germination rates were 28 5% for 5μ, 44 5% for 10μ, 38% for 20μ, and 43% for 50μ. This showed that the beneficial effects of coating thickness did not simply increase with increasing coating thickness, but seemed to reach a peak or maximum where further coating thickness did not result in further improvement of protection

EXAMPLE 5

[000103] This illustrates the effect the thickness and the type of polymer used for seed coating on the cold germination rate of seeds to be treated with a pesticide

[000104] This test substantially duplicated Example 4, except that a cold germination test was run on the treated seeds to determine the effects of the coatings under adverse germination/sprouting conditions The resulting data are shown in Figure 7

[000105] Compared with warm germination, the cold germination test resulted in lower overall germination rates at the end of the test (94 days) Germination rate for uncoated/untreated control was about 60% vs 14% for uncoated/treated seeds All coatings, except one, provided protection for the seed and resulted in higher germination rates In order of improved germination rates, the performance was Vinac XX-210 (10% germination), Methocel E50LV (14%), Flexbond 289 (15%), Maltrin MO40 (23 5%), Methocel A15LV (26%), and Methocel E3LV (34.5%) This was the same ranking as found in the warm germination test, and indicated that polymer properties that determined suitability for the present use did not vary disproportionately, as between the polymers tested, over the temperature range spanned by the warm and cold germination tests In other words, polymers that work well at warm temperatures also seem to work well at cold temperatures

[000106] For seeds that had been treated with different coating thicknesses of Vinac XX-210, germination rates were 10% for 5μ, 18% for 10μ, 16% for 20μ, and 22 5% for 50μ. As in Example 4, this showed that the beneficial effects of coating thickness did not simply increase with increasing coating thickness, but seemed to reach a plateau where further coating thickness did not result in significant further improvement of protection

[000107] All references cited in this specification, including without limitation all papers, publications, patents, patent applications, presentations, texts, reports, manuscripts, brochures, books, internet postings, journal articles, periodicals, and the like, are hereby incorporated by reference into this specification in their entireties The discussion of the references herein is intended merely to summarize the assertions made by their authors and no admission is made that any reference constitutes prior art. Applicants reserve the right to challenge the accuracy and pertinency of the cited references

[000108] In view of the above, it will be seen that the several advantages of the invention are achieved and other advantageous results obtained

[000109] As various changes could be made in the above methods and compositions without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense

WHAT IS CLAIMED IS

1 A method of improving the germination rate of plant seeds which are treated with a phytotoxic agent,
the method comprising

forming a polymer coating on the plant seed before treating the seed with the phytotoxic agent, where the coating is free of the phytotoxic agent and where the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination, and

treating the coated plant seed with the phytotoxic agent.

2 The method according to claim 1, wherein the coating comprises a polymer in an amount of over 10% by weight.

3 The method according to claim 2, wherein the coating comprises a polymer in an amount of at least about 50% by weight

4 The method according to claim 1, wherein the coating thickness is between about 1 micron and about 480 microns

5 The method of claim 1, wherein the polymer is one having a minimum film-forming temperature of lower than 55°C

6 The method of claim 5, wherein the polymer comprises a material selected from the group consisting of maltodextrin, methylcellulose, ethylcellulose, hydroxypropylcellulose, hydroxypropyl/methylcellulose, vinyl acetate - ethylene polymers, ethylene-vinyl chloride polymers, vinyl acetate polymers, vinyl-acrylic polymers, starch-based polymers, SB-2000, polyvinyl acetate -vinyl chloride polymers, vinyl chloride/ vinyl acetate/ ethylene copolymers, styrene-acrylate copolymers, vinylacetate polymers, vinylbutyrate polymers, styrene-vinylbutyrate copolymers, acrylate polymers, styrene-butadiene copolymers, vinylacetate-vinylbutyrate copolymers, vinylacetate-vinylversatate copolymers and polyvinylalcohol

7 The method of claim 5, wherein the polymer comprises polyvinylacetate

8 The method of claim 5, wherein the polymer comprises methocel

9 The method of claim 1, wherein the seed is the seed of an agronomic plant which selected from the group consisting of cereals (wheat, barley, rye, oats, rice, sorghum, related crops, etc), beet, pear-like fruits, stone fruits, and soft fruits (apple, pear, plum, peach, Japanese apricot, prune, almond, cherry, strawberry, raspberry, black berry, tomato, pepper, etc), legumes (kidney bean, lentil, pea, soybean), oil plants (rape, canola, mustard, poppy, olive, sunflower, coconut, castor, cocoa bean, peanut, soybean, corn, etc), Cucurbitaceae (pumpkin, cucumber, melon, etc), citrus (orange, lemon, grape fruit, mandarin, Watson pomelo (citrus natsudaidai), etc), vegetables (lettuce, cabbage, celery cabbage, Chinese radish, carrot, onion, potato, etc), camphor trees (avocado, cinnamon, camphor, etc), corn, tobacco, nuts, coffee, sugar cane, tea, grapevine, hop and banana.

10 The method of claim 9, wherein the agronomic plant is selected from the group consisting of rice, wheat, barley, rye, corn, potato, carrot, sweet potato, sugar beet, bean, pea, chicory, lettuce, cabbage, cauliflower, broccoli, turnip, radish, spinach, asparagus, onion, garlic, eggplant, pepper, celery, canot, squash, pumpkin, zucchini, cucumber, apple, pear, quince, melon, plum, cherry, peach, nectarine, apricot, strawberry, grape, raspberry, blackberry, pineapple, avocado, papaya, mango, banana, soybean, tomato, sorghum and raspberries, banana and other such edible varieties

11 The method of claim 10, wherein the agronomic plant is selected from corn, soybeans, cotton, sorghum, rape (canola), rice, wheat, barley, and rye

12 The method of claim 10, wherein the agronomic plant is corn, soybeans, or cotton

13 The method of claim 1, wherein the phytotoxic agent is selected from the group consisting of pesticides, fertilizers, plant growth regulators, drugs, dyes, biological attractants, scents, pheromones, and mixtures thereof

14 The method of claim 1, wherein the phytotoxic agent comprises a pesticide selected from the group consisting of herbicides, molluscicides, insecticides, nematocides, acaricides, fungicides, bactericides, and mixtures thereof

15 The method of claim 14, wherein the pesticide is selected from the group consisting of pyrethrins, synthetic pyrethroids, azoles, oxadizine insecticides, neonicotinoids, diazoles, triazoles, strobilurin derivatives, organophosphates, pyrrols, pyrazoles, phenyl pyrazoles, diacylhydrazines, biological/fermentation products, carbamates, and mixtures thereof

16 The method of claim 14, wherein the pesticide comprises an insecticide

17 The method of claim 16, wherein the insecticide comprises a pyrethroid or synthetic pyrethrin

18 The method of claim 17, wherein the pyrethrin comprises a member selected from the group consisting of 2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of 2,2-dimethyl-3-(2-methylpropenyl)-cyclopropane carboxylic acid, (2-methyl-1-propenyl)-2-methoxy-4-oxo-3-(2-propenyl)-2-cyclopenten-1-yl ester and mixtures of cis and trans isomers thereof

19 The method of claim 17, wherein the pyrethroid comprises a member selected from the group consisting of (s)-cyano(3-phenoxyphenyl)methyl-4-chloro alpha (1-methylethyl)benzeneacetate (fenvalerate, CAS RN 51630-58-1), (S)-cyano-(3-phenoxyphenyl)methyl (S)-4-chloro-alpha-(1-methylethyl)benzeneacetate (esfenvalerate, CAS RN 66230-04-4), (3-phenoxyphenyl)-methyl(+)cis-trans-3-(2,2-dichoroethenyl)-2,2-dimethylcyclopropanecarboxylate (permethrin, CAS RN 52645-53-1), (±) alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis,trans-3-(2,2-

dichloroethenyl)-2,2-dimethyl-cyclopropane carboxylate (cypermethrin, CAS RN 52315-07-8), (beta-cypermethrin, CAS RN 65731-84-2), (theta cypermethrin, CAS RN 71697-59-1), S-cyano (3-phenoxyphenyl)methyl (±) cis/trans 3-(2,2-dichloroethenyl) 2,2 dimethylcyclopropane carboxylate (zeta-cypermethrin, CAS RN 52315-07-8), (s)-alpha-cyano-3-phenoxybenzyl (1R,3R)-3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate (deltamethrin, CAS RN 52918-63-5), alpha-cyano-3-phenoxybenzyl 2,2,3,3,-tetramethyl cyclopropoanecarboxylate (fenpropathrin, CAS RN 64257-84-7), (RS)-alpha-cyano-3-phenoxybenzyl(R)-2-[2-chloro-4-(trifluoromethyl)anilino]-3-methylbutanoate (tau-fluvalinate, CAS RN 102851-06-9), (2,3,5,6-tetrafluoro-4-methylphenyl)methyl-(1-alpha, 3-alpha)-(Z)-(±)-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (tefluthrin, CAS RN 79538-32-2), (±)-cyano (3-phenoxyphenyl)methyl (±)-4-(difluoromethoxy)-alpha-(1-methyl ethyl)benzeneacetate (flucythrinate, CAS RN 70124-77-5), cyano(4-fluoro-3-phenoxyphenyl)methyl 3-[2-chloro-2-(4-chlorophenyl)ethenyl]-2,2-dimethylcyclopropanecarboxylate (flumethrin, CAS RN 69770-45-2), cyano(4-fluoro-3-phenoxyphenyl) methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanedarboxylate (cyfluthrin, CAS RN 68359-37-5), (beta cyfluthrin, CAS RN 68359-37-5), (transfluthrin, CAS RN 118712-89-3), (S)-alpha-cyano-3-phenoxybenzyl(Z)-(1R-cis)-2,2-dimethyl-3-[2-(2,2,2-trifluoro-trifluoromethyl-ethoxycarbonyl)vinyl]cyclopropane carboxylate (acrinathrin, CAS RN 101007-06-1), (1R cis) S and (1S cis) R enantiomer isomer pair of alpha-cyano-3-phenoxybenzyl-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylate (alpha-cypermethrin, CAS RN 67375-30-8), [1R,3S)3(1'RS)(1',2',2',2'-tetrabromoethyl)]-2,2-dimethylcyclopropanecarboxylic acid (s) alpha-cyano-3-phenoxybenzyl ester (tralomethrin, CAS RN 66841-25-6), cyano-(3-phenoxyphenyl)methyl 2,2-dichloro-1-(4-ethoxyphenyl)cyclopropane carboxylate (cycloprothrin, CAS RN 63935-38-6), [1α, 3α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl 3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate

(cyhalothrin, CAS RN 68085-85-8), [1-alpha (s), 3-alpha(z)]-cyano(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (lambda cyhalothrin, CAS RN 91465-08-6), (2-methyl-[1,1'-biphenyl]-3-yl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-cyclopropanecarboxylate (bifenthrin, CAS RN 82657-04-3), 5-1-benzyl-3-furylmethyl-d-cis(1R,3S,E)2,2-dimethyl-3-(2-oxo,-2,2,4,5 tetrahydro thiophenylidenemethyl)cyclopropanecarboxylate (kadethrin, RU15525, CAS RN 58769-20-3), [5-(phenylmethyl)-3-furanyl]-3-furanyl-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropane carboxylate (resmethrin, CAS RN 10453-86-8), (1R-trans)-[5-(phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate (bioresmethrin, CAS RN 28434-01-7), 3,4,5,6-tetrahydro-phthalimidomethyl (1RS)-cis-trans-chrysanthemate (tetramethrin, CAS RN 7696-12-0), 3-phenoxybenzyl-d,l-cis,trans 2,2-dimethyl-3-(2-methylpropenyl)cyclopropane carboxylate (phenothrin, CAS RN 26002-80-2), (empenthrin, CAS RN 54406-48-3), (cyphenothrin, CAS RN 39515-40-7), (prallethrin, CAS RN 23031-36-9), (imiprothrin, CAS RN 72963-72-5), (RS)-3-allyl-2-methyl-4-oxcyclopent-2-enyl-(1S,3R, 1R,3S)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (allethrin, CAS RN 584-79-2), (bioallethrin, CAS RN 584-79-2), and (ZXI8901, CAS RN 160791-64-0)

19 The method of claim 17, wherein the pyrethroid comprises a member selected from the group consisting of tefluthrin, lambda cyhalothrin, bifenthrin, permethrin and cyfluthrin

20 The method of claim 15, wherein the pesticide comprises an oxidiazine insecticide that is selected from the group consisting of 5-(2-chloropyrid-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 5-(2-chlorothiazol-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 3-methyl-4-nitroimino-5-(1-oxido-3-pyridinomethyl)perhydro-1,3,5-oxadiazine, 5-(2-chloro-1-oxido-5-pyridiniomethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxidiazine, and 3-methyl-5-(2-methylpyrid-5-ylmethyl)-4-nitroiminoperhydro-1,3,5-oxadiazine

21 The method of claim 15, wherein the pesticide comprises a neonicotinoid insecticide that is selected from the group consisting of acetamiprid, imidacloprid, thiamethoxam, clothianidin, dinotefuran, flonicamid, nithiazine, and thiacloprid

22 The method of claim 15, wherein the pesticide comprises a neonicotinoid that is selected from the group consisting of thiamethoxam (CAS RN 153719-23-4), *acetamiprid* ((E)-N-[(6-chloro-3-pyridinyl)methyl]-N'-cyano-N-methylenelmidamide, CAS RN 135410-20-7), imidacloprid (1-[(6-chloro-3-pyridinyl)methyl] N-nitro-2-imidazolidinimine, CAS RN 138261-41-3), nitenpyram (N-[(6-chloro-3-pyridinyl)methyl]-N-ethyl N'-methyl-2-nitro-1,1-ethenediamine, CAS RN 120738-89-8), clothianidin (TI-435 (N-[(2-chloro-5-thiazoyl)*methyl*]-N'-*methyl*-N"-*nitro*,[C(E)]-(9Cl)-guanidine, CAS RN 210880-92-5)

23 The method of claim 15, wherein the pesticide comprises a pyrrol, pyrazole, or phenyl pyrazole that is selected from the group consisting ofchlorfenapyr (4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-trifluoromethylpyrrole-3-carbonitrile, CAS RN 122453-73-0), *fenpyroximate* ((E)-1,1-dimethylethyl-4[[[[(1,3-dimethyl-5-phenoxy-1H-pyrazole-4-yl)methylene]amino]oxy]methyl]benzoate, CAS RN 111812-58-9), tebufenpyrad (4-chloro-N[[4-1,1-dimethylethyl)phenyl]methyl]-3-ethyl-1-methyl-1H-pyrazole-5-carboxamide, CAS RN 119168-77-3), and fipronil (5-amino-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4-[(1R,S)-(trifluoromethyl)sulfinyl]-1H-pyrazole-3-carbonitrile, CAS RN 120068-37-3)

24 The method of claim 15, wherein the pesticide comprises a diacylhydrazine that is selected from the group consisting of halofenozide (4-chlorobenzoate-2-benzoyl 2-(1,1-dimethylethyl)-hydrazide, CAS RN 112226-61-6), *methoxyfenozide* (RH-2485, N-tert-butyl-N'-(3-methoxy-o-toluoyl)-3,5-xylohydrazide, CAS RN 161050-58-4), and tebufenozide (3,5-dimethylbenzoic acid 1-(1,1-dimethylethyl)-2-(4-ethylbenzoyl)hydrazide, CAS RN 112410-23-8)

25 The method of claim 15, wherein the pesticide comprises a triazole selected from the group consisting of amitrole (CAS RN 61-82-5)

and riazamate (ethyl-[[1-[(dimethylamino)carbonyl]-3-(1,1-dimethylethyl)-1H-1,2,4-triazol-5-yl]thio]acetate, CAS RN 112143-82-5)

26 The method of claim 15, wherein the pesticide comprises a biological/fermentation products selected from the group consisting of avermectin (abamectin, CAS RN 71751-41-2) and spinosad (XDE-105, CAS RN 131929-60-7)

27 The method of claim 15, wherein the pesticide comprises an organophosphate insecticide selected from the group consisting of acephate (CAS RN 30560-19-1), chlorpyrifos (CAS RN 2921-88-2), chlorpyrifos-methyl (CAS RN 5598-13-0), diazinon (CAS RN 333-41-5), fenamiphos (CAS RN 22224-92-6), and malathion (CAS RN 121-75-5)

28 The method of claim 15, wherein the pesticide comprises a carbamate insecticide selected from the group consisting of aldicarb (CAS RN 116-06-3), carbaryl (CAS RN 63-25-2), carbofuran (CAS RN 1563-66-2), oxamyl (CAS RN 23135-22-0) and thiodicarb (CAS RN 59669-26-0)

29 The method of claim 14, wherein the pesticide comprises a fungicide

30 The method of claim 29, wherein the fungicide comprises a triazole fungicide selected from the group consisting of amitrol, azaconazole, bitertanol, bromuconazole, climbazole, clotrimazole, cyproconazole, diclobutrazol, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, fluotrimazole, flusilazole, flutriafol, furconazole, furconazole-cis, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, paclobutrazol, penconazole, propiconazole, quinconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triazbutil, triticonazole, 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone, and mixtures thereof

31 The method according to claim 29, wherein the fungicide comprises fluquinconazole, simeconazole, tebuconazole, tetraconazole, triticonazole, 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone, or mixtures thereof

32 The method according to claim 29, wherein the fungicide comprises fluquinconazole

33 The method according to claim 29, wherein the fungicide comprises simeconazole

34 The method according to claim 29, wherein the fungicide comprises tebuconazole

35 The method according to claim 29, wherein the fungicide comprises tetraconazole

36 The method according to claim 29, wherein the fungicide comprises triticonazole

37 The method according to claim 29, wherein the fungicide comprises 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone

38 The method according to claim 29, wherein the fungicide comprises a diazole selected from the group consisting of imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, and mixtures thereof

39 The method according to claim 29, wherein the fungicide comprises a strobilurin type fungicide selected from the group consisting of azoxystrobin, dimoxystrobin, famoxadone, kresoxim-methyl, metominostrobin, picoxystrobin, pyraclostrobin, trifloxystrobin, and mixtures thereof

40 The method according to claim 29, wherein the fungicide comprises a member selected from the group consisting of tebuconazole, simeconazole, fludioxonil, fluquinconazole, difenoconazole, 4,5-dimethyl-N-(2-propenyl)-2-(trimethylsilyl)-3-thiophenecarboxamide (silthiofam), hexaconazole, etaconazole, propiconazole, triticonazole, flutriafol, epoxiconazole, fenbuconazole, bromuconazole, penconazole, imazalil, tetraconazole, flusilazole, metconazole, diniconazole, myclobutanil, triadimenol, bitertanol, pyrimethanil, cyprodinil, tridemorph, fenpropimorph, kresoxim-methyl, azoxystrobin, ZEN90160, fenpiclonil, benalaxyl, furalaxyl, metalaxyl, R-metalaxyl, ofurace, oxadixyl, carboxin, prochloraz, triflumizole, pyrifenox, acibenzolar-S-methyl, chlorothalonil, cymoaxnil, dimethomorph, famoxadone, quinoxyfen, fenpropidine,

spiroxamine, triazoxide, BAS50001F, hymexazole, pencycuron, fenamidone, guazatine, and cyproconazole

41 The method according to claim 29, wherein the fungicide comprises silthiofam

42 The method according to claim 29, wherein the pesticide comprises silthiofam and the polymer comprises polyvinylacetate

43 The method according to claim 14, wherein the pesticide comprises silthiofam and the polymer comprises methocel

44 The method according to claim 1, wherein the treatment comprises the steps

a providing a seed,

b contacting the seed with a latex comprising the polymer;

c forming a polymer coating on the seed before treating the seed with a phytotoxic agent, wherein the coating is free of the phytotoxic agent and wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination, and

d contacting the polymer coated seed with the phytotoxic agent.

45 The method according to claim 44, wherein the polymer coating is applied so that it directly contacts the seed without intervening material between the coating and the seed.

46 Phytotoxic agent-treated plant seed having an improved germination rate, each seed comprising a plant seed having a phytotoxic agent deposited thereupon, and having a polymer coating which is free of the phytotoxic agent located between the seed and the phytotoxic agent, wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental

conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination

47 A plant that is grown from a seed that is treated by the method according to claim 1

48 A method of producing an agronomic crop, the method comprising the steps

a providing plant seeds of the agronomic crop that have been treated by the method according to claim 1,

b planting the seeds, and

c cultivating the planted seeds and plants that sprout from the seeds

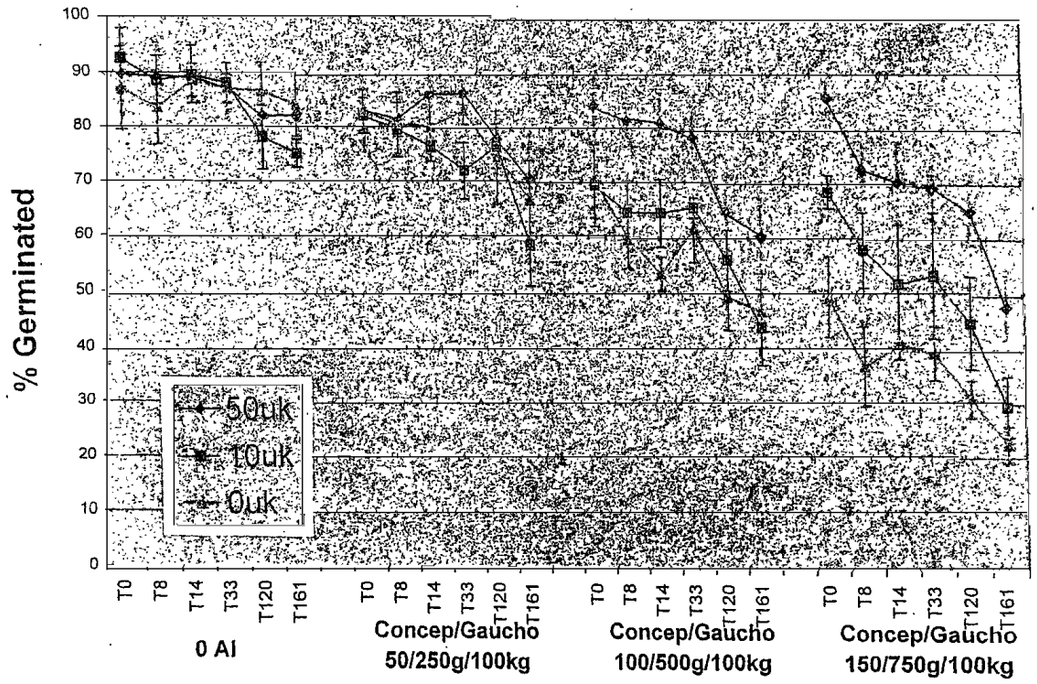

% Germinated
100
90
80
70
60
50
40
30
20
10
0
50uk
10uk
0uk
T0
T8
T14
T33
T120
T161
0 AI
Concep/Gaucho
50/250g/100kg
Concep/Gaucho
100/500g/100kg
Concep/Gaucho
150/750g/100kg

FIGURE 1.

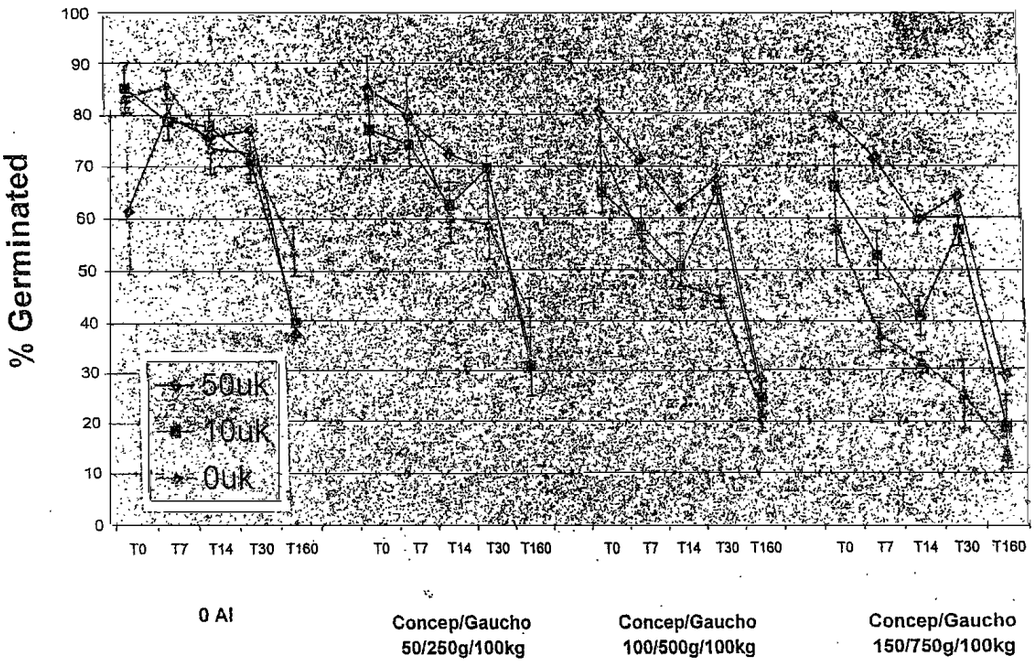

% Germinated
100
90
80
70
60
50
40
30
20
10
0
50uk
10uk
0uk
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
0 AI
Concep/Gaucho
50/250g/100kg
Concep/Gaucho
100/500g/100kg
Concep/Gaucho
150/750g/100kg

FIGURE 2.

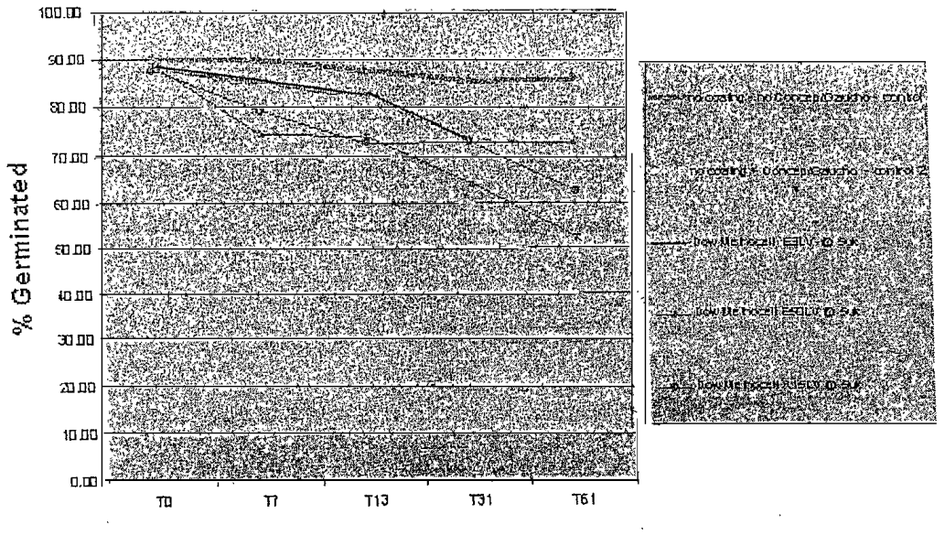

% Germinated
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
T0
T7
T13
T31
T61

FIGURE 3.

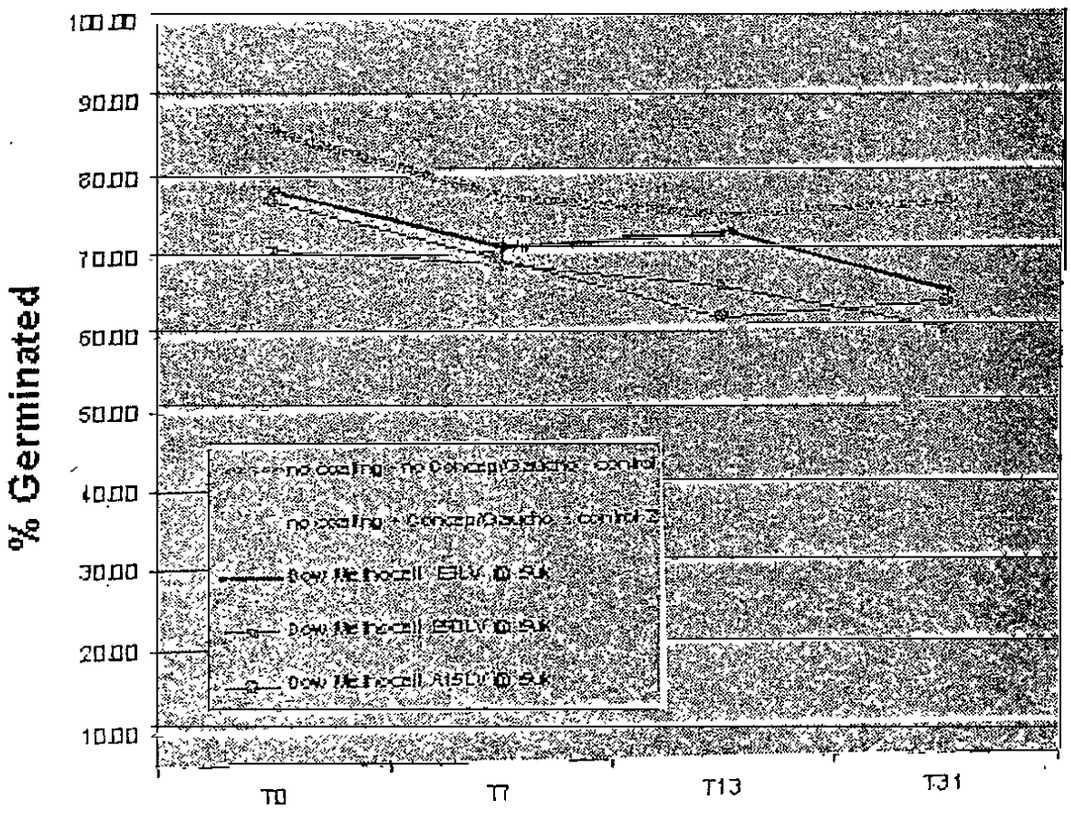

% Germinated
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
T0
T7
T13
T31

FIGURE 4.

% Germinated
100 00
90 00
80 00
70 00
60 00
50.00
40 00
30 00
20 00
10 00
0.00
0uk
100uk SB72000
100uk Vitae XX-210
100uk Maltin M040
100uk Airflex 109
100uk Elvanol 259
T0
T7
T15
T36
T61
T93
T124
0X
1X

FIGURE 5.

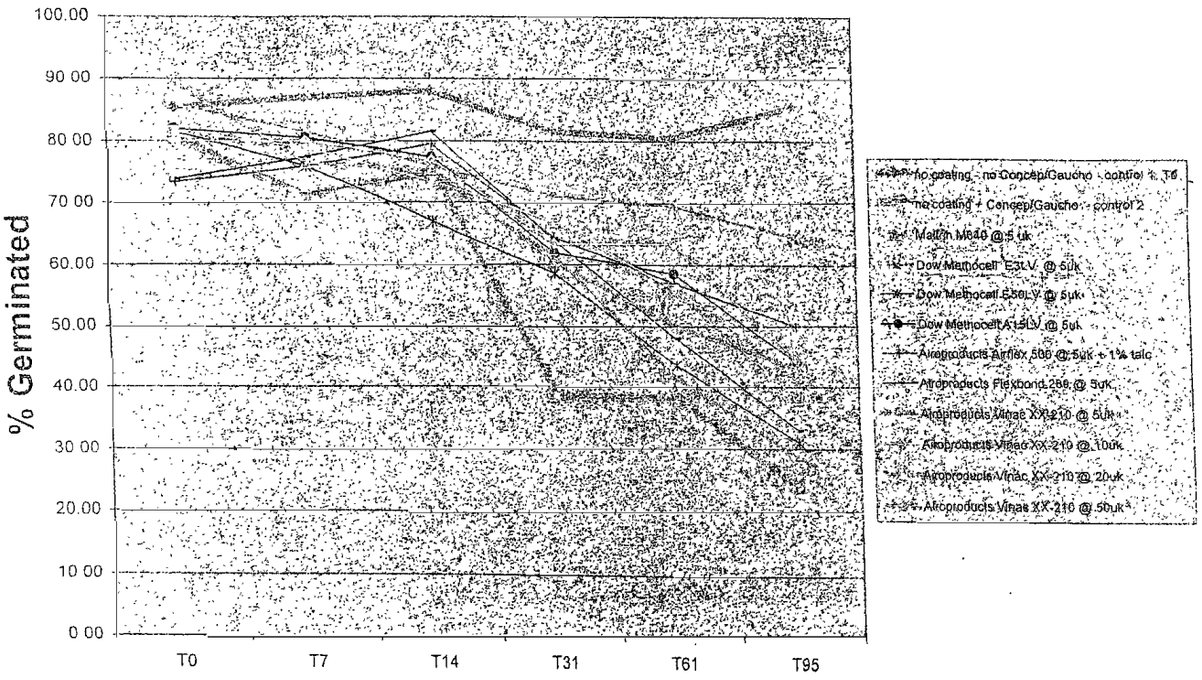

100.00
90 00
80 00
70 00
60.00
50.00
40.00
30 00
20.00
10 00
0 00
% Germinated
T0
T7
T14
T31
T61
T95
no coating - no Concep/Gaucho - control 1, T6
no coating + Concep/Gaucho - control 2
Mat/n M640 @ 5 uk
Dow Methocel E-stLV @ 5uk
Dow Methocel 530LV @ 5uk
Dow Methocel A15LV @ 5uk
Aroproducts Airflex 500 @ 5uk + 1% talc
Atroproducts Flexbond 268 @ 5uk
Aroproducts Vinac XX-210 @ 5uk
Aroproducts Vinac XX-210 @ 10uk
Aroproducts Vinac XX-210 @ 20uk
Aroproducts Vinac XX-210 @ 50uk

FIGURE 6.

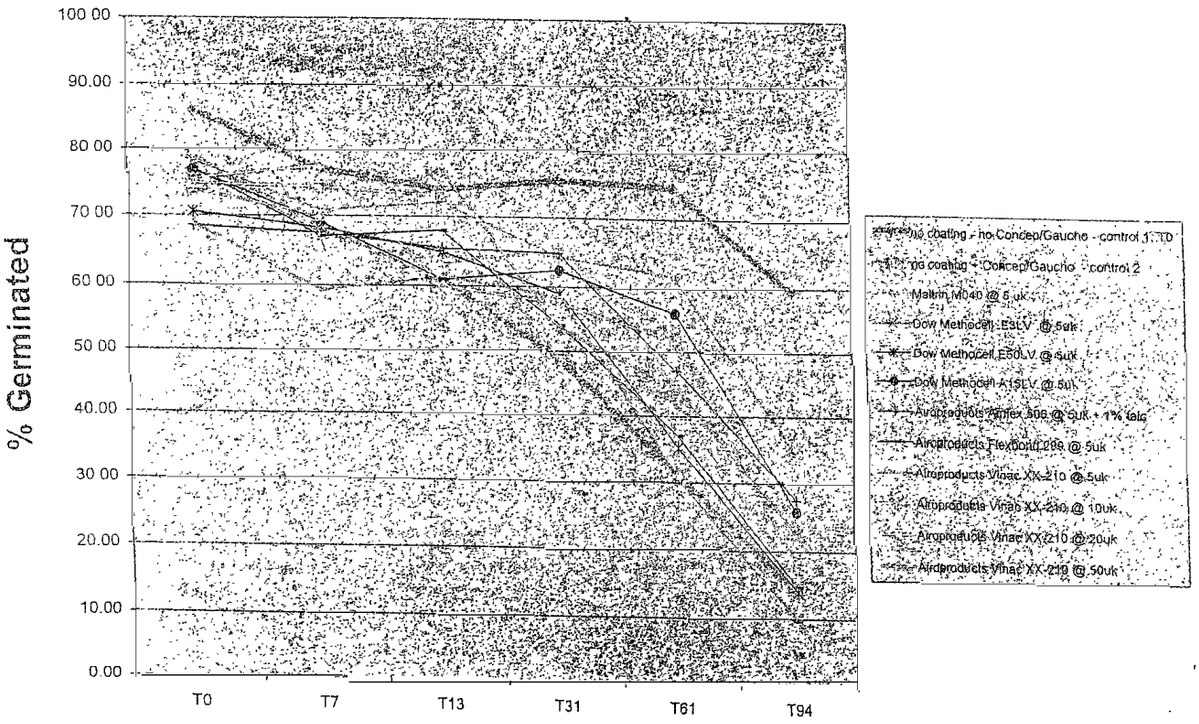

% Germinated
100 00
90.00
80 00
70 00
60 00
50 00
40.00
30 00
20.00
10.00
0.00
T0
T7
T13
T31
T61
T94
no coating - no Concep/Gaucho - control 1 T0
no coating - Concep/Gaucho - control 2
Maxim M040 @ 5 uk
Dow Methocel ESLV @ 5uk
Dow Methocel E50LV @ 5uk
Dow Methocel A15LV @ 5u
Airproducts Airflex 306 @ 5uk + 1% alg
Airproducts Flexbond 296 @ 5uk
Airproducts Vinac XX-210 @ 5uk
Airproducts Vinac XX-210 @ 10uk
Airproducts Vinac XX-210 @ 20uk
Airproducts Vinac XX-210 @ 50uk

FIGURE 7.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/36178

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01C1/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 199 318 B1 (BALACHANDER NATARAJAN ET AL) 13 March 2001 (2001-03-13) cited in the application column 2, line 7-10 column 13, line 52 -column 17, line 38	1-48
Y	US 4 383 391 A (THOMAS NORMAN W ET AL) 17 May 1983 (1983-05-17)	1-46
X	column 1, line 66 -column 5, line 44	47,48
Y	WO 02/080675 A (MONSANTO TECHNOLOGY LLC ,ASRAR JAWED (US), DING YIWEI (US)) 17 October 2002 (2002-10-17)	1-46
X	page 5, line 16 -page 22, line 18	47,48
A	US 5 876 739 A (CHEN YUGUANG ET AL) 2 March 1999 (1999-03-02)	1-46
X	column 1, line 29 -column 8, line 23	47,48
	-/--	

[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex.

Special categories of cited documents

A document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 April 2004	13/05/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Schlichting N

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 03/36178

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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(19) rganización Mundial de Propiedad Intelectual
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17 de junio de 2004 (17 06 2004)

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(81) Países designados *(nacional)* AE AG AL AM AT AU AZ BA, BB BG BR BW BY BZ CA CH CN CO CR CU CZ, DE DK, DM DZ EC EE EG ES FI GB GD GE GH GM HR HU ID IL, IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NI NO NZ OM PG PH PL, PT RO RU SC SD SE SG SK SL SY TJ TM TN TR TT TZ, UA, UG US UZ, VC VN YU ZA ZM ZW

(84) Países designados *(regional)* Patente ARIPO (BW GH GM KE LS MW MZ SD SL SZ, TZ UG ZM ZW) Patente Euroasiática (AM AZ BY KG KZ, MD RU TJ TM) Patente Europea (AT BE BG CH CY CZ, DE DK EE ES FI FR GB GR HU IE IT LU MC NL, PT RO SE SI SK, TR) Patente OAPI (BF BJ CF CG CI CM GA GN GQ GW ML MR NE SN TD TG)

Publicado
— *con informe internacional de búsqueda*
— *antes del vencimiento del tiempo límite para modificar las reivindicaciones y para volverse a publicar en el caso de recibo de modificaciones*

Para códigos de dos letras y otras abreviaturas, remítase a las "Notas Guía sobre Códigos y Abreviaturas que aparece al comienzo de cada edición regular del Boletín Oficial PCT

(54) Título MÉTODO DE PROTEGER SEMILLAS TRATADAS CON UN AGENTE FITOTÓXICO

(57) Extracto Un método de mejorar el porcentaje de germinación en semillas de planta tratadas con plaguicida implica formar una capa de polímero libre de plaguicida sobre una semilla de planta antes de tratar la semilla con un plaguicida donde el tipo de polímero y el espesor de la capa se diseñan para bloquear el contacto fitotóxico del plaguicida con la semilla permitiendo al mismo tiempo suficiente transferencia de oxígeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad bajo condiciones ambientales enfrentadas normalmente por la semilla después de la siembra para posibilitar su germinación y luego tratar la semilla cubierta de planta con un plaguicida Se describen asimismo semillas que se han tratado con este método y plantas que se cultivan de las semillas tratadas.

WO 2004/049778 A1

MÉTODO DE PROTEGER SEMILLAS TRATADAS CON UN AGENTE FITOTÓXICO

ANTECEDENTES DE LA INVENCIÓN

REFERENCIA CRUZADA A PATENTES Y SOLICITUDES DE PATENTE RELACIONADAS

[0001] Esta solicitud reivindica el beneficio de la Solicitud de Patente Provisional de los Estados Unidos Serie No 60/430,572, presentada el 3 de diciembre de 2002, que se incorpora aquí por referencia en su totalidad

(1) Campo de la Invención

[0002] La presente invención se refiere a un método de proteger semillas que se van a tratar con un agente fitotóxico y, en particular, a un método para mejorar el porcentaje de germinación de semillas tratadas con un agente fitotóxico De igual manera se incluyen semillas, que se han tratado por el metodo en cuestión, y plantas que crecen de tales semillas

(2) Descripción del Arte Relacionado

[0003] Una fracción significativa de las semillas de planta se trata actualmente con uno o mas agroquimicos, tales como plaguicidas, inoculantes, factores de crecimiento y fertilizantes, con el fin de controlar plagas y enfermedades, para aportar nutrientes, estimular la germinación e intensificar el crecimiento de la plántula Algunos de los agroquimicos que son útiles en controlar plagas y enfermedades pueden ser igualmente tóxicos para la semilla y la planta que brota de la semilla Tal actividad fitotóxica limita la cantidad de estos agroquímicos que pueden aplicarse sin ningun daño a la semilla.

[0004] Un efecto indeseado de la fitotoxicidad es la reduccion del porcentaje de germinación de semillas que han sido tratadas Por lo general, el porcentaje de germinación de semillas que se tratan con un agente fitotóxico disminuye con el tiempo, después de haberse aplicado el agente, limitando así la longevidad de las semillas tratadas A veces se requieren medidas extraordinarias tales como tratamiento de la semilla en

campo, o tratamiento inmediatamente antes de la siembra, para evitar un daño serio al producto agrícola Se ha comprobado asimismo que el daño fitotóxico a la semilla ocasionado por agentes agroquímicos puede exacerbarse por exposición de la semilla a factores perturbadores ambientales, tales como frío, sequía y similares

[0005] La fitotoxicidad de los agroquímicos se ha tratado de distintas maneras La inclusión de antidotos ("*safeners*") – químicos que hacen mas tolerables los efectos fitotóxicos de los agroquimicos, tales como herbicidas – junto con la semilla, se usa ampliamente, pero esto requiere la aplicacion de un componente químico adicional, a menudo costoso, a la semilla

[0006] Otra forma de superar el efecto fitotóxico es encapsular el agente agroquimico en una matriz, a menudo un polimero, la cual limita el movimiento del agente Vease, *por ejemplo*, la Patente de los Estados Unidos 6,329,319 a Puglisi *y colaboradores* Este metodo puede limitar el contacto del agente con la semilla y la plántula emergente, permitiendo al mismo tiempo disponer del agente más tarde durante la germinación y el crecimiento inicial de la planta, cuando el agente se libera de la matriz de polímero La adecuada operación de la tecnología de encapsulación depende de la cuidadosa combinacion de las propiedades físicas y quimicas del agroquímico y la matriz encapsulante Ni una matriz de polímero ni un proceso de encapsulación son apropiados para encapsulacion de todos los agentes agroquimicos actualmente en uso para el tratamiento de semillas

[0007] De igual manera pueden incluirse agentes agroquímicos en las capas de semilla, que pueden limitar la mobilidad del agente Vease, *por ejemplo* Patente de los Estados Unidos No 6,199,318 a Stewart *y colaboradores*, Patente de los Estados Unidos No 5,129,180 a Stewart, Patente de los Estados Unidos No 5,127,185 a Kojimoto *y colaboradores*, Patente de los Estados Unidos No 5,044,116 a Gago *y colaboradores*, y Patente de los Estados Unidos No 3,947,906 a Watts No obstante, debido a que el agente activo se distribuye de un lado a otro de la capa, necesariamente alguna cantidad finita del agente entra en contacto con la superficie de la semilla Más aun, igual a la encapsulacion, los parámetros

39

físicos y químicos de los materiales de la matriz tienen que ajustarse con las propiedades del agente activo, con el fin de obtener la homogeneidad adecuada de la capa y evitar el fisuramiento

[0008] Se conoce la aplicación de capas de polímero a semillas con el fin de reducir el daño de imbibición por frio ("***imbibitional chilling injury***") Véase, Ni, B-R, Alleviation of seed imbibitional chilling injury using polymer film coating, *British Crop Protection Council Symposium Proceedings*, No 76, Pp 73-82 (2001), además, Taylor, A G, *Bean Improvement Cooperative, 30* 30-31 (1987), Taylor *y colaboradores J Horticultural Sci, 62* 183-189 (1987), Taylor, A G y J Kwiatkowski, Polymer film coatings decrease water uptake and water vapor movement into seeds and reduce imbibitional chilling injury, West *y colaboradores Crop Science, 25* 941-944 (1985) Sin embargo, no se describió la combinación de tales capas con tratamiento consecutivo de las semillas con agroquímicos fitotóxicos

[0009] Sería util, por lo tanto, ofrecer un método para reducir el daño fitotóxico infligido a semillas por agentes fitotóxicos ,de tratamiento de semillas, método que puede usarse con una amplia gama de agentes agroquímicos y aplicarse a una extensa paleta de tipos de semillas

SUMARIO DE LA INVENCIÓN

[00010] En síntesis, la presente invención se dirige por lo tanto a un método novedoso de mejorar el porcentaje de germinación de semillas de planta que se tratan con un agente fitotóxico, método que comprende formar una capa de polímero sobre la semilla de planta antes de tratar la semilla con el agente fitotóxico, en donde la capa está libre del agente fitotóxico y donde el tipo de polímero y el espesor de la capa se diseñan para bloquear un contacto fitotoxico del agente fitotoxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxigeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad bajo condiciones ambientales enfrentadas normalmente por la semilla luego

de la siembra, para posibilitar su germinacion, y tratar la semilla cubierta de planta con el agente fitotoxico

[00011] De igual manera, la presente invención se dirige a una novedosa semilla de una planta tratada con un agente fitotoxico, que tiene un porcentaje de germinación mejorado, comprendiendo cada semilla una semilla de planta con un agente fitotóxico depositado sobre ella, y con una capa de polímero que está libre del agente fitotóxico, localizada entre la semilla y el agente fitotóxico, en donde el tipo de polímero y el espesor de la capa se diseñan para bloquear un contacto fitotóxico del agente fitotóxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxígeno y humedad bajo condiciones ambientales enfrentadas normalmente por la semilla luego de la siembra, para mantener la viabilidad de la semilla y posibilitar su germinacion.

[00012] La presente invención se dirige asimismo a una planta novedosa que se cultiva de una semilla que se trata por el metodo descrito mas arriba

[00013] La presente invención se dirige tambien a un método novedoso de producir un producto agronómico, método que comprende los pasos de

a proveer semillas de planta del producto agronomico, que se han tratado por el método descrito más arriba,

b sembrar las semillas, y

c cultivar las semillas sembradas y las plantas que brotan de las semillas

[00014] Entre las varias ventajas que se descubrió se lograban por la presente invención, pueden anotarse, por lo tanto, la provisión de un método para reducir el daño fitotóxico a las semillas derivados de agentes fitotóxicos de tratamiento de semillas, el cual puede usarse con una amplia gama de agentes agroquímicos y aplicarse a una extensa paleta de tipos de semillas

BREVE DESCRIPCIÓN DE LOS DIBUJOS

[00015] Figura 1 es un gráfico que muestra el porcentaje de germinacion de semillas de sorgo en una prueba de germinación con calor como función de los días despues del tratamiento, para semillas que carecían de capa y que tenían capas de 10µ y 50µ de polímero Vinac XX-210 seguidas por tratamiento con un antídoto ConcepIII y con imidacloprid en niveles de 0, 250 g, 500 g, y 750 g por 100 kg de semillas,

[00016] Figura 2 es un gráfico que muestra el porcentaje de germinación de semillas de sorgo en una prueba de germinación con frío como función de los días después del tratamiento, para semillas que carecían de capa y que tenían capas de 10µ y 50µ de polímero Vinac XX-210 seguidas por tratamiento con un antídoto ConcepIII y con imidacloprid en niveles de 0, 250 g, 500 g, y 750 g por 100 kg de semillas,

[00017] Figura 3 es un gráfico que muestra el porcentaje de germinación de semillas de sorgo en una prueba de germinacion con calor como función de los dias después del tratamiento, para semillas que carecían de capa y que tenían capas de 5µ de tres diferentes polímeros methocel, donde las capas fueron seguidas por un tratamiento con un antídoto ConcepIII y con imidacloprid en niveles de 0 y 250 g/100 kg de semillas,

[00018] Figura 4 es un gráfico que muestra el porcentaje de germinación de semillas de sorgo en una prueba de germinacion con frío como función de los dias posteriores al tratamiento, para semillas que carecían de capa y que tenían capas de 5µ de tres diferentes polimeros methocel, donde las capas fueron seguidas por un tratamiento con un antidoto ConcepIII y con en niveles de 0 y 250 g/100 kg de semillas,

[00019] Figura 5 es un grafico que muestra el porcentaje de germinación de semillas de sorgo en una prueba de germinacion con calor como funcion de los días después del tratamiento, para semillas que carecían de capa y que tenían capas de 10µ de cualquiera de los polímeros SB-2000, Vinac XX-210, Maltrin MO40, Airflex 500, o Flexbond 289, donde las capas fueron seguidas por un tratamiento con un antídoto ConcepIII y con imidacloprid en niveles de 0 y 250 g/100 kg de semillas,

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[00020] Figura 6 es un grafico que muestra el porcentaje de germinación de semillas de sorgo en una prueba de germinación con calor como función de los días despues del tratamiento, para semillas que carecian de capa y que tenian capas de 5µ de Maltrin MO40, Methocel E3LV, Methocel E50LV, Methocel A15LV, Airflex 500 + 1% talco, Flexbond 289, y capas de 5µ, 10µ, 20µ y 50µ de Vinac XX-210, donde las capas fueron seguidas por un tratamiento con un antídoto ConcepIII y con imidacloprid en niveles de 0 y 250 g/100 kg de semillas, y

[00021] Figura 7 es un gráfico que muestra el porcentaje de germinación de semillas de sorgo en una prueba de germinacion con frio como funcion de los días después del tratamiento, para semillas que carecían de capa y que tenían capas de 5µ de Maltrin MO40, Methocel E3LV, Methocel E50LV, Methocel A15LV, Airflex 500 + 1% talco, Flexbond 289, y capas de 5µ, 10µ, 20µ y 50µ de Vinac XX-210, donde las capas fueron seguidas por un tratamiento con un antidoto ConcepIII y con imidacloprid en niveles de 0 y 250 g/100 kg de semillas

DESCRIPCIÓN DETALLADA DE LAS INCORPORACIONES PREFERIDAS

[00022] De acuerdo con la presente invención, se ha descubierto que el porcentaje de germinación de semillas que van a tratarse con un agente fitotoxico puede mejorarse formando una capa de polimero, que esta libre del agente fitotóxico, sobre la semilla de una planta, y tratando luego las semillas con el agente Es importante que el tipo de polímero que se emplea para la capa, y el espesor de la capa, se diseñen para bloquear un contacto fitotoxico del agente fitotóxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxígeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad bajo condiciones ambientales enfrentadas normalmente por la semilla luego de la siembra, para posibilitar su germinación

[00023] En el presente método, los términos "agente fitotoxico" se

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refieren a un ingrediente activo agrícola que es fitotóxico Tal como se emplea aquí, los términos "ingrediente activo agrícola" significan cualquier elemento químico, molécula, o compuesto, o su mezcla, que posee una actividad biológica en una semilla, una planta, o una enfermedad o plaga de una semilla o planta. Tales ingredientes activos agrícolas incluyen, pero no se limitan a, plaguicidas, herbicidas, fertilizantes, reguladores de crecimiento de plantas, fármacos, colorantes, atrayentes biológicos, fragancias y feromonas Por lo tanto, plaguicidas, herbicidas, fertilizantes, reguladores de crecimiento de plantas, fármacos, colorantes, atrayentes biológicos, fragancias y feromonas, que son fitotoxicos, van a incluirse como los agentes fitotóxicos de la presente invención

[00024] Tal como se emplea aquí, un agente es "fitotoxico" si causa lesion o daño a una planta o semilla con la cual entra en contacto La lesión o daño a la planta y la semilla incluye, por ejemplo, atrofia, quemadura química, caída del rendimiento, malformacion, descoloración, ausencia de germinación, reduccion en el porcentaje de germinación, muerte y similares

[00025] Se ha descubierto que el metodo en cuestión es especialmente util cuando el agente fitotóxico es un regulador del crecimiento de plantas, un plaguicida, o un herbicida Ejemplos de plaguicidas que pueden usarse como el agente fitotóxico en la presente invención son acaricidas, garrapaticidas, insecticidas, repelentes de insectos, fungicidas, fungiestáticos, moluscicidas, rodenticidas, nematicidas y bactericidas

[00026] Se sabe que muchos de los plaguicidas, herbicidas y reguladores de crecimiento de plantas más utiles pueden ser fitotoxicos si se les permite entrar en contacto con plantas o semillas y, particularmente, si están presentes en concentraciones altas No obstante, a menudo es mas efectivo, si no necesario, suministrar tales agentes en concentraciones altas con el fin de obtener los beneficios máximos que pueden ofrecer Por consiguiente, ha sido particularmente difícil suministrar estos agentes fitotoxicos en forma concentrada, tal como en gránulos de liberacion controlada, capas, o miniesferas, debido al efecto dañino que el agente

puede tener sobre la semilla o planta propiamente dicha que está destinado a proteger Una propiedad importante de la presente invención es que permite el uso de activos altamente efectivos que son también fitotóxicos Mas aun, los activos pueden usarse en concentraciones que son mas altas de lo que sería posible sin el uso de la capa de polimero libre del agente fitotóxico

[00027] Una función de la capa de polímero es reducir el contacto fitotóxico del agente fitotóxico con la semilla. Tal como se emplea aquí, los términos "contacto fitotóxico" significa contacto de una cantidad de un agente con una semilla, que es suficiente para causar un efecto fitotóxico Debido a que la capa de polímero libre de agente fitotóxico reduce el contacto fitotóxico del agente con la semilla, amplía el tiempo en que la semilla tratada puede almacenarse Además, el tratamiento puede llevarse a cabo en un tiempo muy anterior a la siembra, preferiblemente en un tiempo que es económicamente atractivo y conveniente para la persona que aplica el tratamiento A manera de ejemplo, cuando se van a tratar semillas con un plaguicida, el presente método puede ampliar la longevidad de semillas tratadas con plaguicida en un factor de tres veces, o incluso más Más aun, el presente metodo hace posible tratar semillas con niveles significativamente más altos de plaguicidas de los que pueden emplearse normalmente sin incurrir en porcentajes de germinación inaceptablemente bajos Esto puede acentuar la efectividad del plaguicida y ampliar el tiempo que el plaguicida permanece activo despues de la siembra Por ejemplo, el presente método permite el uso de niveles dos veces, tres veces, o incluso más altos de plaguicida, sin incurrir en una reduccion adicional en los porcentajes de germinación de las semillas tratadas

[00028] Es otra ventaja del presente método que éste puede usarse con una amplia gama de agentes agroquímicos, sin tener en cuenta su compatibilidad física o química con el polímero de la capa El aspecto de aplicar una capa de polimero libre de agente fitotóxico a la semilla antes de aplicar un agente fitotóxico elimina la necesidad de un ajuste cuidadoso de las propiedades del polímero y el agente

[00029] En el presente metodo, cuando se afirma que una finalidad es "mejorar el porcentaje de germinación" de la semilla de una planta, se da a entender que la semilla de una planta, que se ha tratado por el presente metodo, tiene un porcentaje de germinación más alto que la semilla similar de una planta que se ha tratado con la misma cantidad y tipo de agente fitotóxico, pero carece de la capa de polímero libre del agente fitotóxico que es una característica del presente método, cuando ambos tipos de semillas se exponen a las mismas condiciones ambientales y se prueban bajo el mismo protocolo para cuantificar el porcentaje de germinacion Los métodos para cuantificar el porcentaje de germinación son bien conocidos por aquellas personas expertas en el arte de la ciencia de semillas, y se describen con más detalle a continuacion

[00030] En el presente método, se forma una capa de polimero libre del agente fitotóxico sobre una semilla de una planta, antes de tratar la semilla con el agente fitotóxico El tipo de polímero y el espesor de la capa se diseñan para reducir un contacto fitotóxico del agente fitotóxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxigeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad bajo condiciones ambientales enfrentadas normalmente por la semilla luego de la siembra, para posibilitar su germinación Luego de haberse formado la capa de polímero, la semilla cubierta se trata con un agente fitotóxico En incorporaciones preferidas, el agente fitotoxico es un plaguicida.

[00031] Aunque el método en cuestión puede usarse para tratar la semilla de cualquier tipo de planta, se prefiere que la semilla sea la semilla de una planta agronómica Tal como esos terminos se usan aquí, "planta agronómica" se refiere a cualquier planta que se cultiva por el hombre, o de la cual se cosechan partes o productos que son usados por el hombre Plantas agronomicas pueden ser una gimnosperma, una dicotiledonea, o una monocotiledónea

[00032] Ejemplos de plantas agronómicas que son útiles en la presente invención incluyen, sin limitación, cereales (trigo, cebada, centeno, avena,

arroz, sorgo, productos agrícolas relacionados, etc), remolacha, frutas en forma de pera, frutas que tienen pepa y frutas blandas (manzana, pera, ciruela, melocoton, albaricoque japonés, ciruela pasa, almendra, cereza, fresa, frambuesa, mora, tomate, pimiento, etc), legumbres (fríjol, lenteja, arveja, soya), plantas oleaginosas (colza, canola, mostaza, amapola, oliva, girasol, coco, ricino, granos de cacao, maní, soya, maiz, etc), cucurbitaceas (calabaza, cohombro, melón, etc), cítricos (naranja, limón, toronja, mandarina, pomelo Watson (*citrus natsudaidai*), etc), vegetales (lechuga, repollo, col china, rábano chino, zanahoria, cebolla, papa, etc), arboles de alcanfor (aguacate, canela, alcanfor, etc), maíz, tabaco, nueces, cafe, caña de azucar, te, vid, lupulo y banano

[00033] En incorporaciones preferidas, la planta agronomica puede ser arroz, trigo, cebada, centeno, maiz, papa, zanahoria, batata, remolacha azucarera, frijol, arveja, achicoria, lechuga, repollo, coliflor, broculi, nabo, rabano, espinaca, espárrago, cebolla, ajo, berenjena, pimiento, apio, zanahoria, zapallo, calabaza, calabacín, cohombro, manzana, pera, membrillo, melón, ciruela, cereza, melocotón, nectarina, albaricoque, fresa, uva, frambuesa, zarzamora, piña, aguacate, papaya, mango, banano, soya, tomate, sorgo y frambuesas, banano y otras variedades comestibles similares Se prefiere más que la planta agronomica se seleccione de maiz, frijol de soya, algodón, sorgo, colza (canola), arroz, trigo, cebada y centeno Se prefiere aun mas que la planta agronómica sea maíz, frijol de soya o algodon

[00034] Un paso inicial en el presente metodo es formar una capa de polimero libre del agente fitotóxico sobre una semilla Para llevar a cabo la formación de la capa sobre la semilla puede usarse cualquier método que se conozca en el arte de la ciencia de polímeros En un método preferido, la capa puede formarse proveyendo una semilla y poniendo en contacto la semilla con un polímero La puesta en contacto puede llevarse a cabo en uno cualquiera de varios modos Por ejemplo, si el polímero es soluble en agua, puede prepararse una solucion en agua del polímero y la solución de polimero puede aplicarse a la semilla – tal como mediante aspersión,

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inmersión, empañamiento, o similares Para polímeros no solubles en agua, puede formarse una emulsión líquido/polímero del polímero, y la emulsion puede aplicarse a la semilla Se prefiere que el líquido en el cual se forma la emulsión sea agua y, en ese caso, la emulsión puede designarse como un látex de polímero Es una característica importante del presente metodo que el medio que contiene el polímero, que se emplea para la aplicación del polímero a la semilla, esté libre de un agente fitotóxico, con el fin de que la aplicacion del polímero a la semilla resulte en la formacion de una capa de polímero libre del agente fitotóxico sobre la semilla

[00035] Cuando se afirma que el medio que contiene el polimero, o la capa de polimero, están "libres de un agente fitotóxico", se da a entender que cualquier agente fitotóxico, que pudiera estar presente en el medio o la capa, está presente en una concentración que está por debajo de un nivel fitotoxico Se considera que la concentración de un agente fitotóxico está "por debajo de un nivel fitotóxico", si la semilla cubierta con una capa de polímero, que contiene el agente fitotóxico, provee un porcentaje de germinación en prueba de germinacion con calor despues de 30 dias (prueba que se describe más adelante) que no es inferior, en mas 5%, al porcentaje de germinación en prueba de germinación con calor de una semilla similar con una capa de polímero similar, en la cual la concentración del agente fitotóxico es cero

[00036] En incorporaciones preferidas, la capa de polimero se aplica directamente a la semilla, sin material que se interponga entre la capa y la semilla

[00037] Se prefiere que el polímero de la cubierta en cuestión se aplique a la semilla en la forma de una película de una suspension, dispersión o emulsión líquida Tal como se emplea aqui, cuando se describe la capa con el término "emulsion" se entenderá que incluye todas las suspensiones, dispersiones y emulsiones Cuando el líquido en el cual se distribuye el polímero es agua, la emulsion puede denominarse un latex Se entenderá que cuando se emplea el término "película" en esta especificación, generalmente se aplica a la pelicula de la emulsion de

polímero en forma líquida después de la aplicación a la semilla, a menos que el contexto sugiera otra cosa Análogamente, el término "capa" se aplica a la capa sobre la semilla que se forma del curado de la pelicula Cuando se aplica a la semilla una película que contiene el polímero, se prefiere que la película cubra sustancialmente la superficie de la semilla Sin embargo, aunque preferible, tal cobertura sustancial no se requiere con el fin de obtener las ventajas de la invención

[00038] El polímero se añade al líquido bajo condiciones tales que se forme una emulsión. Esto puede hacerse por la adición de partículas finamente molidas del polímero al líquido, o una mezcla de liquido / polimero puede someterse a alta cizalladura para formar la emulsión Tales tecnicas formadoras de emulsión son bien conocidas en el arte

[00039] El polímero puede agregarse al líquido en cualquier cantidad, pero la concentracion del polímero en la emulsión que se emplea para formar la película debe ser lo suficientemente baja para permitir la facil manipulacion y la aplicación de la emulsión a la semilla – tal como mediante aspersión – y la distribución minuciosa de la película entre las semillas, de modo que la superficie exterior de cada semilla se cubra en forma sustancial No obstante, la concentración debe ser lo suficientemente alta, cuando se usa en combinación con los demas parametros del tratamiento de la semilla, para evitar la pérdida de polímero de las semillas por goteo o acumulación de la emulsion Se prefiere que la concentración de polímero en la emulsión, en el momento en que se aplica una película de la emulsión a las semillas, sea de alrededor de 0 5% a alrededor de 50%, en peso, mas preferida es una concentración de alrededor de 0 5% a alrededor de 20%, en peso, aun más preferida es una concentración de alrededor de 2% a alrededor de 20%, todavia más preferida es una concentración de alrededor de 4% a alrededor de 15%, en peso, y aun más preferida es una concentración de alrededor de 5% a alrededor de 11%, en peso

[00040] La cantidad de la emulsión de polimero o solución de polimero que se añade a las semillas es una cantidad que es suficiente para proveer una capa del espesor deseado Una vez aplicada a la semilla la pelicula de

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la emulsión o solución de polímero, ésta se cura para formar la capa de polímero Cuando se dice que la pelicula se "cura", o cuando se alude a "curar la pelicula", lo que se quiere dar a entender es que del polímero contenido en la película se forma una capa solida del polímero El curado es a menudo el resultado del secamiento del liquido de la pelicula, pero puede llevarse también a cabo por reacción química, adsorción, secuestro ("***sequestration***"), u otras formas de curado de polímeros, que son bien conocidas en el arte

[00041] La capa en cuestión es insoluble en agua, como se describe más arriba, y está presente sobre por lo menos alguna parte de la superficie exterior de cada semilla Se prefiere que la capa cubra completamente la superficie exterior de cada semilla.

[00042] Se prefiere que la capa de polímero que se forma sobre la semilla comprenda una cantidad sustancial del polímero Se prefiere que – una vez curada la capa – la capa de polímero contenga un polímero, o mezcla de polímeros, en una cantidad de más de 10% en peso Una cantidad de 50% en peso es más preferida, 70% en peso es aun mas preferida, y 80% en peso es incluso mas preferida En algunos casos, se prefiere que la capa esté conformada esencialmente por el polimero

[00043] Si se desea, la capa puede contener materiales no fitotóxicos distintos del polímero con el fin de servir como plastificantes, emulsionantes, estabilizantes, rellenos, colorantes, antídotos y similares Dichos materiales son bien conocidos en el arte

[00044] Una característica de la capa de polimero libre del agente fitotóxico es que el tipo de polímero y el espesor de la capa se diseñan para reducir un contacto fitotoxico del agente fitotoxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxigeno y humedad bajo las condiciones ambientales normalmente enfrentadas por la semilla después de la siembra para mantener la viabilidad de la semilla y posibilitar su germinacion

[00045] Los tipos de polímero que son utiles para la presente capa incluyen polímeros que pueden procesarse en una solucion acuosa y

polímeros que pueden procesarse en una emulsión acuosa de látex Se prefieren polímeros que forman emulsiones acuosas de látex Se prefiere que los polimeros que se emplean en la presente capa puedan formar una pelicula que tenga excelente adhesion a la superficie de la semilla – es decir, que la película curada se adhiera suficientemente a la superficie de la semilla de manera que no se desprenda o erosione durante el procesamiento, almacenamiento y manipulacion normales Se prefiere ademas que los polímeros formen películas que sean insolubles en agua, pero que tengan permeabilidad suficiente a la humedad y al oxigeno para mantener la viabilidad de la semilla y permitir la germinación cuando se siembre la semilla

[00046] Más aun, se prefiere que el polímero que se utiliza para la presente capa sea uno con una temperatura minima de formación de pelicula (MFT), que sea menor que una temperatura que dañe las semillas que se van a recubrir Se prefiere que el polimero tenga una MTF de menos de 55°C, más preferida de menos de 30°C, e incluso más preferida de menos de 25°C La temperatura mínima de formacion de pelicula puede determinarse de acuerdo con el procedimiento ASTM No D-2354 Vease, *por ejemplo*, la Patente de los Estados Unidos No 6,235,916 B1 En una incorporacion preferida, el presente método de recubrir la semilla incluye exponer la semilla a una temperatura que es superior a la MTF del polímero de la capa, con el fin de obtener una pelicula adherente y uniforme que carezca de, o posea, pocos agujeros

[00047] Ejemplos de los tipos de polímeros que pueden usarse en la presente invención incluyen polímeros solubles en agua, tales como maltodextrinas, metilcelulosa, etilcelulosa, hidroxipropilcelulosa e hidroxipropil/metilcelulosa y polímeros dispersables en agua, tales como polímeros de acetato de etilo – etileno, polímeros de cloruro de vinilo y etileno, polimeros de acetato de vinilo, polímeros acrilicos-vinilicos, polimeros a base de almidón (tales como SB-2000), polimeros de cloruro de vinilo – acetato de polivinilo, copolimeros de cloruro de vinilo / acetato de vinilo / etileno y similares

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[00048] Un polímero que es útil en el presente método es SB 2000, un polímero funcional a base de almidón (disponible de Seedbiotics, Caldwell, ID), del que se ha informado que reduce el daño de imbibición por frío a semillas cuando se emplea como una capa de semilla antes de la siembra (Vease, *por ejemplo*, Taylor, A. G , *y colaboradores*, Polymer film coatings decrease water uptake and water vapour movement into seeds and reduce imbibitional chilling injury, *British Crop Protection Council Symposium Proceedings* No 76 p 215-220 (2001), y Ni, B-R, pp 73-82, en *British Crop Protection Council Symposium Proceedings*, No 76 (2001))

[00049] Otros polímeros que son apropiados para uso en el metodo en cuestión incluyen polimeros que pueden facilitar la permeabilidad del agua sensible a la temperatura, del tipo descrito en las Patentes de los Estados Unidos Nos 5,120,349, 5,129,180 y 5,387,450

[00050] Como se describe mas arriba, el espesor de la capa de polímero libre del agente fitotóxico, en combinación con el tipo de polímero que se usa, se diseña para restringir el contacto del agente fitotóxico con la semilla, pero para permitir un cierto nivel de transferencia de humedad y oxigeno El espesor de la capa de polímero libre del agente fitotoxico se refiere al espesor de la capa de polímero una vez se ha curado o secado para formar una película En otras palabras, se refiere al espesor de la capa final, más que a la capa de la solución o emulsión que contiene el polimero que se aplica a la semilla

[00051] Se ha descubierto que el espesor de la capa de polimero en la presente invención debe ser menos de alrededor de 500 micrones Se prefiere que el espesor de la capa sea entre alrededor de 1 micron y alrededor de 500 micrones, mas preferido es entre alrededor de 1 micrón y alrededor de 480 micrones, aún más preferido es entre alrededor de 2 micrones y alrededor de 400 micrones, todavía más preferido es un espesor de capa de entre alrededor de 3 micrones y alrededor de 300 micrones, aun más preferido es entre alrededor de 5 micrones y alrededor de 200 micrones, todavía más preferido es un espesor de capa de entre alrededor de 8 micrones y alrededor de 100 micrones, y todavia más preferido es entre

alrededor de 10 micrones y alrededor de 50 micrones

[00052] Una vez se ha formado una capa de polímero sobre la semilla, la semilla cubierta se trata entonces con un agente fitotoxico En la presente invención, el agente fitotóxico puede ser cualquier material fitotóxico que se aplica a una semilla, incluidos, pero sin limitarse a, plaguicidas, fertilizantes, factores de crecimiento, colorantes y sus combinaciones

[00053] En incorporaciones preferidas, el agente fitotóxico comprende uno o más plaguicidas

[00054] Ejemplos de plaguicidas que son útiles en el presente metodo incluyen herbicidas, moluscicidas, insecticidas, nematocidas, acaricidas, fungicidas, bactericidas y sus mezclas

[00055] El plaguicida puede seleccionarse de piretrinas, piretroides sinteticos, azoles, insecticidas de oxadizina, neonicotinoides, diazoles, triazoles, derivados de estrobilurina, organofosfatos, pirroles, pirazoles, fenilpirazoles, diacilhidracinas, productos de fermentación / biologicos, carbamatos y sus mezclas

[00056] Ejemplos de los tipos de materiales que son útiles como plaguicidas en el presente método incluyen

a un piretroide o piretrina sintética Ejemplos de piretrinas que son utiles incluyen ester de 2-alil-4-hidroxi-3-metil-2-ciclopenten-1-ona de ácido 2,2-dimetil-3-(2-metilpropenil)-ciclopropanocarboxílico, (2-metil-1-propenil)-2-metoxi-4-oxo-3-(2-propenil)-2-ciclopenten-1-il ester y sus mezclas de isómeros cis y trans Ejemplos de piretroides que son utiles incluyen (s)-ciano(3-fenoxifenil)metil-4-cloro alfa (1-metiletil)bencenoacetato (fenvalerato, CAS RN 51630-58-1), (S)-ciano-(3-fenoxifenil)metil (S)-4-cloro-alpha-(1-metiletil)bencenoacetato (esfenvalerato, CAS RN 66230-04-4), (3-fenoxifenil)-metil(+)cis-trans-3-(2,2-dicloroetenil)-2,2-dimetilciclopropanocarboxilato (permetrina, CAS RN 52645-53-1), (±) alfa-ciano-(3-fenoxifenil)metil(+)-cis,trans-3-(2,2-dicloroetenil)-2,2-dimetil-ciclopropanocarboxilato (cipermetrina, CAS RN 52315-07-8), (beta-cipermetrina, CAS RN 65731-84-2), (theta-

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cipermetrina, CAS RN 71697-59-1), S-ciano (3-fenoxifenil)metil (±) cis/trans 3-(2,2-dicloroetenil) 2,2dimetilciclopropanocarboxilato (zeta-cipermetrina, CAS RN 52315-07-8), (s)-alfa-ciano-3-fenoxibencil (1R,3R)-3-(2,2-dibromovinil)-2,2-dimetilciclopropanocarboxilato (deltametrina, CAS RN 52918-63-5), alfa-ciano-3-fenoxibencil 2,2,3,3,-tetrametil ciclopropanocarboxilato (fenpropatrin, CAS RN 64257-84-7), (RS)-alfa-ciano-3-fenoxibencil(R)-2-[2-cloro-4-(trifluorometil)anilino]-3-metilbutanoato (tau-fluvalinato, CAS RN 102851-06-9), (2,3,5,6-tetrafluoro-4-metilfenil)metil-(1-alfa, 3-alfa)-(Z)-(±)-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (teflutrin, CAS RN 79538-32-2), (±)-ciano (3-fenoxifenil)metil (±)-4-(difluorometoxi)-alfa-(1-metil etil)bencenoacetato (flucitrinato, CAS RN 70124-77-5), ciano(4-fluoro-3-fenoxifenil)metil 3-[2-cloro-2-(4-clorofenil)etenil]-2,2-dimetilciclopropanocarboxilato (flumetrin, CAS RN 69770-45-2), ciano (4-fluoro-3-fenoxifenil) metil 3-(2,2-dicloroetenil)-2,2-dimetil-ciclopropanocarboxilato (ciflutrin, CAS RN 68359-37-5), (beta ciflutrin, CAS RN 68359-37-5), (transflutrin, CAS RN 118712-89-3), (S)-alfa-ciano-3-fenoxibencil(Z)-(1R-cis)-2,2-dimetil-3-[2-(2,2,2-trifluoro-trifluorometil-etoxicarbonil)vinil]ciclopropanocarboxilato (acrinatrin, CAS RN 101007-06-1), pareja de isomero (1R cis) S y (1S cis) R enantiómero de alfa-ciano-3-fenoxibencil-3-(2,2-diclorovinil)-2,2-dimetilciclopropanocarboxilato (alfa-cipermetrin, CAS RN 67375-30-8), ácido [1R,3S)3(1'RS)(1',2',2',2'-tetrabromoetil]-2,2-dimetilciclopropanocarboxilico (s)-alfa-ciano-3-fenoxibencil ester (tralometrin, CAS RN 66841-25-6), ciano-(3-fenoxifenil)metil 2,2-dicloro-1-(4-etoxifenil)ciclopropanocarboxilato (cicloprotrin, CAS RN 63935-38-6), [1α, 3α(Z)]-(±)-ciano-(3-fenoxifenil)metil 3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (cihalotrin, CAS RN 68085-85-8), [1-alfa (s), 3-alfa(z)]-ciano(3-fenoxifenil)metil-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (lambda cihalotrin, CAS RN 91465-08-6), (2-metil-[1,1'-bifenil]-3-il)metil-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetil-ciclopropanocarboxilato (bifentrin, CAS RN 82657-

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04-3), 5-1-bencil-3-furilmetil-d-cis(1R,3S,E)2,2-dimetil-3-(2-oxo,-2,2,4,5 tetrahidro tiofenilidenmetil)ciclopropanocarboxilato (kadetrin, RU15525, CAS RN 58769-20-3), [5-(fenilmetil)-3-furanil]-3-furanil-2,2-dimetil-3-(2-metil-1-propenil)ciclopropanocarboxilato (resmetrin, CAS RN 10453-86-8), (1R-trans)-[5-(fenilmetil)-3-furanil]metil 2,2-dimetil-3-(2-metil-1-propenil) ciclopropanocarboxilato (bioresmetrin, CAS RN 28434-01-7), 3,4,5,6-tetrahidro-ftalimidometil-(1RS)-cis-trans-crisantemato (tetrametrin, CAS RN 7696-12-0), 3-fenoxibencil-d, 1-cis,trans 2,2-dimetil-3-(2-metilpropenil)ciclopropanocarboxilato (fenotrin, CAS RN 26002-80-2), (empentrin, CAS RN 54406-48-3), (cifenotrin, CAS RN 39515-40-7), (praletrin, CAS RN 23031-36-9), (imiprotrin, CAS RN 72963-72-5), (RS)-3-alil-2-metil-4-oxociclopent-2-enil-(1S,3R,1R,3S)-2,2-dimetil-3-(2-metilprop-1-enil)ciclopropanocarboxilato (aletrin, CAS RN 584-79-2), (bioaletrin, CAS RN 584-79-2) y (ZXI8901, CAS RN 160791-64-0) En incorporaciones preferidas el piretroide comprende teflutrin, lambda cihalotrin, bifentrin, permetrin, o ciflutrin

b un insecticida de oxidiazina, tal como 5-(2-cloropirid-5-ilmetil)-3-metil-4-nitroiminoperhidro-1,3,5-oxadiazina, 5-(2-clorotiazol-5-ilmetil)-3-metil-4-nitroiminoperhidro-1,3,5-oxadiazina, 3-metil-4-nitroimino-5-(1-oxido-3-piridinometil)perhidro-1,3,5-oxadiazina, 5-(2-cloro-1-óxido-5-piridinometil)-3-metil-4-nitroiminoperhidro-1,3,5-oxidiazina, ó 3-metil-5-(2-metilpirid-5-ilmetil)-4-nitroiminoperhidro-1,3,5-oxadiazina

c un neonicotinoide Ejemplos de plaguicidas neocotinoides incluyen tiametoxam (CAS RN 153719-23-4), acetamiprid ((E)-N-[(6-cloro-3-piridinil)metil]-N'-ciano-N-metilenimidamida, CAS RN 135410-20-7), imidacloprid (1-[(6-cloro-3-piridinil)metil]-N-nitro-2-imidazolidinimina, CAS RN 138261-41-3), nitenpiram (N-[(6-cloro-3-piridinil)metil]-N-etil-N'-metil-2-nitro-1,1-etendiamina, CAS RN 120738-89-8), clotianidina (TI-435 (N-[(2-cloro-5-tiazoil)metil]-N'-metil-N''-nitro,[C(E)]-(9Cl)-guanidina, CAS RN 210880-92-5) En otras incorporaciones preferidas, el plaguicida comprende un insecticida

neonicotinoide, tal como imidacloprid, tiametoxam, clotianidina, dinotefuran, flonicamid, nitiazina, o tiacloprid.

d un pirrol, pirazol, o fenilpirazol, tal como clorfenapir (4-bromo-2-(4-clorofenil)-1-etoximetil-5-trifluorometilpirrol-3-carbonitrilo, CAS RN 122453-73-0), fenpiroximato ((E)-1,1-dimetiletil-4[[[[(1,3-dimetil-5-fenoxi-1H-pirazol-4-il)metilen]amino]oxi]metil]benzoato, CAS RN 111812-58-9), tebufenpirad (4-cloro-N[[4-1,1-dimetiletil)fenil]metil]-3-etil-1-metil-1H-pirazol-5-carboxamida, CAS RN 119168-77-3), o fipronil (5-amino-[2,6-dicloro-4-(trifluorometil)fenil]-4-[(1R,S)-(trifluorometil)sulfinil]-1H-pirazol-3-carbonitrilo, CAS RN 120068-37-3)

e una diacilhidracina, tal como halofenozida (4-clorobenzoato-2-benzoil-2-(1,1-dimetiletil)-hidracida, CAS RN 112226-61-6), metoxofenozida (RH-2485, N-tert-butil-N'-(3-metoxi-o-toluoil)-3,5-xilohidracida, CAS RN 161050-58-4), o tebufenozida (acido 3,5-dimetilbenzoico 1-(1,1-dimetiletil)-2-(4-etilbenzoil)hidracida, CAS RN 112410-23-8)

f un triazol, tal como amitrol (CAS RN 61-82-5) y riazamate (etil-[[1-[(dimetilamino)carbonil]-3-(1,1-dimetiletil)-1H-1,2,4-triazol-5-il]tio]acetato, CAS RN 112143-82-5)

g productos de fermentación / biológicos seleccionados del grupo conformado por avermectina (abamectina, CAS RN 71751-41-2) y spinosad (XDE-105, CAS RN 131929-60-7)

h un insecticida de organofosfato seleccionado del grupo conformado por acefate (CAS RN 30560-19-1), clorpirifos (CAS RN 2921-88-2), clorpirifos-metil (CAS RN 5598-13-0), diazinon (CAS RN 333-41-5), fenamifos (CAS RN 22224-92-6), y malatión (CAS RN 121-75-5)

i un insecticida de carbamato seleccionado del grupo conformado por aldicarb (CAS RN 116-06-3), carbaril (CAS RN 63-25-2), carbofuran (CAS RN 1563-66-2), oxamil (CAS RN 23135-22-0) y tiodicarb (CAS RN 59669-26-0)

j un fungicida, tal como un fungicida de triazol seleccionado del grupo conformado por amitrol, azaconazol, bitertanol, bromuconazol,

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clımbazol, clotrımazol, cıproconazol, dıclobutrazol, dıfenocoñazol, dınıconazol, dınıconazol-M, epoxıconazol, etaconazol, fenbuconazol, fluquınconazol, fluotrımazol, flusılazol, flutrıafol, furconazol, furconazol-cıs, hexaconazol, ımıbenconazol, ıpconazol, metconazol, mıclobutanıl, paclobutrazol, penconazol, propıconazol, quınconazol, sımeconazol, tebuconazol, tetraconazol, trıadımefon, trıadımenol, trıazbutıl, trıtıconazol, 1-(4-fluorofenıl)-2-(1H-1,2,4-trıazol-1-ıl)etanona y sus mezclas

k un fungıcıda, tal como fluquınconazol, sımeconazol, tebuconazol, tetraconazol, trıtıconazol, 1-(4-fluorofenıl)-2-(1H-1,2,4-trıazol-1-ıl)etanona, o sus mezclas En partıcular, el fungıcıda puede ser fluquınconazol, sımeconazol, tebuconazol, tetraconazol, trıtıconazol, o 1 -(4-fluorofenıl)-2-(1H-1,2,4-trıazol-1-ıl)etanona.

l un fungıcıda, tal como un dıazol seleccıonado del grupo conformado por ımazalıl, oxpoconazol, pefurazoate, procloraz, trıfulmızol y sus mezclas

m un fungıcıda tıpo estrobılurına, tal como azoxıstrobına, dımoxıstrobına, famoxadona, kresoxım-metıl, metomınostrobına, pıcoxıstrobına, pıraclostrobına, trıfloxıstrobına, o sus mezclas

En ıncorporacıones preferıdas, el fungıcıda puede ser tebuconazol, sımeconazol, fludıoxonıl, fluquınconazol, dıfenoconazol, 4,5-dımetıl-N-(2-propenıl)-2-(trımetılsılıl)-3-tıofenocarboxamıda (sıltıofam), hexaconazol, etaconazol, propıconazol, trıtıconazol, flutrıafol, epoxıconazol, fenbuconazol, bromuconazol, penconazol, ımazalıl, tetraconazol, flusılazol, metconazol, dınıconazol, mıclobutanıl, trıadımenol, bıtertanol, pırımetanıl, cıprodınıl, trıdemorf, fenpropımorf, kresoxım-metıl, azoxıstrobına, ZEN90160, fenpıclonıl, benalaxıl, furalaxıl, metalaxıl, R-metalaxıl, orfurace, oxadıxıl, carboxına, procloraz, trıfulmızol, pırıfenox, acıbenzolar-S-metıl, clorotalonıl, cımoaxnıl, dımetomorf, famoxadona, quınoxıfen, fenpropıdına, espıroxamına, trıazoxıde, BAS50001F, hımexazol, pencıcuron, fenamıdona, guazatıne, o cıproconazol El fungıcıda comprende sıltıofam, en ıncorporacıones más preferıdas

[00057] Cuando un plaguıcıda se descrıbe aquı, hay que entender que

la descripcion tiene como fin incluir las formas de sales del plaguicida, asi como cualquier forma isomérica y/o tautomérica del plaguicida que exhibe la misma actividad de la forma del plaguicida que se describe

[00058] Los plaguicidas que son utiles en el presente método pueden ser de cualquier grado o pureza certificados en el comercio como tales Otros materiales, que acompañen los plaguicidas en preparaciones comerciales como impurezas, pueden tolerarse en los metodos y composiciones en cuestión, siempre y cuando tales otros materiales no desestabilicen la composicion o reduzcan significativamente o destruyan la actividad de cualquiera de los componentes del plaguicida contra plaga(s) tomadas como blanco Una persona de habilidades ordinarias en el arte de la producción de plaguicidas estaría en capacidad de identificar facilmente aquellas impurezas que pueden tolerarse y aquellas que no

[00059] Los agentes fitotóxicos que son utiles en la presente invencion pueden suministrarse en forma líquida o sólida, y pueden proporcionarse como emulsiones, dispersiones, soluciones, o en forma de particulas Los agentes fitotóxicos pueden estar solos o pueden hallarse en combinacion con otros materiales, siempre y cuando tales otros materiales no destabilicen, o reduzcan o destruyan significativamente la actividad del agente

[00060] La semilla cubierta con polímero libre de agente fitotóxico puede tratarse con el agente fitotóxico, tal como un plaguicida, por cualquier método que es comunmente conocido o usado para tratar semillas con un plaguicida

[00061] Cuando el agente fitotoxico es un plaguicida, la cantidad del plaguicida que se aplica a la semilla puede ser cualquier cantidad, pero es preferiblemente entre alrededor de 0 5 gm del ingrediente activo del plaguicida /100 kg de semilla y alrededor de 2 000 gm /100 kg de semilla, mas preferiblemente entre alrededor de 25 gm y alrededor de 1 000 gm /100 kg de semilla, y aun más preferiblemente entre alrededor de 100 gm y alrededor de 800 gm /100 kg de semilla

[00062] El agente fitotóxico puede aplicarse a la semilla en cualquier

forma y son apropiadas formas tales como suspensiones en cápsulas (CS), concentrados emulsionables (EC), emulsiones en aceite o agua (EO y EW), granulos (GR), concentrados en suspensión (SC), granulos solubles (SG), concentrados solubles (SL), polvos solubles (SP) y gránulos dispersables en agua (WG) Se prefiere aplicar el agente a la semilla en la forma de un líquido pastoso ("*a flowable liquid*") El agente puede estar en una solución verdadera en el líquido, o puede estar presente como gotículas pequeñas o partículas para formar una suspension, dispersión o emulsión Puesto que muchos plaguicidas tienen una baja solubilidad en agua, se prefiere que cuando el líquido es agua, se use una dispersion, suspensión, o emulsión acuosa del plaguicida, y que el plaguicida esté presente en la dispersión, suspensión, o emulsión en la forma de pequeñas particulas o gotículas Tal como se usa aquí, se considerará que el término "suspensión" incluye cualquier forma de líquido, que contiene particulas pequeñas, y que comprende los términos dispersión y emulsión

[00063] Las partículas de plaguicida en la suspensión liquida pueden ser de cualquier tamaño que permita aplicar la suspension a la semilla por cualquier medio, tal como, por ejemplo, por aspersión Se prefiere que las partículas de plaguicida en la suspensión tengan un tamaño nominal de numero promedio de menos de alrededor de 10 micrones, más preferiblemente de menos de alrededor de 5 micrones, aun mas preferiblemente de menos de alrededor de 2 micrones, y todavía mas preferiblemente de menos de alrededor de 1 micron (es decir, "sub-micrón" en tamaño) Se cree que el uso de tales partículas pequeñas hace que el plaguicida forme una suspensión más estable y homogénea – permitiendo de esa forma una distribución más uniforme del plaguicida sobre la superficie de la semilla, y que las particulas pequeñas están menos sometidas a abrasión de la semilla tratada, una vez se ha aplicado el tratamiento con el plaguicida.

[00064] El agente fitotóxico puede aplicarse a la semilla en cualquier tipo de tratamiento de semillas o equipo de recubrimiento convencional Se ha descubierto que la aplicación en una máquina de tratamiento de semillas

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que tenga las caracteristicas de una máquina de recubrimiento de semillas CMS (Vector Corporation,- Marion, IA), por ejemplo, es adecuada Se ha descubierto que un método útil para aplicar un agente fitotoxico a las semillas es moler el agente sólido a un tamaño de 1 - 2 micrones, o a tamaño sub-micrón, y luego agregar las partículas pequeñas del agente al agua para formar una suspensión acuosa Para la reducción del tamaño puede utilizarse un molino capaz de reducir sólidos a partículas finas, tal como un molino de aire Mirco-Jet Pulverizer, disponible de Fluid Energy Processing and Equipment Company, Hatfield, PA

[00065] Cuando el agente fitotóxico es un plaguicida, la concentración del plaguicida en la suspensión debe ser lo suficientemente baja para permitir la fácil manipulación y aplicacion de la suspensión a la semilla cubierta – tal como por aspersión – y distribución exhaustiva del plaguicida entre las semillas cubiertas, de modo que la superficie exterior de cada semilla se cubra en forma sustancial Sin embargo, la concentracion debe ser lo suficientemente alta, cuando se usa en combinacion con los demas parametros de tratamiento de semillas, para evitar la pérdida del plaguicida de las semillas por goteo o acumulación de la suspension del liquido de tratamiento Concentraciones de plaguicida de entre alrededor de 0 1% y alrededor de 50%, en peso, son utiles para tales suspensiones, se prefieren concentraciones entre alrededor de 0 5% y 15%, en peso, aún más preferidas son las concentraciones entre alrededor de 0 6% y alrededor de 5%, y todavía mas preferidas son las concentraciones del plaguicida entre alrededor de 1% y 3%, en peso de la suspension Igualmente pueden agregarse agentes de adhesión y colorantes a la suspensión del plaguicida para promover la adherencia de la suspensión a las semillas cubiertas y para identificar las semillas como sometidas a tratamiento

[00066] Una cantidad deseada de la suspensión del plaguicida puede rociarse sobre la semilla en, por ejemplo, un tratador de semilla CMS (***"CMS seed treater"***), durante un periodo de tiempo lo suficientemente largo para permitir una distribución minuciosa de la suspensión sobre la semilla, pero lo suficientemente corto, de manera que la semilla tratada no

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se seque completamente Se cree que si las semillas tratadas se dejan permanecer en un tratador de semilla calentado hasta que la suspensión este completamente seca, se incrementa el peligro de pérdida del plaguicida por abrasión A modo de ejemplo, cuando la temperatura de salida del aire caliente, que circula a través de la maquina CMS, se mantiene a alrededor de 95 °F, y la suspensión acuosa contiene alrededor de 1 6% en peso de imidacloprid y 8% en peso de un agente de adhesión, es apropiado un tiempo de aplicación de entre alrededor de 3 minutos y alrededor de 20 minutos, y se prefiere un tiempo de aplicación de entre alrededor de 5 y alrededor de 15 minutos

[00067] Las semillas que se han tratado por el método en cuestión pueden almacenarse, manipularse y sembrarse como cualesquiera otras semillas Métodos y condiciones similares pueden emplearse con cualesquiera otras semillas tratadas, o no tratadas, y puede usarse el mismo equipo de manipulación y siembra que se utiliza para las semillas convencionales

[00068] Las semillas cubiertas y tratadas de la presente invencion pueden recubrirse con una o más capas, aplicadas una vez que las semillas se han tratado con el agente fitotóxico Estas últimas capas pueden contener colorantes, aglutinantes, absorbentes y demás materiales utiles, y pueden aplicarse para efectos de seguridad, proteccion, resistencia a la abrasión, o similares

[00069] Los siguientes ejemplos describen incorporaciones preferidas de la invención Otras incorporaciones dentro del ámbito de las reivindicaciones contenidas aquí serán evidentes a una persona experta en el arte, a partir de la consideración de la especificación o práctica de la invención, tal como se divulga aqui Se pretende que la especificacion, junto con los ejemplos, se considere paradigmática unicamente, indicándose el ambito y el espíritu de la invención por las reivindicaciones que siguen a los ejemplos En los ejemplos, todos los porcentajes se dan sobre una base en peso, a menos que se indique lo contrario

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PROCEDIMIENTOS GENERALES

Método de recubrir semillas con un polímero

[00070] Se recubrieron semillas con polímeros en un tratador de semillas CMS, modelo PSC-0 5 En el proçedimiento normal, 750 g de semilla de maiz, o 500 g de semilla de sorgo, se agregaron al tambor de volteo del tratador CMS Los polímeros solubles en agua que iban a usarse para la capa se pusieron en solución en agua Polímeros no solubles en agua se dispersaron en agua para formar una dispersión de polímero de latex Asimismo pueden usarse con modificación posterior, o sin ella, soluciones de polimeros y látexes de polímeros que se obtienen directamente de un proveedor Una cantidad medida de la solucion de polimero o dispersion de latex se roció sobre las semillas para proporcionar una capa de polimero del espesor deseado La capa de polimero se seco por aire caliente, soplado a través de la cama de volteo de las semillas, para formar una capa de polímero curada que tenía un cierto espesor pre-determinado Todos los ajustes de la máquina estuvieron de acuerdo con las recomendaciones del fabricante y se hallaban dentro de los límites normales, como entendería una persona experta en el arte del recubrimiento de semillas

Metodo de tratar semillas con un plaguicida

[00071] Agentes agroquimicos, normalmente un plaguicida con un antidoto de herbicida, se aplicaron a semillas cubiertas con polímero en un tratador de semillas Hege, modelo 11 Cuando se aplicó un antidoto de herbicida como parte del régimen de tratamiento de la semilla, se empleo Concep III (con 74 3% de fluxofenina como su ingrediente activo, disponible de Novartis Crop Protection, Inc , Greensboro, NC)

[00072] Semillas por tratar se pusieron en un tazón de la maquina Hege 11, se prendió el motor Hege y el Concep III pre-mezclado y el plaguicida

se aplicaron en la cama de volteo de las semillas mediante una jeringa Se dejó continuar el proceso de mezclado durante alrededor de 40 segundos

Prueba de germinación con calor

[00073] Se utilizó esta prueba para determinar el máximo potencial de germinación de semillas sin tratar y semillas que se sometieron a tratamiento

[00074] 50 hojas de peso regular, tamaño 12 pulgadas x 18 pulgadas, toallas de pruebas de germinación se remojaron de un día para otro en 840 ml de agua del grifo 50 semillas se pusieron en una hoja humeda usando bandejas de germinación Hoffman Manufacturing La hoja con semillas se cubrió con una segunda toalla y se enrolló Por cada muestra se efectuaron cuatro réplicas

[00075] Las toallas enrolladas se dispusieron en una posición vertical en un vaso de pico de 1 000 ml, el cual se cubrio con una bolsa de polietileno para impedir el secamiento El recipiente se puso en un incubador de temperatura alternante ajustado para proporcionar ciclos de 20°C durante 16 horas, seguidos por ciclos de 30°C durante 8 horas

[00076] El conteo final de las semillas germinadas se hizo 7 dias después Se determino la germinación porcentual como el numero promedio de semillas que había germinado dentro del periodo de prueba, menos cualesquiera semillas anormales, dividido por el numero total de semillas originales, por 100

Prueba de germinacion con frio

[00077] Esta prueba se diseño para medir la capacidad de las semillas de germinar bajo la condición adversa asociada con alta humedad del suelo, baja temperatura del suelo y actividad microbiana

[00078] Se preparó una mezcla de suelo mezclando concienzudamente 6 litros de arena grado medio, 6 litros de turba cernida, y 1 litro de agua

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Media pulgada de la mezcla de suelo se puso en el fondo de una bandeja y se niveló Cien (100) semillas se pusieron encima del suelo, y 1/2 pulgada más de suelo se puso sobre las semillas y se niveló Por cada muestra se realizaron cuatro replicas, cada una con 100 semillas

[00079] Los recipientes se pusieron en un cuarto frio (10°C) y oscuro durante 7 días Despues de 7 dias, los recipientes se trasladaron a un cuarto caliente (25°C) y oscuro durante 3 dias Las plántulas emergentes se evaluaron como normales o anormales y se contaron El porcentaje de germinacion se determinó como se describe más arriba

EJEMPLO COMPARATIVO 1

[00080] Este ejemplo ilustra las propiedades de capas de varios polímeros formadas sobre semillas de maíz

[00081] Capas de 21 polímeros diferentes y una emulsion de cera se formaron sobre semillas de maíz por el método descrito más arriba Tabla 1 enumera los diferentes polimeros, que se probaron, y describe la composición química del polímero, el pH de la emulsión de polímero, el tamaño promedio de partículas de los sólidos en la emulsión, la temperatura de transición vítrea del polímero (T_g), la temperatura minima de formación de película (MFT) del polimero, y el tipo de tensoactivo (si lo hubiere), que se suministró con la emulsión por el fabricante Se observo que la MFT se relacionaba aproximadamente con la T_g de los polímeros para los cuales se disponia de estos datos, pero que estos valores no siempre se correlacionaban con exactitud.

[00082] Tabla 2 muestra las propiedades físicas de capas sobre semilla de maíz que se formaron de las emulsiones de polímeros descritas en Tabla 1 Se informó el contenido de humedad de las semillas después del tratamiento (% de agua), y se analizó la calidad de la película de acuerdo con tres parámetros

[00083] La integridad de la cobertura de la capa de la semilla se estimo por inspeccion visual (bajo ampliación, si fuere necesario) La cobertura se

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calificó de acuerdo con la siguiente escala

+++++ = No se observaron huecos visuales

++++ = Hay algunos pequeños huecos en la capa y el tamaño de los huecos es de alrededor de 1 mm ó más

+++ = 70-95% de la superficie de la semilla está cubierta con la capa

++ = 50-70% de la superficie de la semilla esta cubierta con la capa

+ = <50% de la superficie de la semilla está cubierta con la capa

[00084] Se probó la adhesión de la capa a la semilla pegando un pedazo de cinta adhesiva marca Scotch® a una parte de la semilla cubierta por una capa, y pelando luego la cinta y determinando que cantidad de la capa se retiraba de la semilla El grado de adhesión se describió de acuerdo con la siguiente escala

+++++ = No se desprende capa

++++ = Se desprende 10-20% de la capa del área pegada con cinta

+++ = Se desprende 30-50% de la capa del area pegada con cinta

++ = Se desprende >50% de la capa del área pegada con cinta

[00085] La calidad de la película (Pelicula) se evaluo por el aspecto de la capa sobre la superficie de la semilla de acuerdo con la inspeccion visual (bajo ampliacion, si fuere necesario) La calidad se expreso de acuerdo con la siguiente escala

+++++ = Película coherente que carecia de particulas de polímero sin fusionar

++++ = Menos de 5% de partículas de polímero sin fusionar

+++ = Partículas de polímero sin fusionar (20-5%) + pelicula (80-95%) del área cubierta por la capa

++ = Partículas de polímero sin fusionar (50-80%) + pelicula (50-20%) del area cubierta por la capa

+ = Partículas de polimero sin fusionar sobre la superficie de la semilla

[00086] En general, las capas que se formaron de los polimeros 208, Vinamul 6975, Mowilith LDM2110, Mowilith DM778, Premafresh 50-V,

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Airflex 4514, Flexbond 381, CP620NA S/B Latex, PB 6820 NA S/A Latex, FC 1040 S/B Latex y CP 6810 NA S/B Latex proporcionaron propiedades de la capa superiores a los demás polímeros probados

EJEMPLO 1

[00087] Este ejemplo ilustra el recubrimiento de semillas de sorgo con acetato de polivinilo, seguido por tratamiento con diferentes niveles de imidacloprid y antídoto fluxofenina.

[00088] Semillas de sorgo se cubrieron con capas de 10 micrones y 50 micrones de espesor de acetato de polivinilo (Vinac XX-210, disponible de Air Products como una emulsión con 55% de sólidos dispersos en agua), y luego se trataron con tres índices diferentes de fluxofenina (Concep III, disponible de Novartis Crop Protection, Inc) e imidacloprid (disponible como Gaucho 600, que contenía 48 7% imidacloprid, de Gustafson LLC, Plano, TX) Los índices de Concep III / Gaucho usadas fueron 50 / 250 gramos, 100 / 500 gramos, y 150 / 750 gramos por 100 kg de semillas El porcentaje de germinacion de las semillas se evaluó por las pruebas de germinación con frio y germinación con calor el dia en que se administró el tratamiento (T0), y entonces las semillas se almacenaron a una temperatura de 35°C para simular un envejecimiento acelerado En la prueba de germinación con calor, las semillas tratadas y los controles no tratados se probaron nuevamente para determinar el porcentaje de germinación después de 8 dias, (T8), 14 días (T14), 33 días (T33), 120 días (T120), y 161 días (T161) Los porcentajes de germinación obtenidos de la prueba de germinacion con calor se muestran en Figura 1 Los porcentajes de germinación de la prueba de germinación con frío se determinaron en aproximadamente los mismos intervalos de tiempo y se muestran en Figura 2

[00089] Figuras 1 y 2 muestran los efectos del tiempo después del tratamiento, el porcentaje de tratamiento con plaguicida y el espesor de la capa en las pruebas de germinacion con calor y germinación con frio,

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respectivamente Se observó que la presencia de plaguicida sobre la semilla redujo el porcentaje de germinacion tanto en las pruebas de germinación con calor como en las de germinación con frio y que, sin una capa de polímero, la reducción en el porcentaje de germinación fue más pronunciada para la germinación con frío Para la germinacion con calor y en frío, se descubrió que aumentar los porcentajes de plaguicida reducía de manera notoria el porcentaje de germinación Semillas con una capa de polímero de 10µ ó 50µ antes del tratamiento con plaguicida tuvieron porcentajes de germinacion mejorados, comparados con semillas sin capa de polimero de ninguna clase Asimismo, el porcentaje de germinacion se incrementó al aumentar el espesor de la capa de 10µ a 50µ

[00090] En la prueba de germinacion con calor, con el nivel más alto de tratamiento con plaguicida, después de 14 días de envejecimiento a 35°C, las semillas con capas de 50µ tuvieron un porcentaje de germinacion de 70% vs 40% para semillas no cubiertas con el mismo indice de tratamiento con pesticida En la prueba de germinacion con frio para semillas similares y condiciones similares, las semillas cubiertas mostraron porcentajes de germinación de 60% vs 30% para semillas no cubiertas

EJEMPLO 2

[00091] Este ejemplo ilustra el efecto de las propiedades de la capa de polímero sobre el porcentaje de germinación de las semillas

[00092] Semillas de sorgo se cubrieron primero como se describe más arriba con una capa de 5 micrones de espesor de diferentes mezclas de hidroxipropilcelulosa y metilcelulosa, que contenían diferentes proporciones de grupos hidroxipropilo y metilo Los polímeros utilizados fueron Methocel E50LV (una solucion 2% p/p en agua con una viscosidad de 40 - 60 mPa a 25°C), Methocel E3LV (una solucion 2% p/p en agua con una viscosidad de 2 4 - 3 6 mPa a 25°C) y Methocel A15LV (una solución 2% p/p en agua con una viscosidad de 12 -18 mPa a 25°C) (todos disponibles de Dow Chemical Co , Midland, Ml, y utilizados como

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emulsiones con 5% de sólidos dispersados en agua) Las semillas cubiertas se trataron con Concep III / Gaucho en un indice de 50/250 gramos por 100 kg de semilla Despues del tratamiento, las semillas tratadas y no tratadas se probaron para determinar la germinacion con calor y la germinacion con frio el mismo dia del tratamiento (T0), y nuevamente despues del envejecimiento acelerado a 35°C durante 7 dias, (T7), 14 dias (T14) y 33 días (T33) Los datos resultantes se muestran en Figura 3 para la prueba de germinación con calor, y en Figura 4 para la prueba de germinacion con frio

[00093] Los datos de las pruebas de germinación con calor y germinación con frío muestran que la presencia de plaguicida sobre semillas no cubiertas reduce el porcentaje de germinación en forma significativa, comparado con semillas que no tuvieron tratamiento con plaguicida. En 31 días, por ejemplo, la adición del plaguicida hace caer el porcentaje de germinación con calor desde alrededor de 86% a alrededor de 60%, y el porcentaje de germinacion con frío desde alrededor de 75% a alrededor de 49% La adicion de cualquiera de las tres capas de polímeros proporcionó una proteccion significativa a las semillas El mejor comportamiento lo obtuvo la capa que comprendía Methocel E3 LV, mientras que la capa que comprendía Methocel A15LV fue la segunda de mejor rendimiento, y la capa que comprendia Methocel E50LV tuvo un desempeño menos bueno de las tres, pero aún ofreció una protección significativa sobre semillas tratadas con plaguicida, que carecian de capa de polímero Este orden de rendimiento fue el mismo para las pruebas de germinacion con calor y de germinación con frio

[00094] Sin entrar en esta o cualquier otra limitacion teórica, se cree que la viscosidad de las soluciones en agua de estos polímeros tuvieron un efecto sobre la integridad de las películas producidas sobre las semillas Se evidenció que las soluciones recubridoras con viscosidades más bajas proporcionaron capas que tuvieron un mejor desempeño que las soluciones recubridoras con viscosidades mas elevadas

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EJEMPLO 3

[00095] Este ejemplo ilustra el efecto del tipo de polímero usado para la capa y el indice de aplicación de plaguicida sobre el porcentaje de germinación de las semillas

[00096] Semillas de sorgo (DK40Y 1752 KXM, de DeKalb Genetics) se cubrieron como se describe más arriba con una capa con 10 micrones de espesor de uno de cinco diferentes polímeros Se prepararon semillas de control sin capa de polímero de ninguna clase Los polimeros utilizados fueron SB-2000 (es un polímero a base de almidon, de marca registrada disponible de Seedbiotics, Inc , Caldwell, ID), Vinac XX-210 (acetato de polivinilo en emulsión protegida con alcohol polivinílico, disponible de Air Products and Chemicals, Inc , Allentown, PA), Maltrin MO40 (maltodextrina, disponible de GPC, Inc , Muscatine, IA), Airflex 500 (copolímero de acetato de polivinilo/etileno, disponible de Air Products and Chemicals, Inc , Allentown, PA), y Flexbond 289 (polímero de acrilato de vinilo, disponible de Air Products and Chemicals, Inc , Allentown, PA) Todos los polimeros se usaron como emulsiones en agua Las semillas cubiertas se dejaron sin tratar (0x tratamiento), o se trataron con Concep III / Gaucho en un indice de 50/250 gramos por 100 kg de semilla (1x tratamiento) Luego del tratamiento, las semillas tratadas y las no tratadas se probaron para determinar el porcentaje de germinacion con calor el mismo día del tratamiento (T0), y nuevamente despues de un envejecimiento acelerado a 35°C durante 7 dias, (T7), 15 días (T15), 36 dias (T36), 61 dias (T61), 93 días (T93, y 124 dias (T124) Los datos resultantes se muestran en Figura 5

[00097] Los datos de la prueba de porcentaje de germinacion con calor mostraron que la presencia de cualquiera de las capas de polimero redujo el porcentaje de germinación de semillas que no tenian tratamiento con plaguicida La reducción fue desdeñable (menos de alrededor de 5% por debajo del porcentaje de germinación para (semillas) sin capa en 124 dias, Flexbond 289, Vinac XX-210), moderado (menos de alrededor de 8% de

reducción, Maltrin MO40), o mayor (menos de alrededor de 10% de reducción, SB-2000, Airflex 500) Cuando las semillas se trataron con Concep III / Gaucho en un indice de 50/250 gramos por 100 kg de semilla, el porcentaje de germinación con calor de la semilla no cubierta se redujo desde alrededor de 87% a 124 días (para semilla no tratada con plaguicida) a apenas por debajo de 70% Las semillas cubiertas con capas de 10µ de Vinac XX-210 (con una MTF de alrededor de 35°C) y Maltrin MO40 tuvieron porcentajes de germinación más elevados que la semilla no cubierta, indicando que la capa de polímero proporcionó protección a la semilla. Las semillas cubiertas con Airflex 500 (MFT de < 0°C) o Flexbond 289 tuvieron un desempeño en alrededor del mismo nivel de germinacion que las semillas no cubiertas El porcentaje de germinación de semillas cubiertas con capas de 10µ de SB-2000 (con una MFT de alrededor de 50°C) fue casi 10% menos que las semillas no cubiertas

[00098] Estos datos indicaron que diferentes tipos de polimeros difenan en su capacidad de proteger las semillas de la fitotoxicidad de plaguicidas recubiertos, cuando se aplican a la semilla no tratada como capas de 10µ

EJEMPLO 4

[00099] Este ejemplo ilustra el efecto del espesor y el tipo de polímero utilizados para capa de semilla sobre el porcentaje de germinación con calor de semillas que se van a tratar con un plaguicida.

[000100] Semillas de sorgo (DeKalb DK40Y 1752KXM) se cubrieron como se describe más arriba con capas de 5µ de uno de siete diferentes polimeros Uno de los polímeros se usó para formar tres capas adicionales de espesores crecientes - 10µ, 20µ, y 50µ) Se prepararon semillas de control sin capa de polímero de ninguna clase (control 1) Los polimeros usados (y el espesor de la capa) fueron Maltrin MO40 (5µ), Methocel E3LV (5µ), Methocel E50LV (5µ), Methocel A15LV (5µ), Airflex 500 (5µ + 1% talco), Flexbond 289 (5µ), y Vinac XX-210 (con 5µ, 10µ, 20µ y 50µ) Todos los polímeros se emplearon como emulsiones en agua

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Semillas cubiertas se dejaron sin tratar (control 2), o se trataron con Concep III / Gaucho 600 en el índice 50/250 gramos por 100 kg de semilla Después del tratamiento, las semillas tratadas y no tratadas se probaron para determinar el porcentaje de germinación por calor el mismo día del tratamiento (T0), y nuevamente luego del envejecimiento acelerado a 35°C durante 7 días, (T7), 14 días (T14), 31 días (T31), 61 días (T61) y 95 dias (T95) Figura 6 muestra los datos resultantes

[000101] Los datos de la prueba del porcentaje de germinacion mostraron que luego de 95 días de envejecimiento, el porcentaje de germinación de las semillas no cubiertas, que se trataron con plaguicida, había caído a casi 24%, vs alrededor de 85% de las semillas no cubiertas y no tratadas Todas las semillas cubiertas/tratadas con capas de polimeros de 5µ tuvieron porcentajes de germinacion mas altos en 95 días que las semillas no cubiertas/tratadas En el orden de porcentaje de germinación mejorado en 95 dias se situaron semillas cubiertas/tratadas que tenian capas de Vinac XX-210 (germinación de 28%), Methocel E50LV (31%), Flexbond 289 (33%), Maltrin MO40 (41%), Methocel A15LV (44%), Airflex 500 + 1% talco (50%), y Methocel E3LV (64 5%) Estos datos ilustraron que diferentes tipos de polímeros proporcionaron distintos niveles de protección cuando se usaron con el mismo espesor de capa En general, se evidenció que polímeros, que proporcionaban una solucion recubridora o látex con baja viscosidad y con una MFT baja, brindaban una mejor protección que los polímeros con una alta viscosidad de solucion o latex y una MFT elevada

[000102] Para semillas que se habían tratado con diferentes espesores de capa de Vinac XX-210, los porcentajes de germinacion fueron 28 5% para 5µ, 44 5% para 10µ, 38% para 20µ, y 43% para 50µ Esto mostró que los efectos beneficos del espesor de la capa no aumentaron simplemente con un espesor creciente de capa, sino parecieron alcanzar un pico o máximo, donde un espesor adicional de la capa no se tradujo en una mejora adicional de la protección

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EJEMPLO 5

[000103] Este ejemplo ilustra el efecto del espesor y el tipo de polímero usados para cubrir las semillas sobre el porcentaje de germinación con frío de semillas a tratarse con un plaguicida.

[000104] Esta prueba duplicó sustancialmente el Ejemplo 4, excepto que se realizó una prueba de germinación con frío en las semillas tratadas para determinar los efectos de las capas bajo condiciones adversas de germinacion/emergencia En Figura 7 se muestran los datos resultantes

[000105] Comparada con la germinacion por calor, la prueba de germinacion con frio resultó en porcentajes totales de germinación mas bajos al final de la prueba (94 días) El porcentaje de germinación del control no cubierto/no tratado fue de alrededor de 60% vs 14% de las semillas no cubiertas/tratadas Todas las capas, excepto una, proporcionaron protección a la semilla y resultaron en porcentajes de germinación más altos En el orden de porcentajes mejorados de germinacion, el rendimiento fue Vinac XX-210 (10% de germinación), Methocel E50LV (14%), Flexbond 289 (15%), Maltrin MO40 (23 5%), Methocel A15LV (26%), y Methocel E3LV (34 5%) Esta fue la misma clasificación hallada en la prueba de germinación con calor, e indicó que las propiedades del polimero, determinantes de la idoneidad para el presente uso, no variaron en forma desproporcionada, como entre los polimeros probados, sobre el rango de temperatura abarcado por las pruebas de germinacion con calor y germinación con frio En otras palabras, polimeros que funcionan bien con temperaturas cálidas parecen funcionar igualmente bien con temperaturas frías

[000106] Para semillas que se habian tratado con diferentes espesores de capa de Vinac XX-210, los porcentajes de germinación fueron 10% para 5µ, 18% para 10µ, 16% para 20µ, y 22 5% para 50µ Como en Ejemplo 4, esto evidenció que los efectos beneficos del espesor de la capa no aumentaron simplemente con un espesor creciente de capa, sino parecieron alcanzar un nivel en donde un espesor adicional de la capa no se tradujo en

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una mejora adicional significativa de la protección

[000107] Todas las referencias citadas en esta especificación, incluidos, sin limitación, todos los escritos, publicaciones, patentes, solicitudes de patente, presentaciones, textos, informes, manuscritos, folletos, libros, artículos enviados a grupos de discusion por internet, artículos periodísticos, publicaciones periódicas y similares, se incorporan aquí por referencia en esta especificación en su totalidad La discusion de las referencias contenidas aquí tiene como propósito unicamente resumir las aseveraciones hechas por sus autores y no se admite que cualquier referencia constituya arte previo Los solicitantes se reservan el derecho de cuestionar la exactitud y pertinencia de las referencias citadas

[000108] En vista de lo anterior, se observará que se logran las distintas ventajas de la invención y se obtienen otros resultados ventajosos

[000109] Como pueden hacerse varios cambios en los métodos y las composiciones anteriores sin apartarse del ambito de la invención, se pretende que toda la materia contenida en la descripcion precedente y mostrada en los dibujos acompañantes se interpretara como ilustrativa y no en un sentido limitante

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LO QUE SE REIVINDICA ES

1 Un método de incrementar el porcentaje de germinación de semillas de planta que se tratan con un agente fitotoxico, método que comprende

formar una capa de polimero sobre la semilla de planta antes de tratar la semilla con el agente fitotóxico, en donde la capa está libre del agente fitotóxico y en donde el tipo de polímero y el espesor de la capa se diseñan para bloquear el contacto fitotóxico del agente fitotóxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxigeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad bajo condiciones ambientales enfrentadas normalmente por la semilla después de la siembra, para posibilitar su germinación, y

tratar la semilla cubierta de planta con el agente fitotóxico

2 El método de acuerdo con la reivindicacion 1, en donde la capa comprende un polímero en una cantidad de más de 10% en peso

3 El método de acuerdo con la reivindicación 2, en donde la capa comprende un polímero en una cantidad de por lo menos alrededor de 50% en peso

4 El método de acuerdo con la reivindicación 1, en donde el espesor de la capa es entre alrededor de 1 micrón y alrededor de 480 micrones

5 El método de la reivindicación 1, en donde el polimero es uno que tiene una temperatura minima de formacion de película de menos de 55°C

6 El método de la reivindicación 5, en donde el polimero comprende un material seleccionado del grupo conformado por maltodextrina, metilcelulosa, etilcelulosa, hidroxipropilcelulosa, hidroxipropil/metilcelulosa, polímero de acetato de vinilo - etileno, polimeros de cloruro de vinilo - etileno, polimeros de acetato de vinilo, polímeros vinil-acrílicos, polímeros a base de almidón, SB-2000, polímeros de cloruro de vinilo – acetato de polivinilo, copolímeros de cloruro de

vinilo / acetato de vinilo / etileno, copolímeros de estireno-acrilato, polímeros de acetato de vinilo, polimeros de butiraro de vinilo, copolímeros de estireno-butirato de vinilo, polimeros de acrilato, copolímeros de estireno-butadieno, copolímeros de acetato de vinilo – butirato de vinilo, copolímeros de acetato de vinilo - versatato de vinilo y alcohol polivinílico

7 El método de la reivindicacion 5, en donde el polimero comprende acetato de polivinilo

8 El método de la reivindicación 5, en donde el polimero comprende methocel

9 El método de la reivindicación 1, en donde la semilla es la semilla de una planta agronómica que se selecciona del grupo conformado por cereales (trigo, cebada, centeno, avena, arroz, sorgo, productos agrícolas relacionados, etc), remolacha, frutas en forma de pera, frutas que tienen pepa y frutas blandas (manzana, pera, ciruela, melocotón, albaricoque japonés, ciruela pasa, almendra, cereza, fresa, frambuesa, mora, tomate, pimiento, etc), legumbres (fríjol, lenteja, arveja, soya), plantas oleaginosas (colza, canola, mostaza, amapola, oliva, girasol, coco, ricino, granos de cacao, maní, soya, maiz, etc) Cucurbitáceas (calabaza, cohombro, melón, etc), cítricos (naranja, limón, toronja, mandarina, pomelo Watson (*citrus* natsudaidai), etc), vegetales (lechuga, repollo, col china, rábano chino, zanahoria, cebolla, papa, etc), árboles de alcanfor (aguacate, canela, alcanfor, etc), maíz, tabaco, nueces, café, caña de azucar, té, vid, lupulo y banano

10 El método de la reivindicacion 9, la planta agronomica se selecciona del grupo conformado por arroz, trigo, cebada, centeno, maiz, papa, zanahoria, batata, remolacha azucarera, frijol, arveja, achicoria, lechuga, repollo, coliflor, broculi, nabo, rábano, espinaca, esparrago, cebolla, ajo, berenjena, pimiento, apio, zanahoria, zapallo, calabaza, calabacin, cohombro, manzana, pera, membrillo, melón, ciruela, cereza, melocotón, nectarina, albaricoque, fresa, uva, frambuesa, zarzamora, piña, aguacate, papaya, mango, banano, soya, tomate, sorgo y frambuesas, banano y otras variedades comestibles similares

11 El método de la reivindicación 10, en donde la planta agronomica se selecciona de maíz, frijol de soya, algodón, sorgo, colza (canola), arroz, trigo, cebada y centeno

12 El método de la reivindicación 10, en donde la planta agronomica es maiz, fríjol de soya, o algodón

13 El método de la reivindicación 1, en donde el agente fitotóxico se selecciona del grupo conformado por plaguicidas, fertilizantes, reguladores de crecimiento de plantas, fármacos, colorantes, atrayentes biologicos, fragancias, feromonas y sus mezclas

14 El método de la reivindicación 1, en donde el agente fitotoxico comprende un plaguicida seleccionado del grupo conformado por herbicidas, moluscicidas, insecticidas, nematocidas, acaricidas, fungicidas, bactericidas y sus mezclas

15 El método de la reivindicacion 14, en donde el plaguicida se selecciona del grupo conformado por piretrinas, piretroides sinteticos, azoles, insecticidas de oxadizina, neonicotinoides, diazoles, triazoles, derivados de estrobilurina, organofosfatos, pirroles, pirazoles, fenilpirazoles, diacilhidracinas, productos de fermentacion / biologicos, carbamatos y sus mezclas

16 El método de la reivindicacion 14, en donde el plaguicida comprende un insecticida

17 El método de la reivindicacion 16, en donde el insecticida comprende un piretroide o piretrina sintética

18 El método de la reivindicación 17, en donde la piretrina comprende un miembro seleccionado del grupo conformado por ester de 2-alil-4-hidroxi-3-metil-2-ciclopenten-1-ona de ácido 2,2-dimetil-3-(2-metilpropenil)-ciclopropanocarboxílico, (2-metil-1-propenil)-2-metoxi-4-oxo-3- (2-propenil)-2-ciclopenten-1-il éster y mezclas de sus isómeros *cis* y *trans*

19 El método de la reivindicación 17, en donde el piretroide comprende un miembro seleccionado del grupo conformado por (s)-ciano (3-fenoxifenil)metil-4-cloro alfa (1-metiletil)bencenoacetato (fenvaleriato,

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CAS RN 51630-58-1), (S)-ciano-(3-fenoxifenil)metil (S)-4-cloro-alfa-(1-metiletil)bencenoacetato (esfenvalerato, CAS RN 66230-04-4), (3-fenoxifenil)-metil(+)cis-trans-3-(2,2-dicloroetenil)-2,2-dimetilciclopropanocarboxilato (permetrin, CAS RN 52645-53-1), (±) alfa-ciano-(3-fenoxifenil)metil(+)-cis,trans-3-(2,2-dicloroetenil)-2,2-dimetil-ciclopropano carboxilato (cipermetrin, CAS RN 52315-07-8), (beta-cipermetrin, CAS RN 65731-84-2), (theta cipermetrin, CAS RN 71697-59-1), S-ciano (3-fenoxifenil)metil (±) cis/trans 3-(2,2-dicloroetenil) 2,2 dimetilciclopropanocarboxilato (zeta-cipermetrin, CAS RN 52315-07-8), (s)-alfa-ciano-3-fenoxibencil (1R,3R)-3-(2,2-dibromovinil)-2,2-dimetilciclopropanocarboxilato (deltametrin, CAS RN 52918-63-5), alfa-ciano-3-fenoxibencil 2,2,3,3,-tetrametil ciclopropoanocarboxilato (fenpropatrin, CAS RN 64257-84-7), (RS)-alfa-ciano-3-fenoxibencil (R)-2-[2-cloro-4-(trifluorometil)anilino]-3-metilbutanoato (tau-fluvalinato, CAS RN 102851-06-9), (2,3,5,6-tetrafluoro-4-metilfenil)metil-(1-alfa, 3-alfa)-(Z)-(±)-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (teflutrin, CAS RN 79538-32-2), (±)-ciano (3-fenoxifenil)metil (±)-4-(difluorometoxi)-alfa-(1-metil etil) bencenoacetato (flucitrinato, CAS RN 70124-77-5), ciano(4-fluoro-3-fenoxifenil)metil 3-[2-cloro-2-(4-clorofenil)etenil]-2,2-dimetilciclopropanocarboxilato (flumetrin, CAS RN 69770-45-2), ciano (4-fluoro-3-fenoxifenil) metil 3-(2,2-dicloroetenil)-2,2-dimetil-ciclopropanodarboxilato (ciflutrin, CAS RN 68359-37-5), (beta ciflutrin, CAS RN 68359-37-5), (transflutrin, CAS RN 118712-89-3), (S)-alfa-ciano-3-fenoxibencil (Z)-(1R-cis)-2,2-dimetil-3-[2-(2,2,2-trifluoro-trifluorometil-etoxicarbonil)vinil]ciclopropanocarboxilato (acrinatrin, CAS RN 101007-06-1), pareja de isómero (1R cis) S y (1S cis) R enantiómero de alfa-ciano-3-fenoxibencil-3-(2,2-diclorovinil)-2,2-dlmetilciclopropanocarboxilato (alfa-cipermetrin, CAS RN 67375-30-8), ácido [1R,3S)3(1'RS)(1',2',2',2'-tetrabromoetil)]-2,2-dimetilciclopropanocarboxílico (s)-alfa-ciano-3-fenoxibencil éster (tralometrin, CAS RN 66841-25-6), ciano-(3-fenoxifenil)metil 2,2-diçloro 1-(4-etoxifenil)ciclopropanocarboxilato

(cicloprotrin, CAS RN 63935-38-6), [1α, 3α(Z)]-(±)-ciano-(3-fenoxifenil)metil 3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (cihalotrin, CAS RN 68085-85-8), [1-alfa (s), 3-alfa(z)]-ciano(3-fenoxifenil)metil-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (lambda cihalotrin, CAS RN 91465-08-6), (2-metil-[1,1'-bifenil]-3-il)metil-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetil-ciclopropanocarboxilato (bifentrin, CAS RN 82657-04-3), 5-1-bencil-3-furilmetil-d-cis(1R,3S,E)2,2-dimetil-3-(2-oxo,-2,2,4,5 tetrahidrotiofenilidenmetil)ciclopropanocarboxilato (kadetrin, RU15525, CAS RN 58769-20-3), [5-(fenilmetil)-3-furanil]-3-furanil-2,2-dimetil-3-(2-metil-1-propenil)ciclopropanocarboxilato (resmetrin, CAS RN 10453-86-8), (1R-trans)-[5-(fenilmetil)-3-furanil]metil 2,2-dimetil-3-(2-metil-1-propenil) ciclopropanocarboxilato (bioresmetrin, CAS RN 28434-01-7), 3,4,5,6-tetrahidro-ftalimidometil-(1RS)-cis-trans-crisantemato (tetrametrin, CAS RN 7696-12-0), 3-fenoxibencil-d, 1-cis,trans 2,2-dimetil-3-(2-metilpropenil)ciclopropanocarboxilato (fenotrin, CAS RN 26002-80-2), (empentrin, CAS RN 54406-48-3), (cifenotrin, CAS RN 39515-40-7), (praletrin, CAS RN 23031-36-9), (imiprotrin, CAS RN 72963-72-5), (RS)-3-alil-2-metil-4-oxciclopent-2-enil-(1S,3R, 1R,3S)-2,2-dimetil-3-(2-metilprop-1-enil) ciclopropanocarboxilato (aletrin, CAS RN 584-79-2), (bioaletrin, CAS RN 584-79-2), y (ZXI8901, CAS RN 160791-64-0)

19 El metodo de la reivindicacion 17, en donde el piretroide comprende un miembro seleccionado del grupo conformado por teflutrin, lambda cihalotrin, bifentrin, permetrin y ciflutrin

20 El método de la reivindicacion 15, en donde el plaguicida comprende un insecticida de oxidiazina que se selecciona del grupo conformado por 5-(2-cloropirid-5-ilmetil)-3-metil-4-nitroiminoperhidro-1,3,5-oxadiazina, 5-(2-clorotiazol-5-ilmetil)-3-metil-4-nitroiminoperhidro-1,3,5-oxadiazina, 3-metil-4-nitroimino-5-(1-oxido-3-piridinometil)perhidro-1,3,5-oxadiazina, 5-(2-cloro-1-oxido-5-piridinometil)-3-metil-4-nitroiminoperhidro-1,3,5-oxidiazina, y 3-metil-5-(2-metilpirid-5-ilmetil)-4-nitroiminoperhidro-1,3,5-oxadiazina

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21 El método de la reivindicación 15, en donde el plaguicida comprende un insecticida neonicotinoide que se selecciona del grupo conformado por acetamiprid, imidacloprid, tiametoxam, clotianidina, dinotefuran, flonicamid, nitiazina y tiacloprid

22 El método de la reivindicacion 15, en donde el plaguicida comprende un neonicotinoide que se selecciona del grupo conformado por tiametoxam (CAS RN 153719-23-4), acetamiprid ((E)-N-[(6 cloro-3-piridinil)metil]-N'-ciano-N-metilenimidamida, CAS RN 135410-20-7), imidacloprid (1-[(6-cloro-3-piridinil)metil]-N-nitro-2-imidazolidinimina, CAS RN 138261-41-3), nitenpiram (N-[(6-cloro-3-piridinil)metil]-N-etil-N'-metil-2-nitro-1,1-etendiamina, CAS RN 120738-89-8), clotianidina (TI-435(N-[(2-cloro-5-tiazoil)metil]-N'-metil-N"-nitro,[C(E)]-(9Cl)-guanidina, CAS RN 210880-92-5)

23 El método de la reivindicación 15, en donde el plaguicida comprende un pirrol, pirazol, o fenilpirazol que se selecciona del grupo conformado por clorfenapir (4-bromo-2-(4-clorofenil)-1-etoximetil-5-trifluorometilpirrol-3-carbonitrilo, CAS RN 122453-73-0), fenpiroximato ((E)-1,1-dimetiletil-4[[[[(1,3-dimetil-5-fenoxi-1H-pirazol-4-il)metilen]amino]oxi]metil]benzoato, CAS RN 111812-58-9), tebufenpirad (4-cloro-N[[4-1,1-dimetiletil)fenil]metil]-3-etil-1-metil-1H-pirazol-5-carboxamida, CAS RN 119168-77-3), y fipronil (5-amino-[2,6-dicloro-4-(trifluorometil)fenil]-4-[(1R,S)-(trifluorometil)sulfinil]-1H-pirazol-3-carbonitrilo, CAS RN 120068-37-3)

24 El método de la reivindicación 15, en donde el plaguicida comprende una diacilhidracina que se selecciona del grupo conformado por halofenozida (4-clorobenzoato-2-benzoil-2-(1,1-dimetiletil)-hidracida, CAS RN 112226-61-6), metoxifenozida (RH-2485, N-tert-butil-N'-(3-metoxi-o-toluoil)-3,5-xilohidracida, CAS RN 161050-58-4), y tebufenozida (acido 3,5-dimetilbenzoico 1-(1,1-dimetiletil)-2-(4-etilbenzoil)hidracida, CAS RN 112410-23-8)

25 El método de la reivindicación 15, en donde el plaguicida comprende un triazol seleccionado del grupo conformado por amitrol (CAS

RN 61-82-5) y riazamate (etil-[[1-[(dimetilamino)carbonil]-3-(1,1-dimetiletil)-1H-1,2,4-triazol-5-il]tio]acetato, CAS RN 112143-82-5)

26 El método de la reivindicación 15, en donde el plaguicida comprende productos biológicos/de fermentación seleccionados del grupo conformado por avermectina (abamectina, CAS RN 71751-41-2) y spinosad (XDE-105, CAS RN 131929-60-7)

27 El método de la reivindicación 15, en donde el plaguicida comprende un insecticida de organofosfato seleccionado del grupo conformado por acefate (CAS RN 30560-19-1), clorpirifos (CAS RN 2921-88-2), clorpirifos-metil (CAS RN 5598-13-0), diazinona (CAS RN 333-41-5), fenamifós (CAS RN 22224-92-6), y malatión (CAS RN 121-75-5)

28 El método de la reivindicación 15, en donde el plaguicida comprende un insecticida de carbamato selecciona del grupo conformado por aldicarb (CAS RN 116-06-3), carbaril (CAS RN 63-25-2), carbofuran (CAS RN 1563-66- 2), oxamil (CAS RN 23135-22-0) y tiodicarb (CAS RN 59669-26-0)

29 El método de la reivindicación 14, en donde el plaguicida comprende un fungicida

30 El método de la reivindicación 29, en donde el fungicida comprende un fungicida de triazol seleccionado del grupo conformado por amitrol, azaconazol, bitertanol, bromuconazol, climbazol, clotrimazol, ciproconazol, diclobutrazol, difenoconazol, diniconazol, diniconazol-M, epoxiconazol, etaconazol, fenbuconazol, fluquinconazol, fluotrimazol, flusilazol, flutriafol, furconazol, furconazol-cis, hexaconazol, imibenconazol, ipconazol, metconazol, miclobutanil, paclobutrazol, penconazol, propiconazol, quinconazol, simeconazol, tebuconazol, tetraconazol, triadimefon, triadimenol, triazbutil, triticonazol, 1-(4-fluorofenil)-2-(1H-1,2,4-triazol-1-il)etanona y sus mezclas

31 El metodo de acuerdo con la reivindicación 29, en donde el fungicida comprende fluquinconazol, simeconazol, tebuconazol, tetraconazol, triticonazol, 1-(4-fluorofenil)-2-(1H-1,2,4-triazol-1-il)etanona, o sus mezclas

32 El método de acuerdo con la reivindicación 29, en donde el fungicida comprende fluquinconazol

33 El método de acuerdo con la reivindicación 29, en donde el fungicida comprende simeconazol

34 El método de acuerdo con la reivindicación 29, en donde el fungicida comprende tebuconazol

35 El metodo de acuerdo con la reivindicación 29, en donde el fungicida comprende tetraconazol

36 El metodo de acuerdo con la reivindicación 29, en donde el fungicida comprende triticonazol

37 El método de acuerdo con la reivindicación 29, en donde el fungicida comprende 1-(4-fluorofenil)-2-(1H-1,2,4-triazol-1-il)etanona

38 El método de acuerdo con la reivindicación 29, en donde el fungicida comprende un diazol seleccionado del grupo conformado por imazalil, oxpoconazol, pefurazoate, procloraz, triflumizol y sus mezclas

39 El método de acuerdo con la reivindicación 29, en donde el fungicida comprende un fungicida tipo estrobilurina seleccionado del grupo conformado por azoxistrobina, dimoxistrobina, famoxadona, kresoxim-metil, metominostrobina, picoxistrobina, piraclostrobina, trifloxistrobina y sus mezclas

40 El método de acuerdo con la reivindicacion 29, en donde el fungicida comprende un miembro seleccionado del grupo conformado por tebuconazol, simeconazol, fludioxonil, fluquinconazol, difenoconazol, 4,5-dimetil-N-(2-propenil)-2-(trimetilsilil)-3-tiofencarboxamida (siltiofam), hexaconazol, etaconazol, propiconazol, triticonazol, flutriafol, epoxiconazol, fenbuconazol, bromuconazol, penconazol, imazalil, tetraconazol, flusilazol, metconazol, diniconazol, miclobutanil, triadimenol, bitertanol, piremetanil, ciprodinil, tridemorf, fenpropimorf, kresoxim-metil, azoxistrobina, ZEN90160, fenpiclonil, benalaxil, furalaxil, metalaxil, R-metalaxl, orfurace, oxadixil, carboxina, procloraz, triflumizol, pirifenox, acibenzolar-S-metil, clorotalonil, cimoaxnil, dimetomorf, famoxadona, quinoxifen, fenpropidina, espiroxamina, triazoxide, BAS50001F,

hímexazol, pencicuron, fenamidona, guazatina y ciproconazol

41 El método de acuerdo con la reivindicación 29, en donde el fungicida comprende siltiofam

42 El metodo de acuerdo con la reivindicación 29, en donde el plaguicida comprende siltiofam y el polímero comprende acetato de polivinilo

43 El método de acuerdo con la reivindicación 14, en donde el plaguicida comprende siltiofam y el polímero comprende methocel

44 El método de acuerdo con la reivindicación 1, en donde el tratamiento comprende los pasos de

a. proveer una semilla,

b poner en contacto la semilla con un látex que comprende el polímero,

c formar una capa de polímero sobre la semilla antes de tratar la semilla con un agente fitotóxico, en donde la capa esta libre del agente fitotóxico y en donde el tipo de polímero y el espesor de la capa se diseñan para bloquear el contacto fitotóxico del agente fitotoxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxígeno y humedad bajo condiciones ambientales enfrentadas normalmente por la semilla después de la siembra, para mantener la viabilidad de la semilla y posibilitar su germinación, y

d poner en contacto la semilla cubierta con el polímero con el agente fitotóxico

45 El método de acuerdo con la reivindicación 44, en donde la capa de polímero se aplica de modo que contacte directamente la semilla sin material intermedio entre la cubierta y la semilla

46 Semilla de una planta tratada con agente fitotoxico que tiene un porcentaje de germinacion mejorado, comprendiendo cada semilla una semilla de planta con un agente fitotoxico depositado sobre ella, y con una capa de polímero que está libre del agente fitotóxico, localizada entre la semilla y el agente fitotóxico, en donde el tipo de polimero y el espesor de la capa se diseñan para bloquear el contacto fitotóxico del agente fitotóxico

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con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxígeno y humedad bajo condiciones ambientales enfrentadas normalmente por la semilla luego de la siembra, para mantener la viabilidad de la semilla y posibilitar su germinación

47 Una planta que se cultiva de una semilla que se trata por el metodo de acuerdo con la reivindicación 1

48 Un método de producir un producto agronómico, método que comprende los pasos de

a proveer semillas de planta del producto agronómico que se han tratado por el método de acuerdo con la reivindicación 1,

b sembrar las semillas, y

c cultivar las semillas sembradas y las plantas que brotan de las semillas

% Germinadas
50uk
10uk
0uk
T0
T8
T14
T33
T120
T161
0 AI
Concep/Gaucho 50/500g/100kg
Concep/Gaucho 100/500g/100kg
Concep/Gaucho 150/750g/100kg

FIGURA 1.

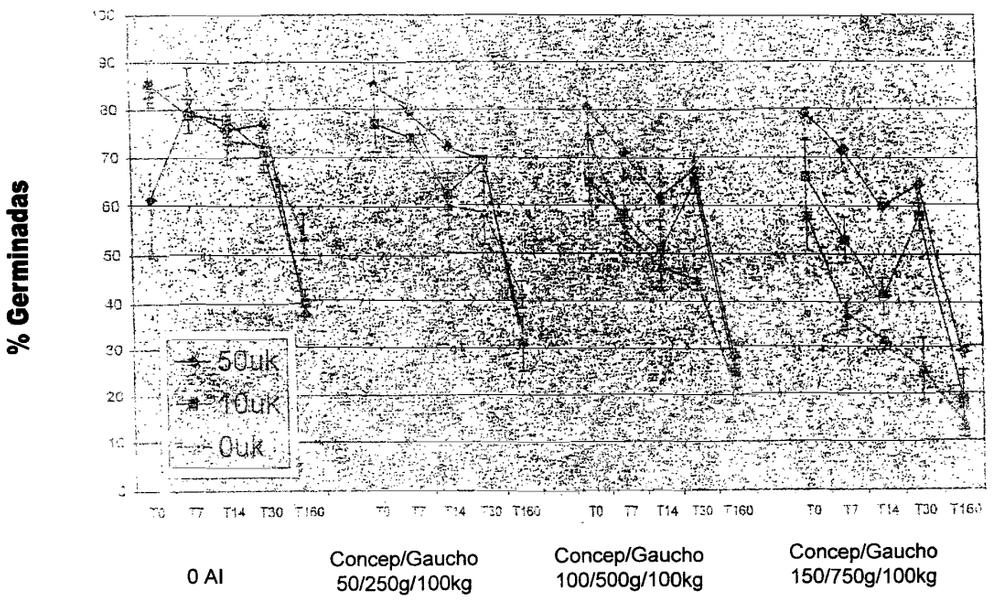

% Germinadas
100
90
80
70
60
50
40
30
20
10
0
50uk
10uk
0uk
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
0 AI
Concep/Gaucho 50/250g/100kg
Concep/Gaucho 100/500g/100kg
Concep/Gaucho 150/750g/100kg

FIGURA 2.

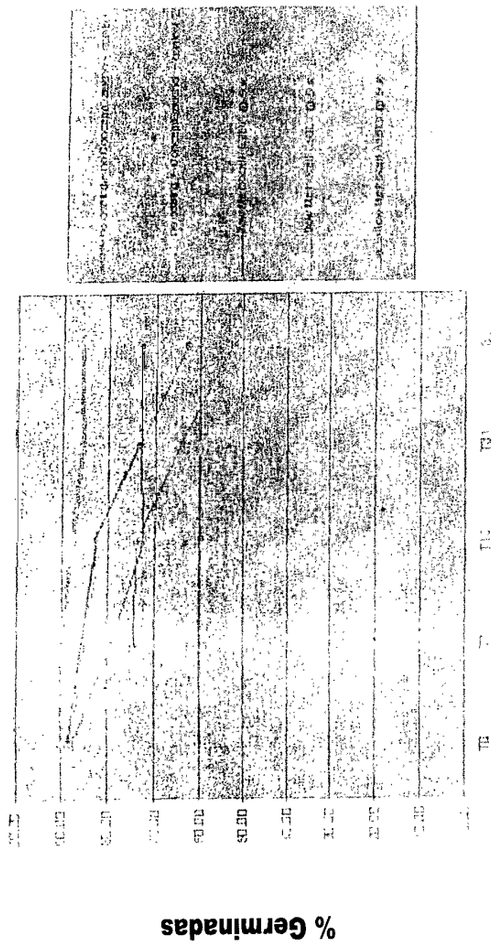


FIGURA 3.

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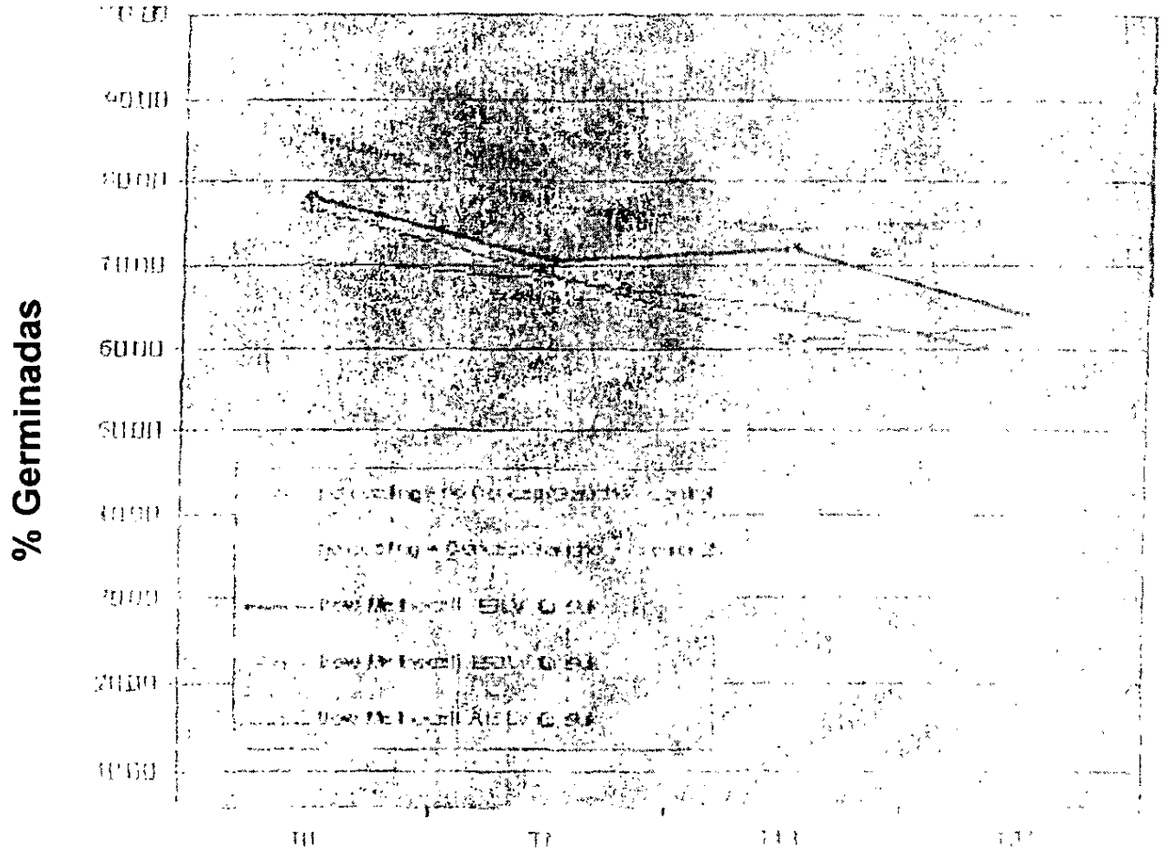


FIGURA 4.

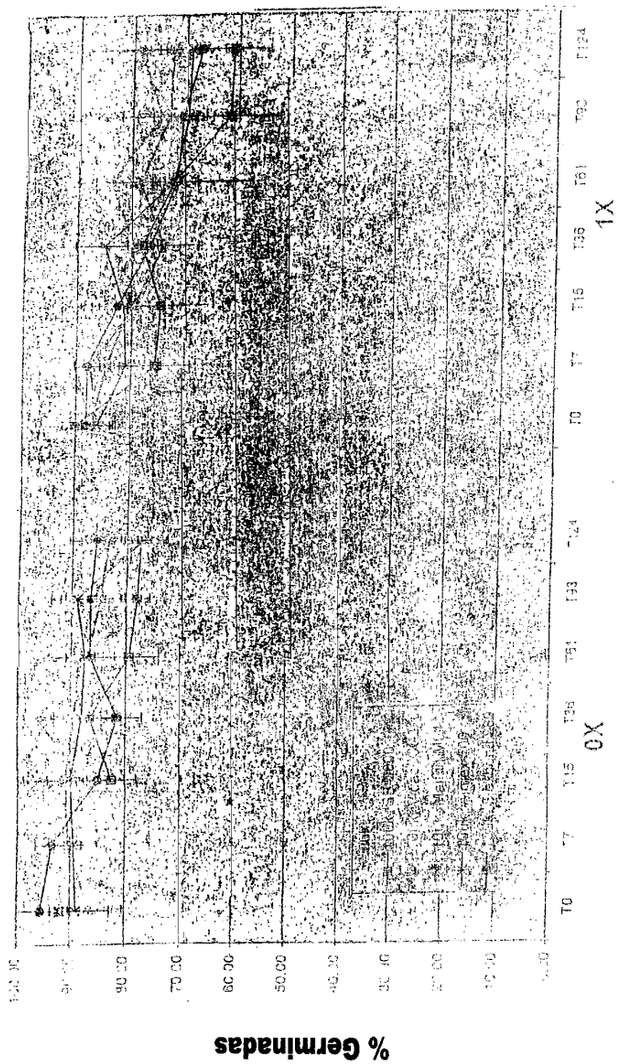

% Germinadas
90.00
80.00
70.00
60.00
T0
T7
T15
T36
T81
T93
T124
0X
1X

FIGURA 5.

% Germinadas
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
T0
T7
T14
T21
T81
T95

FIGURA 6.

% Germinadas
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
T0
T7
T31
T61
T84

FIGURA 7.

PATENT CO PERATION TREATY

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MAR 23 2005

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From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To.

Bosch Henry
MONSANTO SERVICES INTERNATIONAL
Avenue de Tervuren 270-272
1150 Brussels
BELGIQUE

NELSON MULLINS
COLUMBIA OFFICE

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71 1)

Applicant's or agent's file reference	Date of mailing (day/month/year)
	10.03.2005
IMPORTANT NOTIFICATION	

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/US 03/36178	14.11.2003	03.12.2002

Applicant
MONSANTO TECHNOLOGY LLC ET AL.

1 The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any established on the international application

2. A copy of the report and its annexes, if any is being transmitted to the International Bureau for communication to all the elected Offices.

3 Where required by any of the elected Offices the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5) which provides that the criteria of novelty inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether in that State the claimed inventions is patentable or not" (see also Article 27(5)) Such additional criteria may relate, for example to exemptions from patentability requirements for enabling disclosure, clarity and support for the claims

Name and mailing address of the international preliminary examining authority:	Authorized Officer
European Patent Office D-80298 Munich Tel +49 89 2399 0 Tx 523656 epmu d Fax: +49 89 2399 4465	Kiepe, C Tel. +49 89 2399-2164

NELSON MULLINS RILEY & SCARBOROUGH L.L.P.
MAR 28 2005
GREENVILLE, SC

Form PCT/IPEA/416 (January 2004)

MAR 22 2005 18 29 + PAGE 01

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US 03/36176	International filing date (day/month/year) 14.11.2003	Priority date (day/month/year) 09.12.2002
International Patent Classification (IPC) or both national classification and IPC A01C1/06		
Applicant MONSANTO TECHNOLOGY LLC ET AL.		

1 This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES i.e. sheets of the description, claims and/or drawings which have been amended and are the base for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT)

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
02.07.2004	10.03.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 0 Tx: 523656 epmu d Fax: +49 89 2399 4465	Authorized Officer Schlichting N Telephone No. +49 89 2399-2429

cf3 42

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US 03/36178

I Basis of the report

1 With regard to the elements of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-33 as originally filed

Claims, Numbers

1-48 as originally filed

Drawings Sheets

1/7-7/7 as originally filed

2 With regard to the language all the elements marked above were available or furnished to this Authority in the language in which the international application was filed unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b))
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3)

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description pages.
- ☐ the claims Nos.
- ☐ the drawings sheets:

94 93

INTERNATIONAL PRELIMINARY EXAMINATION REPORT International application No. PCT/US 03/36178

5. ☐ This report has been established as if (some of) the amendments had not been made since they have been considered to go beyond the disclosure as filed (Rule 70.2(c))

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-48
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-48
Industrial applicability (IA)	Yes:	Claims	1-48
	No:	Claims	

2. Citations and explanations

see separate sheet

INTERNATIONAL PRELIMINARY EXAMINATION REPORT - SEPARATE SHEET

International application No PCT/US 03/36178

Re Item V

1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1, 46, 47 and 48 is not new in the sense of Article 33(2) PCT

The document D1 (US-A-6 199 318) discloses (the references in parentheses applying to this document) a method of improving the germination rate of plant seeds which are treated with phytotoxic agent, the method comprising

forming a polymer coating on the plant seed (col 1 l 17-18 col. 2, l 7-10; col. 3, l 14-17) before treating the seed with the phytotoxic agent (col. 14, l. 54-59) where the coating is free of the phytotoxic agent (col 14, l 54-59) and where the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed (col 14, l 58-59) while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination (col. 4, l 5-22 the aim of the described coated seed is a more vigorous disease and pest resistant planting or in other words a better germination rate as the seeds are more vigorous and disease and pest resistant; this can only be the case if the seed has enough oxygen and moisture to maintain viability) and

treating the coated plant seed with the phytotoxic agent (col 14 l 54-59)

The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claim 46, claiming a seed which is produced according to a method as described above Claim 48 therefore is also considered not new

Claim 47 claims a plant that is grown from a seed that is treated by the method according to claim 1 Such a plant is also described in D1 (col 23, 4-20)

Claim 48 describes a method of producing an agronomic crop as it is generally in agriculture The use of a plant seed that has been treated by the method according to claim 1 cannot be considered as new, as it is already described in D1 to provide such seeds for producing an agronomic crop (col 23 l 4-20)

2 Dependent claims 2 to 45 (claim 19 is included twice) do not contain any features which in combination with the features of any claim to which they refer meet the requirements of the PCT in respect of novelty, see D1 col 5, l 1 to 17 l 38

3 The requirements of Article 33(4) PCT concerning industrial applicability are fulfilled by claims 1 to 48

Re Item VII

1 Independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate with those features known in combination from the prior art (see Re Item V) being placed in the preamble (Rule 6 3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT)

2. The units of measure (inch) and temperature (°F) employed on pages 22, 24 and 25 are not additionally expressed in terms of the units stipulated by Rule 10 1/(a)/and/(b) PCT

3 The numbering of the claims is not coherent in that claim 19 exists twice In consequence, the references of the following claims are not correct.

Re Item VIII

1 The application does not meet the requirements of Article 6 PCT

2 Claims 1 and 46 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined The claims attempt to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem without providing the technical features necessary for achieving this result The statement concerned is the definition of the polymer and the coating thickness. "the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient

transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination" This statement includes no technical features The technical feature providing the result of blocking phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture is the amount of polymer in the coating (claim 2 or 3) the specific thickness of the coating as given in claim 4 and the film-forming temperature of the polymer as given in claim 5

3 The vague and imprecise statement in the description on page 23 lines 9 (spirit of the invention) implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them

TRATADO SOBRE COOPERACIÓN INTERNACIONAL EN MATERIA DE PATENTES

Remitente

OFICINA ENCARGADA DEL EXAMEN PRELIMINAR INTERNACIONAL

CK/ 07

A

Bosch Henry
MONSANTO SERVICES INTERNATIONAL
Avenue de Tervuren 270-272
1150 Bruselas
BÉLGICA

PCT

COMUNICACIÓN SOBRE EL ENVÍO DEL INFORME DE EXAMEN PRELIMINAR INTERNACIONAL

(Regla 71 1 PCT)

	Fecha de envío *(Día/Mes/Año)* 10 03 2005
No de Expediente del Solicitante o Apoderado	COMUNICACIÓN IMPORTANTE

No de Solicitud Internacional	Fecha Internacional de Presentación *(día/mes/año)*	Fecha de Prioridad *(día/mes/año)*
PCT/US 03/36178	14 11 2003	03 12 2002

Solicitante

MONSANTO TECHNOLOGY LLC ET AL

1 Se comunica al solicitante que la oficina encargada del examen preliminar internacional le envía con el presente el informe de examen preliminar internacional, elaborado para la solicitud internacional en caso dado con los anexos correspondientes

2. Una copia del informe, en caso dado con los anexos correspondientes se hace llegar a la Oficina Internacional para su envío posterior a todas las oficinas seleccionadas.

3 A solicitud de una oficina seleccionada la Oficina Internacional preparará una traducción del informe (pero no de los anexos) al inglés y la remitirá a esta oficina

4 RECORDATORIO

Para ingresar en la fase nacional el solicitante dentro de los 30 meses a partir de la fecha de prioridad (o en algunas oficinas incluso después) tiene que realizar ante cada oficina seleccionada ciertos actos (entrega de traducciones y desembolso de honorarios nacionales) (Artículo 39 (1)) (véase también la información remitida por la Oficina Internacional en el Formulario PCT/IB/301)

Si se tiene que enviar a una oficina seleccionada una traducción de la solicitud internacional, entonces esta traducción tiene que incluir traducciones de todos los anexos al informe de examen preliminar internacional Es obligación del solicitante elaborar dichas traducciones y hacerlas llegar directamente a las oficinas seleccionadas respectivas

Mayores detalles en cuanto a los plazos normativos y los requisitos de las oficinas seleccionadas se desprenden del Volumen II de la guía PCT para solicitantes

Se llama la atención del solicitante al Artículo 33(6) que establece que los criterios de novedad, actividad inventiva y posibilidad de aplicación industrial descritos en Artículo 33(2) a (4) sirven meramente los propósitos del examen preliminar internacional y que "todo Estado Contratante puede aplicar criterios adicionales o diferentes para efectos de decidir si la invención reivindicada es patentable o no (véase también Artículo 27 (5)). Los criterios adicionales pueden incluir por ejemplo, exención de patentabilidad y los requerimientos si se permite la divulgación y de claridad y soporte de las reivindicaciones

Nombre y dirección postal de la Oficina Encargada del Examen Preliminar Internacional (IPEA)	Empleado Autorizado
Oficina Europea de Patentes D-80298 Munich Tel +49 89 2399 0 Tx. 523656 epmu d Fax +49 89 2399 4465	Klepe, C Tel. +49 89 2399 2164

Formulario PCT/IPEA/416 (Enero 2004)

TRATADO SOBRE COOPERACIÓN INTERNACIONAL EN MATERIA DE PATENTES

PCT

INFORME DE EXAMEN PRELIMINAR INTERNACIONAL

(Artículo 36 y Regla 70 PCT)

No de Expediente del Solicitante o Apoderado	**PROCEDIMIENTO POSTERIOR**	Véase comunicación sobre el envío del informe de examen preliminar internacional (Formulario PCT/IPEA/416)
No Solicitud Internacional PCT/US 03/36178	Fecha Internacional de Presentación *(día/mes/año)* 14 11 2003	Fecha de Prioridad *(día/mes/año)* 03 12 2002
Clasificación Internacional de Patente (IPC) o Clasificación Nacional e IPC A01C1/06		
Solicitante MONSANTO TECHNOLOGY LLC ET AL		

1 Este informe de examen preliminar internacional fue elaborado por la Oficina Encargada del Examen Preliminar Internacional y se envía al solicitante según Artículo 36

2 Este INFORME comprende un total de **6** hojas, inclusive esta portada

☐ Además se adjuntan ANEXOS al informe: en este caso se trata de hojas con descripciones reivindicaciones y/o dibujos que se modificaron y que sirven de base para este informe y/o hojas con correcciones efectuadas por esta oficina (véase Regla 70 16 y Sección 607 de las Instrucciones bajo el PCT)

Estos anexos comprenden en total de hojas

3 Este informe contiene datos con respecto a los siguientes puntos.

- I ☒ Base del Concepto
- II ☐ Prioridad
- III ☐ Sin elaboración de un dictamen sobre novedad actividad inventiva y posibilidad de aplicación industrial
- IV ☐ Falta de unidad de la invención
- V ☒ Comprobación justificada según Regla 66 2(a)(ii) con respecto a la novedad la actividad inventiva y la posibilidad de aplicación industrial documentos y explicaciones sustentando esta comprobación
- VI ☐ Ciertos documentos enumerados
- VII ☐ Ciertas deficiencias del registro internacional
- VIII ☐ Ciertas observaciones relacionadas con la solicitud internacional

Fecha de presentación de la petición	Fecha de la conclusión de este informe
02 07 2004	10 03 2005
Nombre y dirección postal de la Oficina Encargada del Examen Preliminar Internacional (IPEA) Oficina Europea de Patentes D-80298 Munich Tel. +49 89 2399 0 Tx. 523656 epmu d Fax: +49 89 2399 4465	Empleado Autorizado **Schlichting, N** Tel. +49 89 2399 2426

Formulario PCT/IPEA/409 (portada) (Enero 2004)

INFORME DE EXAMEN PRELIMINAR INTERNACI NAL

Solicitud Internacional No PCT/US 03/36178

P 99

I Base del Informe

1 Con respecto a los **elementos** de la solicitud internacional *(hojas intercambiables que se han suministrado a la oficina receptora en respuesta a una invitación bajo Artículo 14 se tienen en este informe por "presentadas originalmente y no se anexan a este informe puesto que no contienen correcciones (Reglas 70 16 y 70 17))*

Descripción páginas

1-33 versión original

Reivindicaciones, No

1-48 versión original

Dibujos, Hojas

1/7 7/7 versión original

2 En lo concerniente al **idioma** Todos los elementos indicados más arriba estuvieron a disposición de la oficina o le fueron enviados en el idioma en el cual se radicó la solicitud internacional salvo indicación en contrario consignada bajo este punto

Estos elementos estuvieron a disposición de esta oficina o le fueron enviados en el idioma siguiente en este caso se trata de

- ☐ el idioma de la traducción enviada para efectos de la búsqueda internacional (según la regla 23 1 (b))
- ☐ el idioma de publicación de la solicitud internacional (según la regla 48 3 (b))
- ☐ el idioma de la traducción enviada para los efectos del examen preliminar internacional (según la regla 55 2 y/o 55 3)

3 En lo que concierne a la **secuencia de nucleótidos y/o aminoácidos** divulgada en la solicitud internacional el examen preliminar internacional se llevó a cabo sobre la base del listado de secuencias

- ☐ contenido en la solicitud internacional por escrito
- ☐ presentado con la solicitud internacional en formato de lectura por computador
- ☐ remitido posteriormente a la oficina por escrito
- ☐ remitido posteriormente a la oficina en formato de lectura por computador
- ☐ se ha rendido la declaración según la cual el listado de secuencias por escrito y suministrado posteriormente no va más allá de la divulgación hecha en la solicitud en el momento en que se radicó
- ☐ se ha rendido la declaración según la cual las informaciones registradas en formato de lectura por computador corresponden al listado de secuencias presentados por escrito

4 Las modificaciones han acarreado la anulación

- ☐ de la descripción páginas.
- ☐ de las reivindicaciones Nos
- ☐ de los dibujos hojas

1DX 100

5 ☐ El presente informe se preparó sin tener en cuenta (algunas de) las modificaciones ya que éstas por las razones aducidas en concepto de la oficina van más allá del contenido de divulgación en la versión presentada originalmente (Regla 70 2 (c))

(Hojas intercambiables que incluyan modificaciones de esta índole deben indicarse en el punto 1 y anexarse al presente informe)

6 Observaciones adicionales si son necesarias

V Declaración motivada bajo Artículo 35(2) en cuanto a la novedad la actividad inventiva y la posibilidad de aplicación industrial, documentos y explicaciones que sustentan esta declaración

1 DECLARACIÓN

Novedad (N)	Sí	Reivindicaciones	
	No	Reivindicaciones	1-48
Actividad Inventiva (IS)	Sí	Reivindicaciones	
	No	Reivindicaciones	1-48
Posibilidad de Aplicación Industrial (IA)	Sí	Reivindicaciones	1-48
	No	Reivindicaciones	

2 Documentos y explicaciones

Véase hoja separada

Re Item V

1 La presente solicitud no satisface los criterios del Artículo 33(1) PCT porque el asunto de las reivindicaciones 1, 46 47 y 48 no es nuevo en el sentido del Artículo 33(2) PCT

El documento D1 (US-A-6 199 318) divulga (las referencias entre paréntesis se aplican a este documento) un método de mejorar el porcentaje de germinación de semillas de planta las cuales se tratan con agente fitotóxico método que comprende

formar una capa de polímero sobre la semilla de planta (col 1 renglones 17-18 col 2 renglones 7-10 col 3 renglones 14-17) antes de tratar la semilla con el agente fitotóxico (col 14 renglones 54-59) donde la capa está libre del agente fitotóxico (col 14 renglones 54-59) y donde el tipo de polímero y el espesor de la capa se diseñan para bloquear contacto fitotóxico del agente fitotóxico con la semilla (col 14 renglones 58-59) permitiendo al mismo tiempo suficiente transferencia de oxígeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad bajo condiciones ambientales enfrentadas normalmente por la semilla después de la siembra para posibilitar su germinación (col 4, renglones 5-22 la finalidad de la semilla cubierta descrita es una siembra más vigorosa resistente a las plagas y enfermedades o en otras palabras, un mejor porcentaje de germinación puesto que las semillas son más vigorosas y resistentes a las plagas y a las enfermedades éste sólo puede ser el caso si la semilla tiene suficiente oxígeno y humedad para mantener la viabilidad) y

tratar la semilla cubierta de planta con el agente fitotóxico (col 14 renglones 54-59)

El mismo razonamiento se aplica, mutatis mutandis, al asunto de la reivindicación independiente correspondiente 46 que reivindica una semilla que se produce de acuerdo con un método como se describe más arriba Por lo tanto la reivindicación 46 tampoco se considera nueva

La reivindicación 47 reivindica una que se cultiva de una semilla que se trata por el método de acuerdo con la reivindicación 1 Tal planta se describe asimismo en D1 (col 23 4-20)

La reivindicación 48 describe un método de producir un producto agronómico como se da generalmente en la agricultura El uso de una semilla de planta que se ha tratado por el método de acuerdo con la reivindicación1 no puede considerarse como nuevo puesto que ya se describe en D1 para proporcionar tales semillas para producir un producto agronómico (col 23, renglones 4-20)

2 Las reivindicaciones dependientes 2 a 45 (reivindicación 19 se incluye dos veces) no contienen características que en combinación con las características de cualquier reivindicación a la cual se refieran satisfagan los requerimientos del PCT con respecto a la novedad véase D1 col 5 renglones 1 a 17 renglón 38

3 Los requerimientos del Artículo 33(4) PCT concernientes a la posibilidad de aplicación industrial se cumplen por las reivindicaciones 1 a 48

Re Item VII

1 Las reivindicaciones independientes no están en la forma de dos partes de acuerdo con la Regla 6 3(b) PCT, que en el presente serían apropiadas poniéndose aquellas características conocidas en combinación del arte previo (véase Re Item V) en el preámbulo (Regla 6 3(b)(I) PCT) e incluyéndose las características restantes en la parte caracterizadora (Regla 6 3(b)(ii) PCT)

2 La unidades de medida (pulgadas) y temperatura (°F) empleadas en las páginas 22, 24 y 25 no se expresan adicionalmente en términos de las unidades estipuladas por la Regla 10 1/(a)/y/(b) PCT

3. La numeración de las reivindicaciones no es coherente puesto que la reivindicación 19 existe dos veces En consecuencia las referencias de las reivindicaciones siguientes no son correctas

Re Item VIII

1 La solicitud no satisface los requerimientos del Artículo 6 PCT

2. Las reivindicaciones 1 y 46 no satisfacen los requerimientos del Artículo 6 PCT puesto que la materia, para la cual se busca protección, no está claramente definida Las reivindicaciones intentan definir el asunto en términos del resultado a obtener el cual equivale simplemente a una declaración del problema subyacente, sin proporcionar las características técnicas necesarias para conseguir el resultado La declaración en cuestión es la definición del polímero y el espesor de la capa "el tipo de polímero y el espesor de la capa se diseñan para bloquear el contacto fitotóxico del agente fitotóxico con la semilla permitiendo al mismo tiempo suficiente

transferencia de oxígeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad bajo condiciones ambientales enfrentadas normalmente por la semilla después de la siembra para posibilitar su germinación" Esta declaración no incluye características técnicas La característica técnica que ofrece el resultado de bloquear el contacto fitotóxico con la semilla permitiendo al mismo tiempo suficiente transferencia de oxígeno para mantener la viabilidad de la semilla y suficiente transferencia de humedad es la cantidad de polímero en la capa (reivindicación 2 ó 3) el espesor específico de la capa como se da en la reivindicación 4 y la temperatura formadora de la película del polímero como se da en la reivindicación 5

3 La declaración vaga e imprecisa en la descripción en la página 23 renglón 9 (espíritu de la invención) implica que el asunto para el cual se busca protección puede ser diferente al definido por las reivindicaciones resultando así en falta de claridad (Artículo 6 PCT) cuando se usa para interpretarlas

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:
Bosch, Henry
MONSANTO SERVICES INTERNATIONAL
Avenue de Tervuren 270-272
1150 Brussels
BELGIQUE

FAX:

WRITTEN OPINION

(PCT Rule 66)

Date of mailing (day/month/year)	23/07/2004
Applicant's or agent's file reference: 51-21(52837)	REPLY DUE: within 2 / 00 months/days from the above date of mailing
International application No.: PCT/US03/36178	International filing date (day/month/year): 14/11/2003
Priority date (day/month/year): 03/12/2002	
International Patent Classification (IPC) or both national classification and IPC: A01C1/06	
Applicant: MONSANTO TECHNOLOGY LLC ET AL	

RECEIVED
AUG 17 2004
NELSON MULLINS
COLUMBIA OFFICE

1 This written opinion is the first drawn up by this International Preliminary Examining Author

2 This opinion contains indications relating to the following items:

- I [X] Basis of the opinion
- II [ ] Priority
- III [ ] Non-establishment of opinion with regard to novelty inventive step and industrial applicability
- IV [ ] Lack of unity of invention
- V [X] Reasoned statement under Rule 66.2(a)(ii) with regard to novelty inventive step or industrial applicability; citations and explanations supporting such statement
- VI [ ] Certain documents cited
- VII [ ] Certain defects in the international application
- VIII [ ] Certain observations on the international application

AUG 12 2004

3 The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension., see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4*bis*. For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4 The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 03/04/2005

Name and mailing address of the IPEA/ European Patent Office D-80298 Munich Tel. (+49-89) 2399-0 Tx 523656 epmu d Fax. (+49-89) 2399-4465	Authorized officer: Examiner
	Formalities officer (incl. extension of time limits) Tel. (+49-89) 2399 2821

Form PCT/IPEA/408 (cover sheet) (march 2003)

I Basis of the opinion

1 The basis of this written opinion is the application as originally filed

V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability

1 In light of the documents cited in the international search report, it is considered that the invention as defined in at least some of the claims does not appear to meet the criteria mentioned in Article 33(1) PCT i e does not appear to be novel and/or to involve an inventive step (see international search report in particular the documents cited X and/or Y and corresponding claims references)

2 If amendments are filed the applicant should comply with the requirements of Rule 66.8 PCT and indicate the basis of the amendments in the documents of the application as originally filed (Article 34 (2) (b) PCT) otherwise these amendments may not be taken into consideration for the establishment of the international preliminary examination report. The attention of the applicant is drawn to the fact that if the application contains an unnecessary plurality of independent claims no examination of any of the claims will be carried out.

NB Should the applicant decide to request detailed substantive examination then an international preliminary examination report will normally be established directly Exceptionally the examiner may draw up a second written opinion, should this be explicitly requested

10% 106

AMENDED

CLAIMS

LIST OF CLAIMS WITHOUT MARKINGS

V16 107

1 A method of improving the germination rate of plant seeds which are treated with a phytotoxic agent, the method comprising

forming a polymer coating on the plant seed before treating the seed with the phytotoxic agent, where the coating is free of the phytotoxic agent and is a uniform coating having a thickness of from 1 to 500 microns, and

treating the coated plant seed with the phytotoxic agent

2 The method according to claim 1, wherein the coating comprises a polymer in an amount of over 10% by weight

3 The method according to claim 2, wherein the coating comprises a polymer in an amount of at least about 50% by weight

4 The method according to claim 1, wherein the coating thickness is between about 1 micron and about 480 microns

5 The method of claim 1, wherein the polymer is one having a minimum film-forming temperature of lower than 55°C

6 The method of claim 5, wherein the polymer comprises a material selected from the group consisting of maltodextrin, methylcellulose, ethylcellulose, hydroxypropylcellulose, hydroxypropyl/methylcellulose, vinyl acetate - ethylene polymers, ethylene-vinyl chloride polymers, vinyl acetate polymers, vinyl-acrylic polymers, starch-based polymers, SB-2000, polyvinyl acetate -vinyl chloride polymers, vinyl chloride/ vinyl acetate/ ethylene copolymers, styrene-acrylate copolymers, vinylacetate polymers, vinylbutyrate polymers, styrene-vinylbutyrate copolymers, acrylate polymers, styrene-butadiene copolymers, vinylacetate-vinylbutyrate copolymers, vinylacetate-vinylversatate copolymers and polyvinylalcohol

7 The method of claim 5, wherein the polymer comprises polyvinylacetate

8 The method of claim 5, wherein the polymer comprises methocel

9 The method of claim 1, wherein the seed is the seed of an agronomic plant which selected from the group consisting of cereals (wheat, barley, rye, oats, rice, sorghum, related crops, etc), beet, pear-like fruits, stone fruits, and soft fruits (apple, pear, plum, peach, Japanese apricot, prune, almond, cherry, strawberry, raspb rry,

black berry, tomato, pepper, etc), legumes (kidney bean, lentil, pea soybean), oil plants (rape, canola, mustard, poppy olive, sunflower, coconut, castor, cocoa bean, peanut, soybean, corn, etc), Cucurbitaceae (pumpkin, cucumber, melon, etc), citrus (orange, lemon, grape fruit, mandarin, Watson pomelo (citrus natsudaidai), etc), vegetables (lettuce, cabbage, celery cabbage, Chinese radish, carrot, onion, potato, etc), camphor trees (avocado, cinnamon, camphor, etc), corn, tobacco, nuts, coffee, sugar cane tea, grapevine, hop and banana

10 The method of claim 9, wherein the agronomic plant is selected from the group consisting of rice, wheat, barley rye, corn, potato, carrot, sweet potato, sugar beet, bean, pea, chicory lettuce, cabbage, cauliflower, broccoli, turnip, radish, spinach, asparagus, onion, garlic, eggplant, pepper, celery, canot, squash, pumpkin, zucchini, cucumber, apple, pear, quince, melon, plum, cherry, peach, nectarine, apricot, strawberry, grape, raspberry, blackberry, pineapple, avocado, papaya, mango, banana, soybean, tomato, sorghum and raspberries banana and other such edible varieties

11 The method of claim 10, wherein the agronomic plant is selected from corn, soybeans, cotton, sorghum, rape (canola) rice, wheat, barley, and rye

12 The method of claim 10, wherein the agronomic plant is corn, soybeans, or cotton

13 The method of claim 1, wherein the phytotoxic agent is selected from the group consisting of pesticides fertilizers, plant growth regulators, drugs, dyes, biological attractants, scents, pheromones, and mixtures thereof

14 The method of claim 1, wherein the phytotoxic agent comprises a pesticide selected from the group consisting of herbicides, molluscicides, insecticides, nematocides, acaricides, fungicides, bactericides, and mixtures thereof

15 The method of claim 14, wherein the pesticide is selected from the group consisting of pyrethrins, synthetic pyrethroids, azoles, oxadizine insecticides, neonicotinoids, diazoles, triazoles, strobilurin derivatives, organophosphates, pyrrols, pyrazoles, phenyl pyrazoles, diacylhydrazines, biological/fermentation products, carbamates, and mixtures thereof

16 The method of claim 14, wherein the pesticide comprises an insecticide

17 The method of claim 16, wherein the insecticide comprises a pyrethroid or synthetic pyrethrin

18 The method of claim 17, wherein the pyrethrin comprises a member selected from the group consisting of 2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of 2,2-dimethyl-3-(2-methylpropenyl)-cyclopropane carboxylic acid, (2-methyl-1-propenyl)-2-methoxy-4-oxo-3-(2-propenyl)-2-cyclopenten-1-yl ester and mixtures of cis and trans isomers thereof

19 The method of claim 17, wherein the pyrethroid comprises a member selected from the group consisting of (s)-cyano(3-phenoxyphenyl)methyl-4-chloro alpha (1-methylethyl)benzeneacetate (fenvalerate, CAS RN 51630-58-1), (S)-cyano-(3-phenoxyphenyl)methyl (S)-4-chloro-alpha-(1-methylethyl)benzeneacetate (esfenvalerate, CAS RN 66230-04-4), (3-phenoxyphenyl)-methyl(+)cis-trans-3-(2,2-dichoroethenyl)-2,2-dimethylcyclopropanecarboxylate (permethrin, CAS RN 52645-53-1), (±) alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis,trans-3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropane carboxylate (cypermethrin, CAS RN 52315-07-8), (beta-cypermethrin, CAS RN 65731-84-2), (theta cypermethrin, CAS RN 71697-59-1), S-cyano (3-phenoxyphenyl)methyl (±) cis/trans 3-(2,2-dichloroethenyl) 2 2 dimethylcyclopropane carboxylate (zeta-cypermethrin, CAS RN 52315-07-8), (s)-alpha-cyano-3-phenoxybenzyl (1R,3R)-3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate (deltamethrin, CAS RN 52918-63-5), alpha-cyano-3-phenoxybenzyl 2,2,3,3,-tetramethyl cyclopropoanecarboxylate (fenpropathrin, CAS RN 64257-84-7), (RS)-alpha-cyano-3-phenoxybenzyl(R)-2-[2-chloro-4-(trifluoromethyl)anilino]-3-methylbutanoate (tau-fluvalinate, CAS RN 102851-06-9), (2,3,5,6-tetrafluoro-4-methylphenyl)methyl (1-alpha, 3-alpha)-(Z)-(±)-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (tefluthrin, CAS RN 79538-32-2), (±)-cyano (3-phenoxyphenyl)methyl (±)-4-(difluoromethoxy)-alpha-(1-methyl ethyl)benzeneacetate (flucythrinate, CAS RN 70124-77-5), cyano(4-fluoro-3-phenoxyphenyl)methyl 3-[2-chloro-2-(4-chlorophenyl)ethenyl]-2,2-dimethylcyclopropanecarboxylate (flumethrin, CAS RN 69770-45-2), cyano(4-fluoro-3-phenoxyphenyl) methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanedarboxylate (cyfluthrin, CAS RN 68359-37-5), (beta cyfluthrin, CAS RN 68359-37-5), (transfluthrin,

CAS RN 118712-89-3), (S)-alpha-cyano-3-phenoxybenzyl(Z)-(1R-cis)-2,2-dimethyl-3-[2-(2,2,2-trifluoro-trifluoromethyl-ethoxycarbonyl)vinyl]cyclopropane carboxylate (acrinathrin, CAS RN 101007-06-1), (1R cis) S and (1S cis) R enantiomer isomer pair of alpha-cyano-3-phenoxybenzyl-3 (2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylate (alpha-cypermethrin, CAS RN 67375-30-8), [1R,3S)3(1'RS)(1',2',2',2'-tetrabromoethyl)]-2,2-dimethylcyclopropanecarboxylic acid (s)-alpha-cyano-3-phenoxybenzyl ester (tralomethrin, CAS RN 66841-25-6), cyano-(3-phenoxyphenyl)methyl 2,2-dichloro-1-(4-ethoxyphenyl)cyclopropane carboxylate (cycloprothrin, CAS RN 63935-38-6), [1α, 3α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl 3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (cyhalothrin, CAS RN 68085-85-8), [1-alpha (s), 3-alpha(z)]-cyano(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (lambda cyhalothrin, CAS RN 91465-08-6), (2-methyl-[1,1'-biphenyl]-3-yl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-cyclopropanecarboxylate (bifenthrin, CAS RN 82657-04-3), 5-1-benzyl-3-furylmethyl-d-cis(1R,3S,E)2,2-dimethyl-3-(2-oxo,-2,2,4,5 tetrahydro thiophenylideneethyl)cyclopropanecarboxylate (kadethrin, RU15525, CAS RN 58769-20-3), [5-(phenylmethyl)-3-furanyl]-3-furanyl-2,2 dimethyl-3-(2-methyl-1-propenyl)cyclopropane carboxylate (resmethrin, CAS RN 10453-86-8), (1R-trans)-[5-(phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate (bioresmethrin, CAS RN 28434-01-7), 3,4,5,6-tetrahydro-phthalimidomethyl-(1RS)-cis-trans-chrysanthemate (tetramethrin, CAS RN 7696-12-0), 3 phenoxybenzyl-d,l-cis,trans 2,2-dimethyl-3-(2-methylpropenyl)cyclopropane carboxylate (phenothrin, CAS RN 26002-80-2), (empenthrin, CAS RN 54406-48-3), (cyphenothrin, CAS RN 39515-40-7), (prallethrin, CAS RN 23031-36-9), (imiprothrin, CAS RN 72963-72-5), (RS)-3-allyl-2-methyl-4-oxcyclopent-2-enyl-(1S,3R, 1R,3S)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (allethrin, CAS RN 584-79-2), (bioallethrin, CAS RN 584-79-2), and (ZXI8901, CAS RN 160791-64-0)

20 The method of claim 17, wherein the pyrethroid comprises a member selected from the group consisting of tefluthrin, lambda cyhalothrin bifenthrin, permethrin and cyfluthrin

21 The method of claim 15, wherein the pesticide comprises an oxidiazine insecticide that is selected from the group consisting of 5-(2-chloropyrid-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 5-(2-chlorothiazol-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 3-methyl-4-nitroimino-5-(1-oxido-3-pyridinomethyl)perhydro-1,3,5-oxadiazine, 5-(2-chloro-1-oxido-5-pyridiniomethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxidiazine, and 3-methyl-5-(2-methylpyrid-5-ylmethyl)-4-nitroiminoperhydro-1,3,5-oxadiazine

22 The method of claim 15, wherein the pesticide comprises a neonicotinoid insecticide that is selected from the group consisting of acetamiprid, imidacloprid, thiamethoxam, clothianidin, dinotefuran, flonicamid, nithiazine, and thiacloprid

23 The method of claim 15, wherein the pesticide comprises a neonicotinoid that is selected from the group consisting of thiamethoxam (CAS RN 153719-23-4), acetamiprid ((E)-N-[(6-chloro-3-pyridinyl)methyl]-N'-cyano-N-methyleneimidamide, CAS RN 135410-20-7), imidacloprid (1-[(6-chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimime, CAS RN 138261-41-3), nitenpyram (N-[(6-chloro-3-pyridinyl)methyl]-N-ethyl N'-methyl-2-nitro-1,1-ethenediamine, CAS RN 120738-89-8), clothianidin (TI-435 (N-[(2-chloro-5-thiazoyl)methyl]-N'-methyl-N"-nitro,[C(E)]-(9Cl)-guanidine, CAS RN 210880-92-5)

24 The method of claim 15, wherein the pesticide comprises a pyrrol, pyrazole, or phenyl pyrazole that is selected from the group consisting of chlorfenapyr (4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-trifluoromethylpyrrole-3-carbonitrile, CAS RN 122453-73-0), fenpyroximate ((E)-1,1-dimethylethyl-4[[[(1,3-dimethyl-5-phenoxy-1H-pyrazole-4-yl)methylene]amino]oxy]methyl]benzoate, CAS RN 111812-58-9), tebufenpyrad (4-chloro-N[[4-1,1-dimethylethyl)phenyl]methyl]-3-ethyl-1-methyl-1H-pyrazole-5-carboxamide, CAS RN 119168-77-3), and fipronil (5-amino-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4-[(1R,S)-(trifluoromethyl)sulfinyl]-1H-pyrazole-3-carbonitrile, CAS RN 120068-37-3)

25 The method of claim 15, wherein the pesticide comprises a diacylhydrazine that is selected from the group consisting of halofenozide (4-chlorobenzoate-2-benzoyl-2-(1,1-dimethylethyl)-hydrazide, CAS RN 112226-61-6), methoxyfenozide (RH-2485, N-tert-butyl-N'-(3-methoxy-o-toluoyl)-3,5-xylohydrazide, CAS RN 161050-58-4), and

tebufenozide (3,5-dimethylbenzoic acid 1-(1,1-dimethylethyl)-2-(4-ethylbenzoyl)hydrazide, CAS RN 112410-23-8)

26 The method of claim 15, wherein the pesticide comprises a triazole selected from the group consisting of amitrole (CAS RN 61-82-5) and riazamate (ethyl-[[1-[(dimethylamino)carbonyl]-3-(1,1-dimethylethyl)-1H-1,2,4-triazol-5-yl]thio]acetate, CAS RN 112143-82-5)

27 The method of claim 15, wherein the pesticide comprises a biological/fermentation products selected from the group consisting of avermectin (abamectin, CAS RN 71751-41-2) and spinosad (XDE-105, CAS RN 131929-60-7)

28 The method of claim 15, wherein the pesticide comprises an organophosphate insecticide selected from the group consisting of acephate (CAS RN 30560-19-1), chlorpyrifos (CAS RN 2921-88-2), chlorpyrifos-methyl (CAS RN 5598-13-0), diazinon (CAS RN 333-41-5), fenamiphos (CAS RN 22224-92-6), and malathion (CAS RN 121-75-5)

29 The method of claim 15 wherein the pesticide comprises a carbamate insecticide selected from the group consisting of aldicarb (CAS RN 116-06-3), carbaryl (CAS RN 63-25-2) carbofuran (CAS RN 1563-66-2) oxamyl (CAS RN 23135-22-0) and thiodicarb (CAS RN 59669-26-0)

30 The method of claim 14, wherein the pesticide comprises a fungicide

31 The method of claim 30, wherein the fungicide comprises a triazole fungicide selected from the group consisting of amitrol, azaconazole, bitertanol, bromuconazole, climbazole, clotrimazole, cyproconazole, diclobutrazol, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, fluotrimazole, flusilazole, flutriafol, furconazole, furconazole-cis, hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, paclobutrazol, penconazole, propiconazole, quinconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triazbutil, triticonazole, 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone, and mixtures thereof

32 The method according to claim 30, wherein the fungicide comprises fluquinconazole, simeconazole, tebuconazole, tetraconazole, triticonazole, 1-(4-fluorophenyl)-2 (1H-1,2,4-triazole-1-yl)ethanone, or mixtures thereof

33 The method according to claim 30, wherein the fungicide comprises fluquinconazole

34 The method according to claim 30, wherein the fungicide comprises simeconazole

35 The method according to claim 30, wherein the fungicide comprises tebuconazole

36 The method according to claim 30 wherein the fungicide comprises tetraconazole

37 The method according to claim 30, wherein the fungicide comprises triticonazole

38 The method according to claim 30, wherein the fungicide comprises 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone

39 The method according to claim 30, wherein the fungicide comprises a diazole selected from the group consisting of imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, and mixtures thereof

40 The method according to claim 30, wherein the fungicide comprises a strobilurin type fungicide selected from the group consisting of azoxystrobin, dimoxystrobin, famoxadone, kresoxim-methyl, metominostrobin, picoxystrobin, pyraclostrobin, trifloxystrobin, and mixtures thereof

41 The method according to claim 30, wherein the fungicide comprises a member selected from the group consisting of tebuconazole, simeconazole, fludioxonil, fluquinconazole, difenoconazole, 4,5-dimethyl-N-(2-propenyl)-2-(trimethylsilyl)-3-thiophenecarboxamide (silthiofam), hexaconazole, etaconazole, propiconazole, triticonazole, flutriafol, epoxiconazole, fenbuconazole, bromuconazole, penconazole, imazalil, tetraconazole, flusilazole, metconazole, diniconazole, myclobutanil, triadimenol, bitertanol, pyremethanil, cyprodinil, tridemorph, fenpropimorph, kresoxim-methyl, azoxystrobin, ZEN90160, fenpiclonil, benalaxyl, furalaxyl, metalaxyl, R-metalaxyl, ofurace, oxadixyl, carboxin, prochloraz, triflumizole, pyrifenox, acibenzolar-S-methyl, chlorothalonil, cymoaxnil, dimethomorph, famoxadone, quinoxyfen, fenpropidine, spiroxamine, triazoxide, BAS50001F, hymexazole, pencycuron, fenamidone, guazatine, and cyproconazole

42 The method according to claim 30, wherein the fungicide comprises silthiofam

43 The method according to claim 30, wherein the pesticide comprises silthiofam and the polymer comprises polyvinylacetate

44 The method according to claim 14, wherein the pesticide comprises silthiofam and the polymer comprises methocel

45 The method according to claim 1, wherein the treatment comprises the steps

a providing a seed,

b contacting the seed with a latex comprising the polymer;

c forming a polymer coating on the seed before treating the seed with a phytotoxic agent, wherein the coating is free of the phytotoxic agent and wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination, and

d contacting the polymer coated seed with the phytotoxic agent

46 The method according to claim 45, wherein the polymer coating is applied so that it directly contacts the seed without intervening material between the coating and the seed

47 Phytotoxic agent-treated plant seed having an improved germination rate, each seed comprising a plant seed having a phytotoxic agent deposited thereupon, and having a uniform polymer coating having a thickness of between about 1 and 500 microns which is free of the phytotoxic agent located between the seed and the phytotoxic agent

48 A plant that is grown from a seed that is treated by the method according to claim 1

49 A method of producing an agronomic crop, the method comprising the steps

a providing plant seeds of the agronomic crop that have been treated by the method according to claim 1,

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b planting the seeds, and

c cultivating the planted seeds and plants that sprout from the seeds

REIVINDICACIONES

MODIFICADAS

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LISTADO DE REIVINDICACIONES

1 Un método de incrementar el porcentaje de germinación de semillas de planta que se tratan con un agente fitotóxico, método que comprende

formar una capa de polímero sobre la semilla de planta antes de tratar la semilla con el agente fitotóxico, en donde la capa está libre del agente fitotóxico y es una capa uniforme que tiene un espesor desde 1 a 500 micrones, y

tratar la semilla cubierta de planta con el agente fitotoxico

2 El metodo de acuerdo con la reivindicación 1, en donde la capa comprende un polimero en una cantidad de mas de 10% en peso

3 El metodo de acuerdo con la reivindicacion 2, en donde la capa comprende un polimero en una cantidad de por lo menos alrededor de 50% en peso

4 El método de acuerdo con la reivindicación 1, en donde el espesor de la capa es entre alrededor de 1 micrón y alrededor de 480 micrones

5 El metodo de la reivindicación 1, en donde el polimero es uno que tiene una temperatura minima de formación de pelicula de menos de 55°C

6 El metodo de la reivindicación 5, en donde el polimero comprende un material seleccionado del grupo conformado por maltodextrina, metilcelulosa, etilcelulosa, hidroxipropilcelulosa, hidroxipropil/metilcelulosa, polimeros de acetato de vinilo - etileno, polimeros de cloruro de vinilo - etileno, polimeros de acetato de vinilo, polimeros vinil-acrilicos, polimeros a base de almidón, SB-2000, polimeros de cloruro de vinilo – acetato de polivinilo, copolímeros de cloruro de vinilo / acetato de vinilo / etileno, copolimeros de estireno-acrilato, polimeros de acetato de vinilo, polímeros de butiraro de vinilo, copolimeros de estireno-butirato de vinilo, polimeros de acrilato, copolimeros de estireno-butadieno, copolimeros de acetato de vinilo – butirato de vinilo,

copolimeros de acetato de vinilo - versatato de vinilo y alcohol polivinílico

7 El método de la reivindicación 5, en donde el polimero comprende acetato de polivinilo

8 El método de la reivindicacion 5, en donde el polimero comprende methocel

9 El método de la reivindicación 1, en donde la semilla es la semilla de una planta agronomica que se selecciona del grupo conformado por cereales (trigo, cebada, centeno, avena, arroz, sorgo, productos agricolas relacionados, etc), remolacha, frutas en forma de pera, frutas que tienen pepa y frutas blandas (manzana, pera, ciruela, melocotón, albaricoque japonés, ciruela pasa, almendra, cereza, fresa, frambuesa, mora, tomate, pimiento, etc), legumbres (frijol, lenteja, arveja, soya), plantas oleaginosas (colza, canola, mostaza, amapola, oliva, girasol, coco, ricino, granos de cacao, mani, soya, maiz, etc) Cucurbitáceas (calabaza, cohombro, melon, etc), cítricos (naranja, limon, toronja, mandarina, pomelo Watson (*citrus natsudaidai*), etc), vegetales (lechuga, repollo, col china, rabano chino, zanahoria, cebolla, papa, etc), arboles de alcanfor (aguacate, canela, alcanfor, etc), maiz, tabaco, nueces, café, caña de azucar, te, vid, lupulo y banano

10 El método de la reivindicación 9, la planta agronomica se selecciona del grupo conformado por arroz, trigo, cebada, centeno, maiz, papa, zanahoria, batata, remolacha azucarera, frijol, arveja, achicoria, lechuga, repollo, coliflor, broculi, nabo, rabano, espinaca, espárrago, cebolla, ajo, berenjena, pimiento, apio, zanahoria, zapallo, calabaza, calabacin, cohombro, manzana, pera, membrillo, melón, ciruela, cereza, melocoton, nectarina, albaricoque, fresa, uva, frambuesa, zarzamora, piña, aguacate, papaya, mango, banano, soya, tomate, sorgo y frambuesas, banano y otras variedades comestibles similares

11 El método de la reivindicación 10, en donde la planta agronomica se selecciona de maiz, frijol de soya, algodón, sorgo, colza (canola), arroz, trigo, cebada y centeno

12 El metodo de la reivindicación 10, en donde la planta

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agronomica es maiz, frijol de soya, o algodón

13 El método de la reivindicacion 1, en donde el agente fitotóxico se selecciona del grupo conformado por plaguicidas, fertilizantes, reguladores de crecimiento de plantas, farmacos, colorantes, atrayentes biológicos, fragancias, feromonas y sus mezclas

14 El método de la reivindicacion 1, en donde el agente fitotoxico comprende un plaguicida seleccionado del grupo conformado por herbicidas, moluscicidas, insecticidas, nematocidas, acaricidas, fungicidas, bactericidas y sus mezclas

15 El metodo de la reivindicación 14, en donde el plaguicida se selecciona del grupo conformado por piretrinas, piretroides sinteticos, azoles, insecticidas de oxadizina, neonicotinoides, diazoles, triazoles, derivados de estrobilurina, organofosfatos, pirroles, pirazoles, fenilpirazoles, diacilhidracinas, productos biológicos/de fermentacion, carbamatos y sus mezclas

16 El metodo de la reivindicacion 14, en donde el plaguicida comprende un insecticida

17 El metodo de la reivindicación 16, en donde el insecticida comprende un piretroide o piretrina sintética.

18 El método de la reivindicación 17, en donde la piretrina comprende un miembro seleccionado del grupo conformado por ester de 2-alil-4-hidroxi-3-metil-2-ciclopenten-1-ona de acido 2,2-dimetil-3-(2-metilpropenil)-ciclopropano carboxilico, (2-metil-1-propenil)-2-metoxi-4-oxo-3- (2-propenil)-2-ciclopenten-1-il éster y mezclas de sus isomeros *cis* y *trans*

19 El metodo de la reivindicacion 17, en donde el piretroide comprende un miembro seleccionado del grupo conformado por (s)-ciano (3-fenoxifenil)metil-4-cloro alfa (1-metiletil)bencenoacetato (fenvalerato, CAS RN 51630-58-1), (S)-ciano-(3-tenoxifenil)metil (S)-4-cloro-alfa-(1-metiletil)bencenoacetato (esfenvalerato, CAS RN 66230-04-4), (3-fenoxifenil)-metil(+)cis-trans-3-(2,2-dichoroethenil)-2,2-dimetilciclopropanocarboxilato (permetrin, CAS RN 52645-53-1), (±) alfa-

ciano-(3-fenoxifenil)metil(+)-cis,trans-3-(2,2-dicloroetenil)-2,2-dimetil-ciclopropano carboxilato (cipermetrin, CAS RN 52315-07-8), (beta-cipermetrin, CAS RN 65731-84-2), (theta cipermetrin, CAS RN 71697-59-1), S-ciano (3-fenoxifenil)metil (±) cis/trans 3-(2,2-dicloroetenil) 2,2 dimetilciclopropanocarboxilato (zeta-cipermetrin, CAS RN 52315-07-8), (s)-alfa-ciano-3-fenoxibencil (1R,3R)-3-(2,2-dibromovinil)-2,2-dimetilciclopropanocarboxilato (deltametrin, CAS RN 52918-63-5), alfa-ciano-3-fenoxibencil 2,2,3,3,-tetrametil ciclopropoanocarboxilato (fenpropatrin, CAS RN 64257-84-7), (RS)-alfa-ciano-3-fenoxibencil (R)-2-[2-cloro-4-(trifluorometil)anilino]-3-metilbutanoato (tau-fluvalinato, CAS RN 102851-06-9), (2,3,5,6-tetrafluoro-4-metilfenil)metil-(1-alfa, 3-alfa)-(Z)-(±)-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (teflutrin, CAS RN 79538-32-2), (±)-ciano (3-fenoxifenil)metil (±)-4-(difluorometoxi)-alfa-(1-metil etil)bencenoacetato (flucitrinato, CAS RN 70124-77-5), ciano(4-fluoro-3-fenoxifenil)metil 3-[2-cloro-2-(4-clorofenil)etenil]-2,2-dimetilciclopropanocarboxilato (flumetrin, CAS RN 69770-45-2), ciano (4-fluoro-3-fenoxifenil) metil 3-(2,2-dicloroetenil)-2,2-dimetil-ciclopropanodarboxilato (ciflutrin, CAS RN 68359-37-5), (beta ciflutrin, CAS RN 68359-37-5), (transflutrin, CAS RN 118712-89-3), (S)-alfa-ciano-3-fenoxibencil (Z)-(1R-cis)-2,2-dimetil-3-[2-(2,2,2-trifluoro-trifluorometil-etoxicarbonil)vinil]ciclopropanocarboxilato (acrinatrin, CAS RN 101007-06-1), pareja de isomero (1R cis) S y (1S cis) R enantiómero de alfa-ciano-3-fenoxibencil-3-(2,2-diclorovinil)-2,2-dimetilciclopropanocarboxilato (alfa-cipermetrin, CAS RN 67375-30-8), acido [1R,3S)3(1'RS)(1',2',2',2'-tetrabromoetil)]-2,2-dimetilciclopropanocarboxilico (s)-alfa-ciano-3-fenoxibencil éster (tralometrin, CAS RN 66841-25-6), ciano-(3-fenoxifenil)metil 2,2-dicloro-1-(4-etoxifenil)ciclopropanocarboxilato (cicloprotrin, CAS RN 63935-38-6), [1α, 3α(Z)]-(±)-ciano-(3-fenoxifenil)metil 3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetilciclopropanocarboxilato (cihalotrin, CAS RN 68085-85-8), [1-alfa (s), 3-alfa(z)]-ciano(3-fenoxifenil)metil-3-(2-cloro-3,3,3-trifluoro-1-

propenil)-2,2-dimetilciclopropanocarboxilato (lambda cihalotrin, CAS RN 91465-08-6), (2-metil-[1,1'-bifenil]-3-il)metil-3-(2-cloro-3,3,3-trifluoro-1-propenil)-2,2-dimetil-ciclopropanocarboxilato (bifentrin, CAS RN 82657-04-3), 5-1-bencil-3-furilmetil-d-cis(1R,3S,E)2,2-dimetil-3-(2-oxo,-2,2,4,5 tetrahidrotiofenilidenmetil)ciclopropanocarboxilato (kadetrin, RU15525, CAS RN 58769-20-3), [5-(fenilmetil)-3-furanil]-3-furanil-2,2-dimetil-3-(2-metil-1-propenil)ciclopropanocarboxilato (resmetrin, CAS RN 10453-86-8), (1R-trans)-[5-(fenilmetil)-3-furanil]metil 2,2-dimetil-3-(2-metil-1-propenil) ciclopropanocarboxilato (bioresmetrin, CAS RN 28434-01-7), 3,4,5,6-tetrahidro-ftalimidometil-(1RS)-cis-trans-crisantemato (tetrametrin, CAS RN 7696-12-0), 3-fenoxibencil-d, 1-cis, trans 2,2-dimetil-3-(2-metilpropenil)ciclopropanocarboxilato (fenotrin, CAS RN 26002-80-2), (empentrin, CAS RN 54406-48-3), (cifenotrin, CAS RN 39515-40-7), (praletrin, CAS RN 23031-36-9), (imiprotrin, CAS RN 72963-72-5), (RS)-3-alil-2-metil-4-oxciclopent-2-enil-(1S,3R,1R,3S)-2,2-dimetil-3-(2-metilprop-1-enil) ciclopropanocarboxilato (aletrin, CAS RN 584-79-2), (bioaletrin, CAS RN 584-79-2), y (ZXI8901, CAS RN 160791-64-0)

20 El método de la reivindicación 17, en donde el piretroide comprende un miembro seleccionado del grupo conformado por teflutrin, lambda cihalotrin, bifentrin, permetrin y ciflutrin

21 El método de la reivindicación 15, en donde el plaguicida comprende un insecticida de oxidiazina que se selecciona del grupo conformado por 5-(2-cloropirid-5-ilmetil)-3-metil-4-nitroiminoperhidro-1,3,5-oxadiazina, 5-(2-clorotiazol-5-ilmetil)-3-metil-4-nitroiminoperhidro-1,3,5-oxadiazina, 3-metil-4-nitroimino-5-(1-oxido-3-piridinometil)perhidro-1,3,5-oxadiazina, 5-(2-cloro-1-oxido-5-piridinometil)-3-metil-4-nitroiminoperhidro-1,3,5-oxidiazina, y 3-metil-5-(2-metilpirid-5-ilmetil)-4-nitroiminoperhidro-1,3,5-oxadiazina

22 El metodo de la reivindicación 15, en donde el plaguicida comprende un insecticida neonicotinoide que se selecciona del grupo conformado por acetamiprid, imidacloprid, tiametoxam, clotianidina, dinotefuran, flonicamid, nitiazina y tiacloprid

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23 El método de la reivindicación 15, en donde el plaguicida comprende un neonicotinoide que se selecciona del grupo conformado por tiametoxam (CAS RN 153719-23-4), acetamiprid ((E)-N-[(6 cloro-3-piridinil)metil]-N'-ciano-N-metilenimidamida, CAS RN 135410-20-7), imidacloprid (1-[(6-cloro-3-piridinil)metil]-N-nitro-2-imidazolidinimina, CAS RN 138261-41-3), nitenpiram (N-[(6-cloro-3-piridinil)metil]-N-etil-N'-metil-2-nitro-1,1-etendiamina, CAS RN 120738-89-8), clotianidina (TI-435(N-[(2-cloro-5-tiazoil)metil]-N'-metil-N"-nitro,[C(E)]-(9CI)-guanidina, CAS RN 210880-92-5)

24 El metodo de la reivindicacion 15, en donde el plaguicida comprende un pirrol, pirazol, o fenilpirazol que se selecciona del grupo conformado por clorfenapir (4-bromo-2-(4-clorofenil)-1-etoximetil-5-trifluorometilpirrol-3-carbonitrilo, CAS RN 122453-73-0), fenpiroximato ((E)-1,1-dimetiletil-4[[[[(1,3-dimetil-5-fenoxi-1H-pirazol-4-il)metilen]amino]oxi]metil]benzoato, CAS RN 111812-58-9), tebufenpirad (4-cloro-N[[4-1,1-dimetiletil)fenil]metil]-3-etil-1-metil-1H-pirazol-5-carboxamida, CAS RN 119168-77-3), y fipronil (5-amino-[2,6-dicloro-4-(trifluorometil)fenil]-4-[(1R,S)-(trifluorometil)sulfinil]-1H-pirazol-3-carbonitrilo, CAS RN 120068-37-3)

25 El metodo de la reivindicacion 15, en donde el plaguicida comprende una diacilhidracina que se selecciona del grupo conformado por halofenozida (4-clorobenzoato-2-benzoil-2-(1,1-dimetiletil)-hidracida, CAS RN 112226-61-6), metoxifenozida (RH-2485, N-tert-butil-N'-(3-metoxi-o-toluoil)-3,5-xilohidracida, CAS RN 161050-58-4), y tebufenozida (acido 3,5-dimetilbenzoico 1-(1,1-dimetiletil)-2-(4-etilbenzoil)hidracida, CAS RN 112410-23-8)

26 El metodo de la reivindicacion 15, en donde el plaguicida comprende un triazol seleccionado del grupo conformado por amitrol (CAS RN 61-82-5) y riazamate (etil-[[1-[(dimetilamino)carbonil]-3-(1,1-dimetiletil)-1H-1,2,4-triazol-5-il]tio]acetato, CAS RN 112143-82-5)

27 El método de la reivindicación 15, en donde el plaguicida comprende productos biológicos/de fermentacion seleccionados del grupo

conformado por avermectina (abamectina, CAS RN 71751-41-2) y spinosad (XDE-105, CAS RN 131929-60-7)

28 El metodo de la reivindicación 15, en donde el plaguicida comprende un insecticida de organofosfato seleccionado del grupo conformado por acefate (CAS RN 30560-19-1), clorpirifos (CAS RN 2921-88-2), clorpirifos-metil (CAS RN 5598-13-0), diazinona (CAS RN 333-41-5), fenamifos (CAS RN 22224-92-6), y malatión (CAS RN 121-75-5)

29 El metodo de la reivindicacion 15, en donde el plaguicida comprende un insecticida de carbamato selecciona del grupo conformado por aldicarb (CAS RN 116-06-3), carbaril (CAS RN 63-25-2), carbofuran (CAS RN 1563-66- 2), oxamil (CAS RN 23135-22-0) y tiodicarb (CAS RN 59669-26-0)

30 El metodo de la reivindicacion 14, en donde el plaguicida comprende un fungicida

31 El método de la reivindicación 30, en donde el fungicida comprende un fungicida de triazol seleccionado del grupo conformado por amitrol, azaconazol, bitertanol, bromuconazol, climbazol, clotrimazol, ciproconazol, diclobutrazol, difenoconazol, diniconazol, diniconazol-M, epoxiconazol, etaconazol, fenbuconazol, fluquinconazol, fluotrimazol, flusilazol, flutriafol, furconazol, furconazol-cis, hexaconazol, imibenconazol, ipconazol, metconazol, miclobutanil, paclobutrazol, penconazol, propiconazol, quinconazol, simeconazol, tebuconazol, tetraconazol, triadimefon, triadimenol, triazbutil, triticonazol, 1-(4-fluorofenil)-2-(1H-1,2,4-triazol-1-il)etanona y sus mezclas

32 El metodo de acuerdo con la reivindicacion 30, en donde el fungicida comprende fluquinconazol, simeconazol, tebuconazol, tetraconazol, triticonazol, 1-(4-fluorofenil)-2-(1H-1,2,4-triazol-1-il)etanona, o sus mezclas

33 El método de acuerdo con la reivindicacion 30, en donde el fungicida comprende fluquinconazol

34 El metodo de acuerdo con la reivindicación 30, en donde el fungicida comprende simeconazol

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35 El metodo de acuerdo con la reivindicacion 30, en donde el fungicida comprende tebuconazol

36 El metodo de acuerdo con la reivindicacion 30, en donde el fungicida comprende tetraconazol

37 El metodo de acuerdo con la reivindicacion 30, en donde el fungicida comprende triticonazol

38 El metodo de acuerdo con la reivindicación 30, en donde el fungicida comprende 1-(4-fluorofenil)-2-(1H-1,2,4-triazol-1-il)etanona

39 El metodo de acuerdo con la reivindicacion 30, en donde el fungicida comprende un diazol seleccionado del grupo conformado por imazalil, oxpoconazol, pefurazoate, procloraz, trifulmizol y sus mezclas

40 El metodo de acuerdo con la reivindicacion 30, en donde el fungicida comprende un fungicida tipo estrobilurina seleccionado del grupo conformado por azoxistrobina, dimoxistrobina, famoxadona, kresoxim-metil, metominostrobina, picoxistrobina, piraclostrobina, trifloxistrobina y sus mezclas

41 El método de acuerdo con la reivindicación 30, en donde el fungicida comprende un miembro seleccionado del grupo conformado por tebuconazol, simeconazol, fludioxonil, fluquinconazol, difenoconazol, 4,5-dimetil-N-(2-propenil)-2-(trimetilsilil)-3-tiofencarboxamida (siltiofam), hexaconazol, etaconazol, propiconazol, triticonazol, flutriafol, epoxiconazol, fenbuconazol, bromuconazol, penconazol, imazalil, tetraconazol, flusilazol, metconazol, diniconazol, miclobutanil, triadimenol, bitertanol, piremetanil, ciprodinil, tridemorf, fenpropimorf, kresoxim-metil, azoxistrobina, ZEN90160, fenpiclonil, benalaxil, furalaxil, metalaxil, R-metalaxl, orfurace, oxadixil, carboxina, procloraz, trifulmizol, pirifenox, acibenzolar-S-metil, clorotalonil, cimoaxnil, dimetomorf, famoxadona, quinoxifen, fenpropidina, espiroxamina, triazoxide, BAS50001F, himexazol, pencicuron, fenamidona, guazatina y ciproconazol

42 El metodo de acuerdo con la reivindicacion 30, en donde el fungicida comprende siltiofam

43 El metodo de acuerdo con la reivindicacion 30, en donde el

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plaguicida comprende siltiofam y el polimero comprende acetato de polivinilo

44 El metodo de acuerdo con la reivindicacion 14, en donde el plaguicida comprende siltiofam y el polimero comprende methocel

45 El metodo de acuerdo con la reivindicación 1, en donde el tratamiento comprende los pasos de

a proveer una semilla,

b poner en contacto la semilla con un látex que comprende el polimero,

c formar una capa de polimero sobre la semilla antes de tratar la semilla con un agente fitotóxico, en donde la capa esta libre del agente fitotóxico y en donde el tipo de polimero y el espesor de la capa se diseñan para bloquear el contacto fitotóxico del agente fitotóxico con la semilla, permitiendo al mismo tiempo suficiente transferencia de oxigeno y humedad bajo condiciones ambientales enfrentadas normalmente por la semilla después de la siembra, para mantener la viabilidad de la semilla y posibilitar su germinación, y

d poner en contacto la semilla cubierta con el polimero con el agente fitotoxico

46 El metodo de acuerdo con la reivindicacion 45, en donde la capa de polimero se aplica de modo que contacte directamente la semilla sin material intermedio entre la cubierta y la semilla

47 Semilla de una planta tratada con agente fitotoxico que tiene un porcentaje de germinación mejorado, comprendiendo cada semilla una semilla de planta con un agente fitotoxico depositado sobre ella, y con una capa uniforme de polimero que tiene un espesor de entre alrededor de 1 y 500 micrones, la cual esta libre del agente fitotoxico, localizada entre la semilla y el agente fitotóxico

48 Una planta que se cultiva de una semilla que se trata por el método de acuerdo con la reivindicacion 1

49 Un metodo de producir un producto agronómico, metodo que comprende los pasos de

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a proveer semillas de planta del producto agronomico que se han tratado por el metodo de acuerdo con la reivindicacion 1,

b sembrar las semillas, y

c cultivar las semillas sembradas y las plantas que brotan de las semillas

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PCT REQUEST

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0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and PCT International Application*	

0-4	Form PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2 92 (updated 01 11 2003)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	United States Patent and Trademark Office (USPTO) (RO/US)
0-7	Applicant's or agent's file reference	17396/09181
I	Title of invention	METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT
II	Applicant	
II 1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	MONSANTO TECHNOLOGY, LLC
II-5	Address.	800 North Lindbergh Boulevard St Louis, MO 63167 United States of America
II-6	State of nationality	US
II-7	State of residence	US
II-8	Telephone No.	(314) 694-1000
II-9	Facsimile No.	(314) 694-9058
III-1	Applicant and/or inventor	
III-1 1	This person is.	applicant and inventor
III 1-2	Applicant for	US only
III-1-4	Name (LAST First)	ASRAR, Jawed
III 1-5	Address.	14949 Royal Brook Chesterfield, MO 63017 United States of America
III-1-6	State of nationality	US
III 1 7	State of residence	US

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III-2	Applicant and/or Inventor	
III-2-1	This person is.	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST First)	BEKKER, Vladimir, O
III-2-5	Address.	32 Forsythia Lane Olivette, MO 63132 United States of America
III-2-6	State of nationality	US
III-2-7	State of residence	US
III-3	Applicant and/or Inventor	
III-3-1	This person is.	applicant and inventor
III-3-2	Applicant for	US only
III-3-4	Name (LAST First)	DING, Yiwei
III-3-5	Address.	423 Castle Pines Court Ballwin, MO 63021 United States of America
III-3-6	State of nationality	US
III-3-7	State of residence	US
IV 1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV 1 1	Name	NELSON MULLINS RILEY & SCARBOROUGH, LLC
IV 1-2	Address:	P O Box 11070 Columbia, SC 29211 United States of America
IV 1-3	Telephone No.	(864) 250-2238
IV 1-4	Facsimile No.	(803) 256-7500
IV 1-5	e-mail	ced@nmrs com
IV 1-6	Agent's registration No.	35,124

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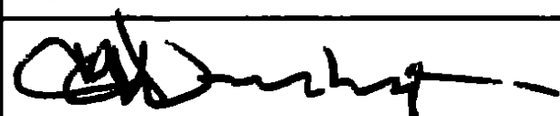
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V	Designation of States	
V 1	Regional Patent (other kinds of protection or treatment, if any are specified between parentheses after the designation(s) concerned)	AP BW GH GM KE LS MW MZ SD SL SZ TZ UG ZM ZW and any other State which is a Contracting State of the Harare Protoc l and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE BG CH&LI CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL PT RO SE SI SK TR and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GQ GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any are specified between parentheses after the designation(s) concerned)	AE AG AL AM AT AU AZ BA BB BG BR BW BY BZ CA CH&LI CN CO CR CU CZ DE DK DM DZ EC EE EG ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NI NO NZ OM PG PH PL PT RO RU SC SD SE SG SK SL SY TJ TM TN TR TT TZ UA UG US UZ VC VN YU ZA ZM ZW
V-5	Precautionary Designation Statement In addition to the designations made under Items V 1 V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under Item V-6 below The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1 1	Filing date	03 December 2002 (03 12 2002)
VI-1-2	Number	60/430,572
VI 1-3	Country	US

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VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s)	VI-1	
VII-1	International Searching Authority Chosen	European Patent Office (EPO) (ISA/EP)	
VIII	Declarations	Number of declarations	
VIII 1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	Check list	number of sheets	electronic file(s) attached
IX-1	Request (including declaration sheets)	5	-
IX-2	Description	33	-
IX-3	Claims	10	-
IX-4	Abstract	1	EZABST00.TXT
IX-5	Drawings	7	-
IX-7	TOTAL	56	
	Accompanying Items	paper document(s) attached	electronic file(s) attached
IX-8	Fee calculation sheet	✓	-
IX-17	PCT-EASY diskette	-	Diskette
IX-18	Other (specified)	Transmittal Letter to the USRO	-
IX-18	Other (specified):	Unexecuted PCT Power of Attorney	-
IX-18	Other (specified)	Return postcard	-
IX-19	Figure of the drawings which should accompany the abstract	1	
IX-20	Language of filing of the international application	English	
X-1	Signature of applicant, agent or common representative		
X-1 1	Name	NELSON MULLINS RILEY & SCARBOROUGH, LLC	
X-1-2	Name of signatory	Charles E Dunlap	
X-1-3	Capacity	Agent of Record	

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10-1	Date of actual receipt of the purported international application	
10-2	Drawings	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/EP
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11 1	Date of receipt of the record copy by the International Bureau	

PCT (ANNEX FEE CALCULATION SHEET)

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(This sheet is not part of and does not count as a sheet of the international application)

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0	For receiving Office use only	
0-1	International Application No.	
0-2	Date stamp of the receiving Office	

0-4	Form PCT/RO/101 (Annex) PCT Fee Calculation Sheet				
0-4-1	Prepared using		PCT-EASY Version 2 92 (updated 01 11 2003)		
0-9	Applicant's or agent's file reference		17396/09181		
2	Applicant		MONSANTO TECHNOLOGY, LLC, et al		
12	Calculation of prescribed fees		fee amount/multiplier	Total amounts (USD)	
12-1	Transmittal fee	T	⇨	240	
12-2-1	Search fee	S	⇨	1,119	
12-2-2	International search to be carried out by		EP		
12-3	International fee				
	Basic fee				
	(first 30 sheets)	b1	476		
12-4	Remaining sheets		26		
12-5	Additional amount	(X)	12		
12-6	Total additional amount	b2	312		
12-7	b1 + b2 =	B	788		
12-8	Designation fees				
	Number of designations contained in international application		99		
12-9	Number of designation fees payable (maximum 5)		5		
12-10	Amount of designation fee	(X)	104		
12-11	Total designation fees	D	520		
12-12	PCT-EASY fee reduction	R	-148		
12-13	Total international fee (B+D-R)	I	⇨	1,160	
12-14	Fee for priority document				
	Number of priority documents requested		1		
12-15	Fee per document	(X)	20		
12-16	Total priority document fee	P	⇨	20	
12-17	TOTAL FEES PAYABLE (T+S+I+P)		⇨	2,539	
12-19	Mode of payment		cheque		
12-20	Deposit account instructions				
	The receiving Office		United States Patent and Trademark Office (USPTO) (RO/US)		
12-20-2	Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.		✓		
12-20-3	Authorization to charge the fee for priority document.		✓		

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13-2-7	Validation messages Contents	Yellow! The power of attorney or a copy of the general power of attorney will need to be furnished unless all applicants sign the request form

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METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

BACKGROUND OF THE INVENTION

CROSS REFERENCE TO RELATED PATENTS AND PATENT APPLICATIONS

[0001] This application claims the benefit of U S Provisional Patent Application Serial No 60/430,572, filed December 3, 2002, which is incorporated by reference herein in its entirety

(1) Field of the Invention

[0002] The present invention relates to a method of protecting seeds that are to be treated with a phytotoxic agent, and in particular, to a method for improving the germination rate of phytotoxic agent-treated seeds Also included are seeds that have been treated by the subject method, and plants that grow from such seeds

(2) Description of the Related Art

[0003] A significant fraction of plant seed is now treated with one or more agrochemicals, such as pesticides inoculants, growth factors and fertilizers, in order to control pests and diseases, to provide nutrients, stimulate germination, and enhance the growth of the seedling Some of the agrochemicals that are useful in controlling pests and diseases can also be toxic to the seed and to the plant that sprouts from the seed Such phytotoxic activity limits the amount of these agrochemicals that can safely be applied to the seed

[0004] One undesirable effect of phytotoxicity is the reduction of the germination rate of seeds that have been treated Typically, the germination rate of seeds that are treated with a phytotoxic agent decreases with time after the agent has been applied, thereby limiting the shelf life of the treated seeds Sometimes extraordinary measures, such as in field seed treatment or treatment immediately before planting, are required to avoid serious damage to the crop It has also been recognized that phytotoxic damage to seed by agrochemical agents may be

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exacerbated by exposure of the seed to environmental stresses, such as cold, drought, and the like

[0005] Phytotoxicity of agrochemicals has been dealt with in several ways The inclusion of safeners – chemicals which ameliorate the phytotoxic affects of agrochemicals, such as herbicides - along with the seed, is widely used but this requires the application of an additional, often expensive, chemical component to the seed

[0006] Another way to overcome the phytotoxic effect is to encapsulate the agrochemical agent in a matrix, often a polymer which limits the movement of the agent See, *e g*, U S Patent 6,329,319 to Puglisi *et al* This method can limit the contact of the agent with the seed and the emerging seedling, while permitting the agent to become available later during germination and initial plant growth as the agent is released from the polymer matrix The proper operation of encapsulation technology depends on careful matching of the physical and chemical properties of the agrochemical and the encapsulating matrix Neither one polymer matrix, nor one encapsulation process, is suitable for encapsulation of all agrochemical agents now in use for seed treatment

[0007] Agrochemical agents can also be included in seed coatings, which can limit the mobility of the agent See, *e g*, U S Patent No 6,199,318 to Stewart *et al*, U S Patent No 5,129,180 to Stewart, U S Patent No 5,127,185 to Kojimoto *et al*, U S Patent No 5,044 116 to Gago *et al*, and U S Patent No 3,947,906 to Watts However, because the active agent is distributed throughout the coating, some finite amount of the agent, by necessity, comes in contact with the surface of the seed Moreover, like encapsulation, the chemical and physical parameters of the matrix material must be matched with the properties of the active agent in order to obtain the proper homogeneity for the coating and to avoid cracking

[0008] It is known to apply polymer coatings to seeds for the purpose of reducing imbibitional chilling injury See, Ni, B-R, Alleviation of seed imbitional chilling injury using polymer film coating, *British Crop Protection*

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Council Symposium Proceedings, No 76, Pp 73 82 (2001) also, Taylor, A G , *Bean Improvement Cooperative, 30*:30-31 (1987), Taylor *et al* , *J Horticultural Sci 62*:183-189 (1987), Taylor, A G and J Kwiatkowski, Polymer film coatings decrease water uptake and water vapor movement into seeds and reduce imbibitional chilling injury, West *et al* , *Crop Science, 25*:941 944 (1985) But the combination of such coatings with subsequent seed treatment with phytotoxic agrochemicals was not described

[0009] It would be useful therefore, to provide a method for reducing phytotoxic injury to seeds from phytotoxic seed treatment agents, which method can be used with a broad range of agrochemical agents and applied to a broad range of seed types

SUMMARY OF THE INVENTION

[00010] Briefly therefore the present invention is directed to a novel method of improving the germination rate of plant seeds which are treated with a phytotoxic agent, the method comprising forming a polymer coating on the plant seed before treating the seed with the phytotoxic agent, where the coating is free of the phytotoxic agent and where the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination, and treating the coated plant seed with the phytotoxic agent

[00011] The present invention is also directed to a novel phytotoxic agent treated plant seed having an improved germination rate, each seed comprising a plant seed having a phytotoxic agent deposited thereupon, and having a polymer coating which is free of the phytotoxic agent located between the seed and the phytotoxic agent, wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the

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seed after planting to maintain the seed's viability and enable its germination

[00012] The present invention is also directed to a novel plant that is grown from a seed that is treated by the method described above

[00013] The present invention is also directed to a novel method of producing an agronomic crop, the method comprising the steps

a providing plant seeds of the agronomic crop that have been treated by the method described above

b planting the seeds, and

c cultivating the planted seeds and plants that sprout from the seeds

[00014] Among the several advantages found to be achieved by the present invention, therefore may be noted the provision of a method for reducing phytotoxic injury to seeds from phytotoxic seed treatment agents, which can be used with a broad range of agrochemical agents and applied to a broad range of seed types

BRIEF DESCRIPTION OF THE DRAWINGS

[00015] Figure 1 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment for seeds having no coating and having 10μ and 50μ coatings of Vinac XX-210 polymer followed by treatment with a Concep III safener and with imidacloprid at levels of 0, 250 g, 500 g, and 750 g per 100 kg of seeds,

[00016] Figure 2 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment, for seeds having no coating and having 10μ and 50μ coatings of Vinac XX-210 polymer followed by treatment with a Concep III safener and with imidacloprid at levels of 0, 250 g, 500 g, and 750 g per 100 kg of seeds,

[00017] Figure 3 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 5μ coatings of three different Methocel polymers where the coatings were followed by treatment with a

Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds,

[00018] Figure 4 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment, for seeds having no coating and having 5µ coatings of three different Methocel polymers, where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds,

[00019] Figure 5 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 10µ coatings of either SB-2000 polymer Vinac XX 210, Maltrin MO40, Airflex 500, or Flexbond 289 polymers where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds,

[00020] Figure 6 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 5µ coatings of Maltrin MO40, Methocel E3LV, Methocel E50LV, Methocel A15LV, Airflex 500 + 1% talc, Flexbond 289, and 5µ, 10µ, 20µ and 50µ coatings of Vinac XX 210, where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds, and

[00021] Figure 7 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment, for seeds having no coating and having 5µ coatings of Maltrin MO40, Methocel E3LV Methocel E50LV, Methocel A15LV, Airflex 500 + 1% talc, Flexbond 289, and 5µ, 10µ, 20µ and 50µ coatings of Vinac XX-210, where the coatings were followed by treatment with a Concepill safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

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[00022] In accordance with the present invention, it has been discovered that the germination rate of seeds that are to be treated with a phytotoxic agent can be improved by forming a polymer coating, which is free of the phytotoxic agent, on a plant seed, and then treating the seeds with the agent It is important that the type of polymer that is employed for the coating, and the coating thickness, are designed to block phytotoxic contact of the agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination

[00023] In the present method, the terms "phytotoxic agent" refer to an agricultural active ingredient that is phytotoxic As used herein, the terms "agricultural active ingredient" mean any chemical element, molecule, or compound, or mixture thereof, which has a biological activity in a seed, a plant or a disease or pest of a seed or plant Such agricultural active ingredients include but are not limited to, pesticides, herbicides, fertilizers, plant growth regulators, drugs, dyes, biological attractants, scents and pheromones Therefore, pesticides, herbicides, fertilizers, plant growth regulators, drugs, dyes, biological attractants, scents and pheromones that are phytotoxic are to be included as the phytotoxic agents of the present invention

[00024] As used herein, an agent is "phytotoxic" if it causes harm or damage to a plant or seed with which it comes in contact Plant and seed damage or harm includes for example, stunting chemical burning, yield depression, malformation discoloration, lack of germination, reduction in germination rate, death, and the like

[00025] The subject method has been found to be especially useful when the phytotoxic agent is a plant growth regulator, a pesticide, or a herbicide Examples of pesticides that can be used as the phytotoxic agent in the present invention are acaricides, miticides, insecticides, insect repellants, fungicides, fungistats, molluscicides, rodenticides, nematicides, and bactericides

[00026] It is known that many of the most useful pesticides, herbicides and plant growth regulators can be phytotoxic if they are allowed to contact plants or seeds, and particularly if they are present in high concentrations Nonetheless, it is often more effective, if not necessary, to provide such agents at high concentrations in order to obtain the maximum benefits that they can offer Consequently, it has been particularly difficult to supply these phytotoxic agents in concentrated form, such as in controlled release granules, coatings, or pellets, due to the harmful effect that the agent can have upon the very seed or plant that it is designed to protect An important property of the present invention is that it permits the use of highly effective actives that are also phytotoxic Moreover, the actives can be used at concentrations that are higher than would be possible without the use of the phytotoxic agent free polymer coating

[00027] One function of the polymer coating is to reduce phytotoxic contact of the phytotoxic agent with the seed As used herein the terms "phytotoxic contact" means contact of an amount of an agent with a seed that is sufficient to cause a phytotoxic effect Because the phytotoxic agent-free polymer coating reduces phytotoxic contact of the agent with the seed, it extends the time that treated seed can be stored Also, the treatment can be carried out at a time well before the seed is planted, preferably at a time that is economically attractive and convenient for the person applying the treatment By way of example, when seeds are to be treated with a pesticide, the present method can extend the shelf life of pesticide-treated seeds by a factor of three times, or even more Furthermore, the present method makes it possible to treat seeds with significantly higher levels of pesticides than can normally be used without incurring unacceptably low germination rates This can enhance the effectiveness of the pesticide and extend the time that the pesticide remains active after planting For example, the present method permits the use of two-times, three times, or even higher levels of pesticide, without incurring additional reduction in germination rates for treated seeds

[00028] It is another advantage of the present method that it can be used with a broad range of agrochemical agents, irrespective of their chemical or physical compatibility with the coating polymer The aspect of applying a phytotoxic agent-free polymer coating to the seed before applying a phytotoxic agent eliminates the need for careful matching of the properties of the polymer and the agent

[00029] In the present method, when it is said that a purpose is "improving the germination rate" of plant seed, it is meant that plant seed that have been treated by the present method have a higher germination rate than similar plant seed that have been treated with the same amount and type of phytotoxic agent, but lack the phytotoxic agent-free polymer coating that is a feature of the present method, when both types of seeds are exposed to the same environmental conditions and tested under the same protocol for the measurement of germination rate Methods for the measurement of germination rate are well known to those having skill in the art of seed science, and are described in more detail below

[00030] In the present method, a phytotoxic agent-free polymer coating is formed on a plant seed before treating the seed with the phytotoxic agent The type of polymer and the coating thickness are designed to reduce phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination After the polymer coating has been formed the coated seed is treated with a phytotoxic agent In preferred embodiments, the phytotoxic agent is a pesticide

[00031] Although the subject method can be used to treat the seed of any type of plant, it is preferred that the seed is the seed of an agronomic plant As those terms are used herein, "agronomic plant" refers to any plant that is cultivated by man, or from which is harvested parts or products that are used by man Agronomic plants can be a gymnosperm, a dicotyledon, or a monocotyledon

[00032] Examples of agronomic plants which are useful in the present invention include, without limitation, cereals (wheat, barley, rye, oats, rice, sorghum, related crops, etc), beet pear-like fruits stone fruits and soft fruits (apple, pear, plum, peach, Japanese apricot, prune, almond, cherry, strawberry, raspberry, black berry, tomato, pepper, etc), legumes (kidney bean, lentil, pea, soybean), oil plants (rape, canola, mustard, poppy, olive, sunflower, coconut castor, cocoa bean, peanut, soybean corn, etc), Cucurbitaceae (pumpkin, cucumber, melon, etc), citrus (orange, lemon, grape fruit, mandarin Watson pomelo (citrus natsudaidai), etc), vegetables (lettuce, cabbage celery cabbage, Chinese radish, carrot, onion potato, etc) camphor trees (avocado, cinnamon camphor, etc), corn, tobacco, nuts, coffee sugar cane, tea, grapevine, hop and banana

[00033] In preferred embodiments, the agronomic plant can be rice, wheat, barley, rye, corn, potato carrot, sweet potato, sugar beet, bean, pea, chicory, lettuce, cabbage, cauliflower, broccoli turnip, radish, spinach, asparagus, onion garlic, eggplant, pepper, celery, canot, squash pumpkin, zucchini, cucumber, apple, pear, quince melon, plum, cherry, peach, nectarine, apricot, strawberry, grape, raspberry blackberry, pineapple avocado, papaya, mango, banana, soybean, tomato, sorghum and raspberries, banana and other such edible varieties It is more preferred that the agronomic plant is selected from corn, soybeans, cotton, sorghum rape (canola), rice, wheat, barley and rye It is even more preferred that the agronomic plant is corn, soybeans, or cotton

[00034] An initial step in the present method is forming a phytotoxic agent-free polymer coating on a seed Any method that is known in the art of polymer science can be used to accomplish the formation of the coating on the seed In one preferred method, the coating can be formed by providing a seed, and contacting the seed with a polymer The contacting can be carried out in any one of several ways For example, if the polymer is water soluble, a water solution of the polymer can be prepared and the polymer solution can be applied to the seed – such as by spraying, dipping, misting, or the like For non-water soluble polymers a

liquid/polymer emulsion of the polymer can be formed, and the emulsion can be applied to the seed It is preferred that the liquid in which the emulsion is formed is water, and, in that case, the emulsion can be referred to as a polymer latex It is an important feature of the present method that the polymer-containing medium that is used for the application of the polymer to the seed is free of a phytotoxic agent in order that the application of the polymer to the seed results in the formation of a phytotoxic agent free polymer coating on the seed

[00035] When it is said that the polymer-containing medium, or the polymer coating, are "free of a phytotoxic agent", it is meant that any phytotoxic agent that might be present in the medium or the coating is present at a concentration that is below a phytotoxic level The concentration of a phytotoxic agent is considered to be "below a phytotoxic level" if seed coated with a polymer coating containing the phytotoxic agent provide a warm-germ test germination rate at 30 days (as that test is described below) that is not more than 5% lower than the warm-germ test germination rate of similar seed having a similar polymer coating in which the concentration of the phytotoxic agent is zero

[00036] In preferred embodiments, the polymer coating is applied directly to the seed without intervening material between the coating and the seed

[00037] It is preferred that the polymer of the subject coating be applied to the seed in the form of a film of a liquid suspension dispersion or emulsion As used herein, when describing the coating the term "emulsion" will be understood to include all suspensions, dispersions and emulsions When the liquid in which the polymer is distributed is water, the emulsion can be termed a latex It will be understood that when the term "film" is used in this specification, it generally applies to the film of the polymer emulsion in liquid form after application to the seed unless the context suggests otherwise Likewise, the term "coating" applies to the coating on the seed that is formed from the curing of the film When a film containing the polymer is applied to the seed, it is preferred that the film

substantially covers the surface of the seed However, while preferable, such substantial coverage is not required in order to obtain the advantages of the invention

[00038] The polymer is added to the liquid under conditions that an emulsion is formed This can be done by the addition of finely milled particles of the polymer to the liquid or a liquid/ polymer mixture can be subjected to high shear to form the emulsion Such emulsion forming techniques are well known in the art

[00039] The polymer can be added to the liquid in any amount, but the concentration of the polymer in the emulsion that is used to form the film should be low enough to permit easy handling and application of the emulsion to the seed – such as by spraying – and thorough distribution of the film among the seeds so that the outer surface of each seed is substantially covered However, the concentration should be high enough, when used in combination with the other parameters of seed treatment, to avoid the loss of polymer from the seeds by dripping or pooling of the emulsion It is preferred that the concentration of polymer in the emulsion at the time that a film of the emulsion is applied to the seeds is about 0 5% to about 50%, by weight, more preferred is a concentration of about 0 5% to about 20%, by weight, even more preferred is a concentration of about 2% to about 20%, yet more preferred is a concentration of about 4% to about 15%, by weight, and even more preferred is a concentration of about 5% to about 11%, by weight

[00040] The amount of the polymer emulsion or polymer solution that is added to the seeds is an amount that is sufficient to provide a coating of the desired thickness After the film of the polymer emulsion or solution has been applied to the seed, it is cured to form the polymer coating When it is said that the film is "cured", or when "curing the film" is referred to, what is meant is that a solid coating of the polymer is formed from the polymer in the film Curing is often the result of drying of the liquid from the film, but can also be carried out by chemical reaction, adsorption sequestration, or other forms of polymer curing that are known in the art

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[00041] The subject coating is insoluble in water, as described above, and is present on at least some part of the outer surface of each seed It is preferred that the coating completely cover the outer surface of each seed

[00042] It is preferred that the polymer coating that is formed on the seed comprises a substantial amount of the polymer It is preferred that – after the coating is cured – the polymer coating contains a polymer, or blend of polymers, in an amount of over 10% by weight An amount of 50% by weight is more preferred, 70% by weight is yet more preferred, and 80% by weight is even more preferred In some instances, it is preferred that the coating consists essentially of the polymer

[00043] If it is desirable, the coating can contain non phytotoxic materials other than the polymer in order to serve as plasticizers, emulsifiers, stabilizers, fillers dyes, safeners, and the like Such materials are well known in the art

[00044] A feature of the phytotoxic agent-free polymer coating is that the type of polymer and the coating thickness are designed to reduce phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination

[00045] The types of polymer that are useful for the present coating include polymers that can be processed into an aqueous solution and polymers that can be processed into an aqueous latex emulsion Polymers that form aqueous latex emulsions are preferred It is preferred that the polymers that are used in the present coating can form a film that has good adhesion to the surface of the seed - that is, the cured film adheres sufficiently tightly to the surface of the seed that it does not detach or abrade away during normal processing storage and handling It is further preferred that the polymers form films that are water insoluble, but have sufficient permeability to moisture and oxygen to maintain seed viability and permit germination when the seed is planted

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[00046] Furthermore, it is preferred that the polymer that is used for the present coating be one having a minimum film-forming temperature (MFT) that is lower than a temperature that would harm the seeds being coated It is preferred that the polymer have a MTF of lower than 55°C, more preferred of lower than 30°C, and even more preferred of lower than 25°C Minimum film-forming temperature can be determined according to ASTM procedure No D-2354 See, *e g*, U S Patent No 6,235,916 B1 In a preferred embodiment, the present method of coating the seed includes exposing the seed to a temperature that is higher than the MTF of the coating polymer in order to obtain an adherent and uniform film having few or no pinholes

[00047] Examples of the types of polymers that can be used in the present invention include water soluble polymers, such as maltodextrins, methylcellulose ethylcellulose, hydroxypropylcellulose, and hydroxypropyl/methylcellulose, and water dispersible polymers, such as vinyl acetate - ethylene polymers, ethylene-vinyl chloride polymers, vinyl acetate polymers, vinyl-acrylic polymers, starch-based polymers (such as SB-2000) polyvinyl acetate -vinyl chloride polymers, vinyl chloride/ vinyl acetate/ ethylene copolymers, and the like

[00048] A polymer that is useful in the present method is SB 2000, a starch-based functional polymer (available from Seedbiotics, Caldwell, ID), which has been reported to reduce imbibitional chilling injury to seeds when used as a seed coating prior to planting (See, *e g*, Taylor, A G, *et al*, Polymer film coatings decrease water uptake and water vapour movement into seeds and reduce imbibitional chilling injury, *British Crop Protection Council Symposium Proceedings* No 76 p 215-220 (2001), and Ni, B-R, pp 73-82, In *British Crop Protection Council Symposium Proceedings*, No 76 (2001))

[00049] Other polymers that are suitable for use in the subject method include polymers that can provide temperature-sensitive water permeability, of the type described in U S Patent Nos 5,120,349, 5,129,180 and 5,387,450

[00050] As described above the thickness of the phytotoxic agent free polymer coating, in combination with the type of polymer that is used, is designed to restrict the contact of the phytotoxic agent with the seed, but to permit a certain level of moisture and oxygen transfer The thickness of the phytotoxic agent-free polymer coating refers to the thickness of the polymer coating after it has been cured or dried to form a film In other words it refers to the thickness of the final coating, rather than to the coating of the polymer-containing solution or emulsion that is applied to the seed

[00051] It has been found that the thickness of the polymer coating in the present invention should be less than about 500 microns It is preferred that the coating thickness is between about 1 micron and about 500 microns, more preferred is between about 1 micron and about 480 microns, yet more preferred is between about 2 microns and about 400 microns, even more preferred is a coating thickness of between about 3 microns and about 300 microns, yet more preferred is between about 5 microns and about 200 microns even more preferred is a coating thickness of between about 8 microns and about 100 microns and yet more preferred is between about 10 microns and about 50 microns

[00052] After a polymer coating has been formed on the seed, the coated seed is then treated with a phytotoxic agent In the present invention, the phytotoxic agent can be any phytotoxic material that is applied to a seed, including, but not limited to pesticides fertilizers, growth factors, dyes, and combinations thereof

[00053] In preferred embodiments, the phytotoxic agent comprises one or more pesticides

[00054] Examples of pesticides that are useful in the present method include herbicides, molluscicides, insecticides, nematocides, acaricides, fungicides, bactericides, and mixtures thereof

[00055] The pesticide can be selected from pyrethrins, synthetic pyrethroids azoles, oxadizine insecticides, neonicotinoids, diazoles, triazoles, strobilurin derivatives, organophosphates, pyrrols, pyrazoles,

phenyl pyrazoles, diacylhydrazines, biological/fermentation products, carbamates, and mixtures thereof

[00056] Examples of the types of materials that are useful as pesticides in the present method include

a a pyrethroid or synthetic pyrethrin Examples of pyrethrins that are useful include 2 allyl-4 hydroxy-3-methyl-2-cyclopenten-1-one ester of 2 2 dimethyl-3 (2 methylpropenyl)-cyclopropane carboxylic acid, (2-methyl-1 propenyl) 2-methoxy-4-oxo-3-(2 propenyl)-2-cyclopenten-1-yl ester and mixtures of cis and trans isomers thereof Examples of pyrethroids that are useful include (s)-cyano(3-phenoxyphenyl)methyl-4-chloro alpha (1 methylethyl)benzeneacetate (fenvalerate, CAS RN 51630-58-1), (S)-cyano (3 phenoxyphenyl)methyl (S)-4-chloro-alpha-(1-methylethyl)benzeneacetate (esfenvalerate, CAS RN 66230-04-4), (3-phenoxyphenyl) methyl(+)cis-trans-3 (2,2-dichoroethenyl) 2,2-dimethylcyclopropanecarboxylate (permethrin, CAS RN 52645-53-1), (±) alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis,trans-3 (2 2-dichloroethenyl)-2,2-dimethyl-cyclopropane carboxylate (cypermethrin, CAS RN 52315-07-8) (beta-cypermethrin, CAS RN 65731-84-2), (theta cypermethrin, CAS RN 71697-59-1), S-cyano (3-phenoxyphenyl)methyl (±) cis/trans 3-(2,2-dichloroethenyl) 2,2 dimethylcyclopropane carboxylate (zeta-cypermethrin, CAS RN 52315-07 8), (s) alpha-cyano-3-phenoxybenzyl (1R,3R)-3-(2 2-dibromovinyl) 2 2-dimethylcyclopropanecarboxylate (deltamethrin, CAS RN 52918-63-5), alpha-cyano-3-phenoxybenzyl 2,2,3,3, tetramethyl cyclopropoanecarboxylate (fenpropathrin, CAS RN 64257-84-7), (RS)-alpha-cyano-3-phenoxybenzyl(R)-2 [2-chloro-4 (trifluoromethyl)anilino]-3-methylbutanoate (tau-fluvalinate, CAS RN 102851-06-9), (2,3,5,6-tetrafluoro-4 methylphenyl)methyl (1 alpha, 3-alpha) (Z)-(±)-3-(2-chloro-3,3,3-trifluoro-1 propenyl)-2,2-dimethylcyclopropanecarboxylate (tefluthrin, CAS RN 79538-32 2), (±)-cyano (3-phenoxyphenyl)methyl (±)-4 (difluoromethoxy)-alpha-(1-methyl ethyl)benzeneacetate (flucythrinate, CAS RN 70124-77 5), cyano(4-fluoro-3-phenoxyphenyl)methyl 3-[2-chloro 2-(4-chlorophenyl)ethenyl] 2,2-dimethylcyclopropanecarboxylate

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(flumethrin, CAS RN 69770-45-2), cyano(4 fluoro-3-phenoxyphenyl) methyl 3 (2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanedarboxylate (cyfluthrin, CAS RN 68359-37-5), (beta cyfluthrin, CAS RN 68359-37-5), (transfluthrin, CAS RN 118712 89-3), (S)-alpha-cyano-3-phenoxybenzyl(Z) (1R cis) 2,2 dimethyl-3-[2 (2,2,2-trifluoro-trifluoromethyl-ethoxycarbonyl)vinyl]cyclopropane carboxylate (acrinathrin, CAS RN 101007-06 1), (1R cis) S and (1S cis) R enantiomer isomer pair of alpha-cyano-3 phenoxybenzyl-3-(2 2-dichlorovinyl) 2,2-dimethylcyclopropane carboxylate (alpha cypermethrin, CAS RN 67375-30-8), [1R,3S)3(1'RS)(1',2',2',2'-tetrabromoethyl)] 2,2-dimethylcyclopropanecarboxylic acid (s)-alpha-cyano-3-phenoxybenzyl ester (tralomethrin, CAS RN 66841-25-6), cyano (3-phenoxyphenyl)methyl 2,2-dichloro-1-(4 ethoxyphenyl)cyclopropane carboxylate (cycloprothrin, CAS RN 63935-38 6), [1α, 3α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl 3-(2-chloro-3 3,3-trifluoro-1-propenyl)-2 2-dimethylcyclopropanecarboxylate (cyhalothrin, CAS RN 68085-85-8), [1-alpha (s), 3-alpha(z)]-cyano(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate (lambda cyhalothrin, CAS RN 91465-08-6), (2-methyl-[1,1' biphenyl]-3-yl)methyl-3-(2 chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-cyclopropanecarboxylate (bifenthrin, CAS RN 82657-04-3), 5-1-benzyl-3 furylmethyl-d-cis(1R,3S E)2,2 dimethyl-3-(2 oxo,-2,2,4,5 tetrahydro thiophenylidenemethyl)cyclopropanecarboxylate (kadethrin, RU15525, CAS RN 58769-20-3), [5 (phenylmethyl)-3 furanyl]-3-furanyl 2,2 dimethyl-3-(2-methyl-1 propenyl)cyclopropane carboxylate (resmethrin, CAS RN 10453 86-8), (1R-trans)-[5-(phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate (bioresmethrin CAS RN 28434-01 7), 3,4,5 6-tetrahydro-phthalimidomethyl-(1RS)-cis trans-chrysanthemate (tetramethrin, CAS RN 7696-12-0), 3 phenoxybenzyl-d,l-cis,trans 2,2-dimethyl-3 (2 methylpropenyl)cyclopropane carboxylate (phenothrin, CAS RN 26002-80 2), (empenthrin, CAS RN 54406-48-3), (cyphenothrin, CAS RN 39515-40-7), (prallethrin, CAS RN 23031-36-9) (imiprothrin, CAS RN

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72963-72-5), (RS)-3-allyl 2-methyl-4-oxcyclopent 2-enyl (1S,3R, 1R,3S)-2,2-dimethyl-3 (2-methylprop-1-enyl)cyclopropanecarboxylate (allethrin, CAS RN 584-79 2), (bioallethrin, CAS RN 584-79 2), and (ZXI8901, CAS RN 160791-64-0) In preferred embodiments the pyrethroid comprises tefluthrin, lambda cyhalothrin, bifenthrin, permethrin, or cyfluthrin

b an oxidiazine insecticide, such as 5-(2-chloropyrid-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 5-(2 chlorothiazol-5-ylmethyl)-3 methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 3-methyl-4-nitroimino-5-(1-oxido-3-pyridinomethyl)perhydro-1,3,5-oxadiazine, 5-(2-chloro-1-oxido-5 pyridiniomethyl)-3-methyl-4 nitroiminoperhydro-1,3,5-oxidiazine, or 3-methyl-5 (2-methylpyrid-5-ylmethyl)-4 nitroiminoperhydro-1,3,5-oxadiazine

c a neonicotinoid Examples of useful neonicotinoid pesticides include thiamethoxam (CAS RN 153719-23-4), acetamiprid ((E) N-[(6-chloro-3 pyridinyl)methyl] N'-cyano-N-methyleneimidamide, CAS RN 135410-20-7), imidacloprid (1 [(6-chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimime, CAS RN 138261-41-3), nitenpyram (N-[(6-chloro-3-pyridinyl)methyl]-N-ethyl-N' methyl-2-nitro-1,1 ethenediamine, CAS RN 120738-89-8), clothianidin (TI-435 (N [(2-chloro 5-thiazoyl)methyl]-N'-methyl-N" nitro,[C(E)]-(9Cl)-guanidine, CAS RN 210880-92-5) In other preferred embodiments, the pesticide comprises a neonicotinoid insecticide such as imidacloprid, thiamethoxam, clothianidin dinotefuran, flonicamid, nithiazine or thiacloprid

d a pyrrol, pyrazole, or phenyl pyrazole, such as chlorfenapyr (4-bromo-2-(4-chlorophenyl) 1 ethoxymethyl 5-trifluoromethylpyrrole-3-carbonitrile, CAS RN 122453-73 0), fenpyroximate ((E)-1,1-dimethylethyl-4[[[[(1,3-dimethyl-5 phenoxy-1H-pyrazole-4-yl)methylene]amino]oxy]methyl]benzoate, CAS RN 111812-58-9) tebufenpyrad (4-chloro-N[[4-1,1-dimethylethyl)phenyl]methyl]-3-ethyl-1-methyl 1H-pyrazole-5-carboxamide, CAS RN 119168-77-3), or fipronil (5-amino-[2,6 dichloro-4-(trifluoromethyl)phenyl]-4-[(1R,S)-(trifluoromethyl)sulfinyl]-1H pyrazole-3-carbonitrile, CAS RN 120068-37-3)

e a diacylhydrazine, such as halofenozide (4-chlorobenzoate-2 benzoyl 2 (1,1-dimethylethyl)-hydrazide, CAS RN 112226-61-6), methoxyfenozide (RH-2485, N tert butyl-N' (3 methoxy-o-toluoyl)-3,5-xylohydrazide, CAS RN 161050-58-4), or tebufenozide (3,5-dimethylbenzoic acid 1-(1,1 dimethylethyl) 2 (4-ethylbenzoyl)hydrazide, CAS RN 112410-23-8)

f a triazole, such as amitrole (CAS RN 61-82 5) and nazamate (ethyl-[[1 [(dimethylamino)carbonyl]-3-(1,1-dimethylethyl)-1H-1,2,4-triazol 5-yl]thio]acetate, CAS RN 112143 82-5)

g a biological/fermentation products selected from the group consisting of avermectin (abamectin, CAS RN 71751-41 2) and spinosad (XDE 105, CAS RN 131929-60-7)

h an organophosphate insecticide selected from the group consisting of acephate (CAS RN 30560-19-1), chlorpyrifos (CAS RN 2921 88-2), chlorpyrifos methyl (CAS RN 5598-13-0), diazinon (CAS RN 333-41-5), fenamiphos (CAS RN 22224-92-6), and malathion (CAS RN 121-75-5)

i a carbamate insecticide selected from the group consisting of aldicarb (CAS RN 116-06-3), carbaryl (CAS RN 63-25-2), carbofuran (CAS RN 1563 66-2), oxamyl (CAS RN 23135-22-0) and thiodicarb (CAS RN 59669-26-0)

j a fungicide, such as a triazole fungicide selected from the group consisting of amitrol azaconazole, bitertanol, bromuconazole, climbazole clotrimazole, cyproconazole diclobutrazol, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, etaconazole, fenbuconazole fluquinconazole, fluotrimazole, flusilazole, flutriafol furconazole, furconazole-cis, hexaconazole, imibenconazole, ipconazole, metconazole myclobutanil, paclobutrazol, penconazole, propiconazole, quinconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triazbutil, triticonazole, 1-(4-fluorophenyl) 2 (1H-1,2,4 triazole-1-yl)ethanone, and mixtures thereof

k a fungicide, such as fluquinconazole simeconazole, tebuconazole, tetraconazole, triticonazole, 1-(4 fluorophenyl)-2-(1H-1,2,4-triazole-1 yl)ethanone, or mixtures thereof In particular, the fungicide can be fluquinconazole, simeconazole, tebuconazole, tetraconazole, triticonazole, or 1 (4 fluorophenyl)-2-(1H-1,2,4-triazole 1 yl)ethanone

l a fungicide, such as a diazole selected from the group consisting of imazalil oxpoconazole, pefurazoate, prochloraz, triflumizole and mixtures thereof

m a strobilurin type fungicide, such as azoxystrobin, dimoxystrobin, famoxadone, kresoxim-methyl, metominostrobin, picoxystrobin, pyraclostrobin, trifloxystrobin, or mixtures thereof

In preferred embodiments, the fungicide can be tebuconazole, simeconazole, fludioxonil, fluquinconazole, difenoconazole, 4,5-dimethyl-N-(2-propenyl)-2-(trimethylsilyl)-3-thiophenecarboxamide (silthiofam), hexaconazole, etaconazole, propiconazole, triticonazole, flutriafol, epoxiconazole, fenbuconazole, bromuconazole, penconazole, imazalil, tetraconazole flusilazole, metconazole, diniconazole, myclobutanil, triadimenol, bitertanol, pyremethanil, cyprodinil, tridemorph, fenpropimorph, kresoxim methyl, azoxystrobin, ZEN90160 fenpiclonil, benalaxyl, furalaxyl, metalaxyl, R-metalaxyl, orfurace, oxadixyl, carboxin, prochloraz, triflumizole, pyrifenox acibenzolar-S methyl, chlorothalonil, cymoaxnil, dimethomorph, famoxadone, quinoxyfen, fenpropidine, spiroxamine, triazoxide, BAS50001F, hymexazole, pencycuron, fenamidone, guazatine, or cyproconazole In more preferred embodiments, the fungicide comprises silthiofam

[00057] When a pesticide is described herein, it is to be understood that the description is intended to include salt forms of the pesticide as well as any isomeric and/or tautomeric form of the pesticide that exhibits the same activity as the form of the pesticide that is described

[00058] The pesticides that are useful in the present method can be of any grade or purity that pass in the trade as such pesticide Other materials that accompany the pesticides in commercial preparations as

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Impurities can be tolerated in the subject methods and compositions, as long as such other materials do not destabilize the composition or significantly reduce or destroy the activity of any of the pesticide components against a target pest(s) One of ordinary skill in the art of the production of pesticides would be able to readily identify those impurities that can be tolerated and those that cannot

[00059] The phytotoxic agents that are useful in the present invention can be provided in solid or liquid form, and can be provided as emulsions, dispersions, solutions, or in particulate form The phytotoxic agents can be alone or can be in combination with other materials, as long as such other materials do not destabilize or significantly reduce or destroy the activity of the agent

[00060] The phytotoxic agent-free polymer coated seed can be treated with the phytotoxic agent such as a pesticide, by any method that is commonly known or used for treating seeds with a pesticide

[00061] When the phytotoxic agent is a pesticide, the amount of the pesticide that is applied to the seed can be any amount, but is preferably between about 0 5 gm of the pesticide active ingredient / 100 kg of seed and about 2 000 gm / 100 kg of seed, more preferably between about 25 gm and about 1,000 gm / 100 kg of seed, and even more preferably between about 100 gm and about 800 gm / 100 kg of seed

[00062] The phytotoxic agent can be applied to the seed in any form and such forms as capsule suspensions (CS), emulsifiable concentrates (EC), emulsions in oil or water (EO and EW), granules (GR),suspension concentrates (SC), soluble granules (SG) soluble concentrates (SL), soluble powders (SP) and water dispersible granules (WG) are suitable It is preferred to apply the agent to the seed in the form of a flowable liquid The agent can be in a true solution in the liquid, or it can be present as small droplets or particles to form a suspension, dispersion or emulsion Since many pesticides have low water solubility, it is preferred that when water is the liquid, an aqueous dispersion, suspension, or emulsion of the pesticide be used, and that the pesticide be present in the dispersion,

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suspension, or emulsion in the form of small particles or droplets As used herein, the term "suspension" will be considered to include any form of liquid containing small particles, and to include the terms dispersion and emulsion

[00063] The particles of pesticide in the liquid suspension can be of any size that permits the suspension to be applied to the seed by any means, such as, for example by spraying It is preferred that the particles of pesticide in the suspension have a number average nominal size of less than about 10 microns more preferably of less than about 5 microns, even more preferably of less than about 2 microns, and even more preferably of less than about 1 micron (be "sub micron" in size) It is believed that the use of such small particles causes the pesticide to form a more stable and homogenous suspension – thereby allowing a more even distribution of the pesticide over the surface of the seed, and that the small particles are less subject to abrasion from the treated seed after the pesticide treatment has been applied

[00064] The phytotoxic agent can be applied to the seed in any type of conventional seed treatment or coating equipment Application in a seed treating machine having the characteristics of a CMS seed coating machine (Vector Corporation, Marion, IA), for example, has been found to be suitable One method that has been found to be successful for applying a phytotoxic agent to seed, is to mill the solid agent to 1 – 2 micron, or to sub-micron, size and then to add the small particles of the agent to water to form an aqueous suspension A mill that is capable of reducing solids to fine particles, such as a Mirco-Jet Pulverizer air mill, available from Fluid Energy Processing and Equipment Company, Hatfield, PA, can be used for the size reduction

[00065] When the phytotoxic agent is a pesticide, the concentration of the pesticide in the suspension should be low enough to permit easy handling and application of the suspension to the coated seed – such as by spraying - and thorough distribution of the pesticide among the coated seeds so that the outer surface of each seed is substantially covered

However, the concentration should be high enough that, when used in combination with the other parameters of seed treatment, to avoid the loss of pesticide from the seeds by dripping or pooling of the treating liquid suspension Pesticide concentrations of between about 0 1% and about 50%, by weight, are useful for such suspensions, preferred are concentrations between about 0 5% and 15%, by weight, even more preferred are concentrations between about 0 6% and about 5%, and yet more preferred are concentrations of the pesticide between about 1% and 3%, by weight of the suspension Sticking agents and dyes can also be added to the pesticide suspension to promote the adherence of the suspension to the coated seeds and to identify the seeds as having been treated

[00066] A desired amount of the suspension of the pesticide can be sprayed onto the seed in, for example, a CMS seed treater, over a period of time that is long enough to permit thorough distribution of the suspension over the seed, but short enough so that the treated seed do not completely dry It is believed that if the treated seed are allowed to remain in a heated seed treater until the suspension is completely dry the danger of loss of the pesticide by abrasion increases By way of example, when the exit temperature of the heated air circulating through the CMS machine is held to about 95 °F, and the aqueous suspension contains about 1 6% by weight imidacloprid and 8% by weight of a sticking agent, an application time of between about 3 minutes and about 20 minutes is suitable, and an application time of between about 5 and about 15 minutes is preferred

[00067] Seeds that have been treated by the subject method can be stored, handled and planted like any other seeds Similar methods and conditions can be used as are used with any other treated, or non-treated seeds and the same handling and planting equipment can be used that is used for conventional seeds

[00068] The coated and treated seeds of the present invention can be overcoated with one or more coatings applied after the seeds have been

treated with the phytotoxic agent These later coatings can contain dyes, binders, absorbents, and other useful materials, and can be applied for the purpose of safety, protection, abrasion resistance, or the like

[00069] The following examples describe preferred embodiments of the invention Other embodiments within the scope of the claims herein will be apparent to one skilled in the art from consideration of the specification or practice of the invention as disclosed herein It is intended that the specification, together with the examples, be considered to be exemplary only, with the scope and spirit of the invention being indicated by the claims which follow the examples In the examples all percentages are given on a weight basis unless otherwise indicated

GENERAL PROCEDURES

Method of coating seed with a polymer

[00070] Seeds were coated with polymers in a CMS Seed Treater model PSC-0 5 In the normal procedure, 750 g of corn seed, or 500g of sorghum seed, was added to the revolving drum of the CMS Treater Water soluble polymers that were to be used for the coating were placed into solution in water Non-water soluble polymers were dispersed into water to form a polymer latex dispersion Polymer solutions and polymer latexes that are obtained directly from a supplier can also be used with or without further modification A measured amount of the polymer solution or latex dispersion was sprayed onto the seeds to provide a polymer coating of the thickness that was desired The polymer coating was dried by hot air blowing through the tumbling seed bed to form a cured polymer coating having a certain pre-determined thickness All machine settings were according to the manufacturer's recommendations and within normal limits as would be understood by one having skill in the art of seed coating

Method of treating seed with a pesticide

[00071] Agrochemical agents, normally a pesticide with a herbicide safener, were applied to polymer-coated seeds in a Hege Model 11 seed treater When a herbicide safener was applied as a part of the seed

treatment regimen, Concep III (having 74 3% fluxofenin as its active ingredient, available from Novartis Crop Protection, Inc , Greensboro, NC) was used

[00072] Seeds to be treated were placed in the bowl of the Hege 11 machine, the Hege motor was turned on and the premixed Concep III and pesticide were applied into the bed of tumbling seed via syringe Mixing was allowed to continue for about 40 sec

Warm germination test:

[00073] This test was used to determine the maximum germination potential of untreated seeds and seeds that were subjected to treatment

[00074] 50 sheets of regular weight, size 12 in X 18 in, germination testing towels were soaked overnight in 840 ml of tap water 50 seeds were placed on a wet sheet using Hoffman Manufacturing germination trays The sheet with seeds was covered with a second towel and rolled up Four replicates were run for each sample

[00075] The rolled towels were placed in an upright position in a 1000 ml beaker which was covered with a polyethylene bag to prevent drying The container was placed in an alternating temperature germination incubator set for providing cycles of 20°C for 16 hrs followed by 30°C for 8 hrs

[00076] Final count of germinated seeds was made after 7 days Percent germination was determined as the average number of seeds which had germinated within the test period minus any abnormal seeds, divided by the total number of original seeds, times 100

Cold germination test

[00077] This test was designed to measure the ability of seeds to germinate under adverse condition associated with high soil moisture, low soil temperature and microbial activity

[00078] A soil mixture was prepared by thoroughly mixing 6 liters of medium grade sand, 6 liter of sifted peat moss, and 1 liter of water One half inch of the soil mixture was placed in the bottom of a tray and leveled One hundred (100) seeds were placed on top of the soil, and an additional

1/2 in of soil is placed over the seeds and leveled Four replicates, each having 100 seeds were run for each sample

[00079] The containers were placed in a cold (10°C) dark room for 7 days After 7 days containers were moved to a warm (25°C) dark room for 3 days Emerging seedlings were evaluated as either normal or abnormal and counted Germination rate was determined as described above

COMPARATIVE EXAMPLE 1

[00080] This example illustrates the properties of coatings of several polymers formed on corn seeds

[00081] Coatings of 21 different polymers and one wax emulsion were formed on corn seeds by the method described above Table 1 lists the different polymers that were tested and describes the chemical makeup of the polymer, the pH of the polymer emulsion, the average particle size of the solids in the emulsion, the glass transition temperature of the polymer (T_g), the minimum film forming temperature of the polymer (MFT), and the type of surfactant (if any) that was provided with the emulsion by the manufacturer It was noticed that the MFT was roughly related to the T_g for the polymers for which this data was available, but that these values did not always correlate precisely

[00082] Table 2 shows the physical properties of coatings on corn seed that were formed from the polymer emulsions described in Table 1 The moisture content of the seeds after treatment (Water %) was reported, and the quality of the film was analyzed according to three parameters

[00083] The integrity of the coating coverage of the seed was estimated by visual inspection (under magnification if needed) Coverage was rated according to the following scale

+++++ = No visual holes are observed

++++ = There are some small holes on the coating and the size of the holes is about 1 mm or above

+++ = 70-95% of the seed surface is covered with the coating

++ = 50-70% of the seed surface is covered with the coating

+ = <50% of the seed surface is covered with the coating

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[00084] The adhesion of the coating to the seed was tested by adhering a piece of Scotch® brand adhesive tape to a part of a seed that was covered by a coating, and then peeling off the tape and determining how much of the coating was removed from the seed The degree of adhesion was described according to the following scale

+++++ = No coating comes off

++++ = 10-20% of the coating from taped area comes off

+++ = 30-50% of the coating from taped area comes off

++ = >50% of the coating from taped area comes off

[00085] The quality of the film (Film) was evaluated by the appearance of the coating on the surface of the seed according to visual inspection (under magnification as needed) The quality was expressed according to the following scale

+++++ = Coherent film having no unfused polymer particles

++++ = Less than 5% of unfused polymer particles

+++ = Unfused polymer particles (20-5%)+ film (80-95%)for the coating covered area

++ = Unfused polymer particles(50-80%) + film (50-20%) for the coating covered area

+ = Unfused polymer particles on the surface of the seed

[00086] In general, coatings that were formed from Polymer 208, Vinamul 6975 Mowilith LDM2110 Mowilith DM778, Premafresh 50-V, Airflex 4514, Flexbond 381 CP620NA S/B Latex, PB 6820 NA S/A Latex, FC 1040 S/B Latex, and CP 6810 NA S/B Latex provided coating properties that were superior to the other polymers tested

EXAMPLE 1

[00087] This example illustrates the coating of sorghum seeds with polyvinylacetate followed by treatment with different levels of imidacloprid and fluxofenin safener

[00088] Sorghum seeds were coated with 10 micron and 50 micron thick coatings of polyvinylacetate (Vinac XX 210, available from Air Products as a 55% d s emulsion in water) and then treated with three

different rates of fluxofenin (Concep III, available from Novartis Crop Protection, Inc) and imidaclopnd (available as Gaucho 600, containing 48 7% imidaclopnd, from Gustafson LLC, Plano, TX) Concep III/ Gaucho rates used were 50 / 250 gram, 100 / 500 gram, and 150 / 750 grams per 100 kg of seeds The germination rate of the seeds was tested by cold germination and warm germination tests on the day that the treatment was administered (T0), and the seeds were then stored at a temperature of 35°C to simulate accelerated aging In the warm germination test, treated seeds and untreated controls were again tested for germination rate after 8 days, (T8), 14 days (T14), 33 days (T33), 120 days (T120), and 161 days (T161) Germination rates obtained from the warm germination test are shown in Figure 1 Germination rates for the cold germination test were determined at approximately the same time intervals and are shown in Figure 2

[00089] Figures 1 and 2 show the effects of time-after-treatment pesticide treatment rate and coating thickness on germination in warm and cold germination tests, respectively It was seen that the presence of pesticide on the seed reduced the germination rate in both warm and cold germ tests, and that without a polymer coating, the reduction in germination rate was more pronounced for cold germination For both warm and cold germination, it was found that increasing pesticide rates markedly reduced the germination rate Seeds having either a 10µ or a 50µ polymer coating prior to pesticide treatment had improved germination rates compared to seeds without any polymer coating Also the germination rate was increased as the coating thickness was increased from 10µ to 50µ.

[00090] In the warm germination test, at the highest level of pesticide treatment, after 14 days of aging at 35°C, seeds having 50µ coatings had a germination rate of 70% vs 40% for uncoated seeds with the same rate of pesticide treatment In the cold germination test for similar seeds and similar conditions, coated seeds showed germination rates of 60% vs 30% for uncoated seeds

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EXAMPLE 2

[00091] This example illustrates the effect of the properties of the polymer coating upon seed germination rate

[00092] Sorghum seeds were first coated as described above with a 5 micron thick coating of different blends of hydroxypropyl cellulose and methyl cellulose, which contained different ratios of hydroxypropyl and methyl groups The polymers used were Methocel E50LV (a 2% w/w solution in water having a viscosity of 40 - 60 mPa at 25°C), Methocel E3LV (a 2% w/w solution in water having a viscosity of 2 4 - 3 6 mPa at 25°C), and Methocel A15LV (a 2% w/w solution in water having a viscosity of 12 - 18 mPa at 25°C) (all available from Dow Chemical Co , Midland, MI, and used as 5% d s emulsions in water) Coated seeds were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed After treatment, untreated and treated seeds were tested for warm germination and cold germination on the same day as the treatment (T0), and again after accelerated aging at 35°C for 7 days, (T7), 14 days (T14) and 33 days (T33) The resulting data are shown in Figure 3 for the warm germination test and in Figure 4 for the cold germination test.

[00093] The data for both warm and cold germination tests show that the presence of the pesticide on uncoated seeds reduces the germination rate significantly compared with seeds having no pesticide treatment At 31 days, for example, the addition of the pesticide causes the warm germination rate to drop from about 86% to about 60%, and the cold germination rate to drop from about 75% to about 49% The addition of any of the three polymer coatings provided significant protection to the seeds The coating comprising Methocel E3 LV performed best, while the coating comprising Methocel A15LV performed next best, and the coating comprising Methocel E50LV performed least well of the three but still provided significant protection over pesticide treated seeds having no polymer coating This order of performance was the same for both the warm germination and the cold germination tests

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[00094] Without being bound by this or any other theory, it is believed that the viscosity of the water solutions of these polymers had an effect on the integrity of the films that were produced on the seeds It appeared that coating solutions having lower viscosities provided coatings that performed better than coating solutions that had higher viscosities

EXAMPLE 3

[00095] This example illustrates the effect of the type of polymer used for the coating and the rate of pesticide application upon seed germination rate

[00096] Sorghum seeds (DK40Y 1752 KXM, from DeKalb Genetics) were coated as described above with a 10 micron thick coating of one of five different polymers Control seeds were prepared without any polymer coating The polymers used were SB-2000 (a proprietary, starch-based polymer available from Seedbiotics, Inc , Caldwell, ID), Vinac XX-210 (polyvinlyacetate in polyvinylalcohol-protected emulsion, available from Air Products and Chemicals Inc , Allentown, PA), Maltrin MO40 (maltodextrin, available from GPC, Inc , Muscatine, IA), Airflex 500 (polyvinylacetate/ethylene copolymer, available from Air Products and Chemicals Inc Allentown PA), and Flexbond 289 (vinylacrylate polymer, available from Air Products and Chemicals, Inc , Allentown, PA) All polymers were used as water emulsions Coated seeds were either left untreated (0x treatment), or were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed (1x treatment) After treatment, untreated and treated seeds were tested for warm germination rate on the same day as the treatment (T0), and again after accelerated aging at 35°C for 7 days, (T7), 15 days (T15) 36 days (T36), 61 days (T61), 93 days (T93, and 124 days (T124) The resulting data are shown in Figure 5

[00097] The data for the warm germination rate test showed that the presence of any of the polymer coatings reduced the germination rate for seeds having no pesticide treatment The reduction was either negligible (less than about 5% below the germination rate for no coating at 124 days, Flexbond 289, Vinac XX 210), moderate (less than about 8% reduction,

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Maltrin MO40), or higher (less than about 10% reduction, SB-2000, Airflex 500) When seeds were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed, the warm germination rate of uncoated seed was reduced from about 87% at 124 days (for non pesticide treated seed) to just under 70% Seeds coated with 10µ coatings of Vinac XX 210 (having an MTF of about 35°C) and Maltrin MO40 had higher germination rates than uncoated seed, indicating that the polymer coating provided protection for the seed Seeds coated with Airflex 500 (MFT of < 0°C) or Flexbond 289 performed at about the same germination level as uncoated seeds Germination rate of seeds coated with 10µ coatings of SB-2000 (having an MFT of about 50°C) was almost 10% lower than uncoated seeds

[00098] This data indicated that different types of polymers differed in their ability to protect seeds from phytotoxicity of overcoated pesticides when applied to the untreated seed as 10µ coatings

EXAMPLE 4

[00099] This illustrates the effect the thickness and the type of polymer used for seed coating on the warm germination rate of seeds to be treated with a pesticide

[000100] Sorghum seeds (DeKalb DK40Y 1752KXM) were coated as described above with 5µ coatings of one of seven different polymers One of the polymers was used to form three additional coatings of increasing thicknesses – 10µ, 20µ, and 50µ) Control seeds were prepared without any polymer coating (control 1) The polymers used (and the coating thickness) were Maltrin MO40 (5µ), Methocel E3LV (5µ), Methocel E50LV (5µ), Methocel A15LV (5µ), Airflex 500 (5µ + 1% talc), Flexbond 289 (5µ), and Vinac XX-210 (at 5µ, 10µ, 20µ, and 50µ) All polymers were used as water emulsions Coated seeds were either left untreated (control 2), or were treated with Concep III / Gaucho 600 at the rate of 50/250 grams per 100 kg of seed After treatment, untreated and treated seeds were tested for warm germination rate on the same day as the treatment (T0), and

again after accelerated aging at 35°C for 7 days, (T7), 14 days (T14), 31 days (T31), 61 days (T61), and 95 days (T95) The resulting data are shown in Figure 6

[000101] The data for the germination rate test showed that after 95 days of aging, the germination rate of uncoated seeds that were treated with pesticide had dropped to almost 24%, vs about 85% for uncoated and untreated seeds All coated/treated seeds having 5µ polymer coatings had higher germination rates at 95 days than uncoated/treated seeds In order of improving germination rate at 95 days were coated/treated seeds having coatings of Vinac XX 210 (28% germination), Methocel E50LV (31%), Flexbond 289 (33%), Maltrin MO40 (41%), Methocel A15LV (44%), Airflex 500 + 1% talc (50%), and Methocel E3LV (64 5%) These data illustrated that different types of polymers provided different levels of protections when used at the same coating thickness In general, it appeared that polymers that provided a coating solution or latex having low viscosity and having a low MFT gave better protection that did polymers having a high solution or latex viscosity and a high MFT

[000102] For seeds that had been treated with different coating thicknesses of Vinac XX 210, germination rates were 28 5% for 5µ, 44 5% for 10µ, 38% for 20µ, and 43% for 50µ. This showed that the beneficial effects of coating thickness did not simply increase with increasing coating thickness, but seemed to reach a peak or maximum where further coating thickness did not result in further improvement of protection.

EXAMPLE 5

[000103] This illustrates the effect the thickness and the type of polymer used for seed coating on the cold germination rate of seeds to be treated with a pesticide

[000104] This test substantially duplicated Example 4, except that a cold germination test was run on the treated seeds to determine the effects of the coatings under adverse germination/sprouting conditions The resulting data are shown in Figure 7

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[000105] Compared with warm germination, the cold germination test resulted in lower overall germination rates at the end of the test (94 days) Germination rate for uncoated/untreated control was about 60% vs 14% for uncoated/treated seeds All coatings, except one, provided protection for the seed and resulted in higher germination rates In order of improved germination rates, the performance was Vinac XX-210 (10% germination), Methocel E50LV (14%), Flexbond 289 (15%), Maltrin MO40 (23 5%), Methocel A15LV (26%), and Methocel E3LV (34 5%) This was the same ranking as found in the warm germination test, and indicated that polymer properties that determined suitability for the present use did not vary disproportionately, as between the polymers tested, over the temperature range spanned by the warm and cold germination tests In other words, polymers that work well at warm temperatures also seem to work well at cold temperatures

[000106] For seeds that had been treated with different coating thicknesses of Vinac XX-210, germination rates were 10% for 5µ, 18% for 10µ, 16% for 20µ, and 22 5% for 50µ As in Example 4, this showed that the beneficial effects of coating thickness did not simply increase with increasing coating thickness, but seemed to reach a plateau where further coating thickness did not result in significant further improvement of protection

[000107] All references cited in this specification, including without limitation all papers, publications, patents, patent applications, presentations texts, reports, manuscripts brochures, books, internet postings, journal articles, periodicals, and the like, are hereby incorporated by reference into this specification in their entireties The discussion of the references herein is intended merely to summarize the assertions made by their authors and no admission is made that any reference constitutes prior art Applicants reserve the right to challenge the accuracy and pertinency of the cited references

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[000108] In view of the above it will be seen that the several advantages of the invention are achieved and other advantageous results obtained

[000109] As various changes could be made in the above methods and compositions without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense

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WHAT IS CLAIMED IS

1 A method of improving the germination rate of plant seeds which are treated with a phytotoxic agent,
the method comprising
forming a polymer coating on the plant seed before treating the seed with the phytotoxic agent, where the coating is free of the phytotoxic agent and where the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination, and
treating the coated plant seed with the phytotoxic agent

2 The method according to claim 1, wherein the coating comprises a polymer in an amount of over 10% by weight

3 The method according to claim 2, wherein the coating comprises a polymer in an amount of at least about 50% by weight

4 The method according to claim 1, wherein the coating thickness is between about 1 micron and about 480 microns

5 The method of claim 1, wherein the polymer is one having a minimum film forming temperature of lower than 55°C

6 The method of claim 5, wherein the polymer comprises a material selected from the group consisting of maltodextrin, methylcellulose, ethylcellulose, hydroxypropylcellulose, hydroxypropyl/methylcellulose, vinyl acetate - ethylene polymers, ethylene-vinyl chloride polymers, vinyl acetate polymers, vinyl-acrylic polymers, starch-based polymers, SB 2000, polyvinyl acetate -vinyl chloride polymers, vinyl chloride/ vinyl acetate/ ethylene copolymers, styrene-acrylate copolymers, vinylacetate polymers, vinylbutyrate polymers, styrene vinylbutyrate copolymers acrylate polymers, styrene-butadiene copolymers, vinylacetate vinylbutyrate copolymers, vinylacetate-vinylversatate copolymers and polyvinylalcohol

7 The method of claim 5, wherein the polymer comprises polyvinylacetate

8 The method of claim 5, wherein the polymer comprises methocel

9 The method of claim 1, wherein the seed is the seed of an agronomic plant which selected from the group consisting of cereals (wheat, barley, rye, oats, rice, sorghum, related crops, etc), beet pear like fruits, stone fruits, and soft fruits (apple, pear, plum, peach, Japanese apricot, prune, almond, cherry, strawberry, raspberry, black berry, tomato, pepper, etc), legumes (kidney bean, lentil, pea, soybean), oil plants (rape, canola, mustard, poppy, olive, sunflower, coconut, castor, cocoa bean, peanut, soybean, corn, etc) Cucurbitaceae (pumpkin, cucumber, melon, etc), citrus (orange, lemon, grape fruit, mandarin, Watson pomelo (citrus natsudaidai), etc), vegetables (lettuce cabbage, celery cabbage, Chinese radish carrot onion potato, etc), camphor trees (avocado, cinnamon, camphor, etc), corn, tobacco, nuts, coffee, sugar cane tea, grapevine, hop and banana.

10 The method of claim 9, wherein the agronomic plant is selected from the group consisting of rice, wheat, barley, rye, corn, potato, carrot, sweet potato, sugar beet, bean, pea, chicory lettuce, cabbage, cauliflower, broccoli, turnip radish, spinach, asparagus, onion, garlic, eggplant, pepper, celery, canot, squash, pumpkin zucchini, cucumber, apple, pear, quince, melon, plum, cherry, peach nectarine, apricot, strawberry, grape, raspberry, blackberry, pineapple, avocado, papaya, mango, banana, soybean, tomato, sorghum and raspbernes, banana and other such edible varieties

11 The method of claim 10, wherein the agronomic plant is selected from corn, soybeans, cotton, sorghum, rape (canola), rice, wheat, barley, and rye

12 The method of claim 10, wherein the agronomic plant is corn, soybeans, or cotton

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13 The method of claim 1, wherein the phytotoxic agent is selected from the group consisting of pesticides, fertilizers, plant growth regulators, drugs dyes, biological attractants scents, pheromones, and mixtures thereof

14 The method of claim 1, wherein the phytotoxic agent comprises a pesticide selected from the group consisting of herbicides molluscicides, insecticides, nematocides, acaricides, fungicides, bactericides, and mixtures thereof

15 The method of claim 14, wherein the pesticide is selected from the group consisting of pyrethrins, synthetic pyrethroids, azoles, oxadizine insecticides, neonicotinoids, diazoles triazoles, strobilurin derivatives, organophosphates, pyrrols, pyrazoles, phenyl pyrazoles, diacylhydrazines, biological/fermentation products, carbamates, and mixtures thereof

16 The method of claim 14, wherein the pesticide comprises an insecticide

17 The method of claim 16 wherein the insecticide comprises a pyrethroid or synthetic pyrethrin

18 The method of claim 17, wherein the pyrethrin comprises a member selected from the group consisting of 2-allyl-4-hydroxy-3 methyl-2-cyclopenten-1-one ester of 2,2-dimethyl-3-(2 methylpropenyl)-cyclopropane carboxylic acid, (2-methyl-1-propenyl)-2-methoxy-4-oxo-3-(2 propenyl)-2-cyclopenten 1-yl ester and mixtures of cis and trans isomers thereof

19 The method of claim 17, wherein the pyrethroid comprises a member selected from the group consisting of (s)-cyano(3-phenoxyphenyl)methyl-4-chloro alpha (1-methylethyl)benzeneacetate (fenvalerate, CAS RN 51630-58-1), (S)-cyano-(3-phenoxyphenyl)methyl (S)-4-chloro alpha-(1-methylethyl)benzeneacetate (esfenvalerate, CAS RN 66230-04-4), (3 phenoxyphenyl) methyl(+)cis-trans-3-(2,2-dichoroethenyl)-2,2-dimethylcyclopropanecarboxylate (permethrin, CAS RN 52645-53-1), (±) alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis,trans-3-(2,2-

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dichloroethenyl) 2,2-dimethyl-cyclopropane carboxylate (cypermethrin, CAS RN 52315 07-8), (beta-cypermethrin, CAS RN 65731-84-2), (theta cypermethrin, CAS RN 71697-59 1), S-cyano (3-phenoxyphenyl)methyl (±) cis/trans 3-(2,2-dichloroethenyl) 2,2 dimethylcyclopropane carboxylate (zeta-cypermethrin, CAS RN 52315-07-8), (s) alpha-cyano-3-phenoxybenzyl (1R,3R)-3 (2,2-dibromovinyl)-2,2 dimethylcyclopropanecarboxylate (deltamethrin, CAS RN 52918-63-5), alpha-cyano-3 phenoxybenzyl 2,2,3,3, tetramethyl cyclopropoanecarboxylate (fenpropathrin, CAS RN 64257-84-7), (RS)-alpha-cyano-3-phenoxybenzyl(R) 2-[2-chloro-4-(trifluoromethyl)anilino]-3-methylbutanoate (tau-fluvalinate CAS RN 102851-06-9), (2,3,5 6-tetrafluoro-4-methylphenyl)methyl-(1-alpha, 3-alpha)-(Z)-(±)-3-(2-chloro-3 3,3 trifluoro 1 propenyl)-2,2-dimethylcyclopropanecarboxylate (tefluthrin, CAS RN 79538-32-2), (±)-cyano (3-phenoxyphenyl)methyl (±)-4-(difluoromethoxy)-alpha (1-methyl ethyl)benzeneacetate (flucythrinate, CAS RN 70124-77-5), cyano(4-fluoro-3-phenoxyphenyl)methyl 3-[2-chloro-2-(4-chlorophenyl)ethenyl]-2,2-dimethylcyclopropanecarboxylate (flumethrin, CAS RN 69770-45-2), cyano(4-fluoro-3-phenoxyphenyl) methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanedarboxylate (cyfluthrin, CAS RN 68359-37-5), (beta cyfluthrin, CAS RN 68359-37-5), (transfluthrin, CAS RN 118712 89-3), (S)-alpha-cyano-3-phenoxybenzyl(Z)-(1R-cis)-2,2-dimethyl-3-[2 (2,2,2-trifluoro trifluoromethyl-ethoxycarbonyl)vinyl]cyclopropane carboxylate (acrinathrin, CAS RN 101007-06 1), (1R cis) S and (1S cis) R enantiomer isomer pair of alpha cyano-3-phenoxybenzyl-3-(2,2-dichlorovinyl) 2,2-dimethylcyclopropane carboxylate (alpha-cypermethrin, CAS RN 67375-30-8), [1R,3S)3(1'RS)(1',2',2',2' tetrabromoethyl)]-2,2-dimethylcyclopropanecarboxylic acid (s)-alpha-cyano-3-phenoxybenzyl ester (tralomethrin CAS RN 66841 25-6), cyano-(3-phenoxyphenyl)methyl 2,2-dichloro-1-(4-ethoxyphenyl)cyclopropane carboxylate (cycloprothrin, CAS RN 63935-38 6), [1α, 3α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl 3-(2-chloro-3,3,3-trifluoro 1 propenyl)-2,2-dimethylcyclopropanecarboxylate

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(cyhalothrin, CAS RN 68085 85-8), [1-alpha (s) 3-alpha(z)]-cyano(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1 propenyl)-2,2-dimethylcyclopropanecarboxylate (lambda cyhalothrin, CAS RN 91465-08-6), (2 methyl [1,1'-biphenyl]-3-yl)methyl-3-(2-chloro-3,3,3 trifluoro-1-propenyl)-2,2 dimethyl-cyclopropanecarboxylate (bifenthrin, CAS RN 82657 04-3), 5-1-benzyl-3-furylmethyl-d-cis(1R,3S,E)2,2-dimethyl-3-(2-oxo,-2,2,4,5 tetrahydro thiophenylidenemethyl)cyclopropanecarboxylate (kadethrin, RU15525, CAS RN 58769 20-3), [5-(phenylmethyl)-3 furanyl]-3-furanyl-2,2-dimethyl-3-(2-methyl 1 propenyl)cyclopropane carboxylate (resmethrin, CAS RN 10453 86 8), (1R-trans) [5-(phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2 methyl-1-propenyl)cyclopropanecarboxylate (bioresmethrin, CAS RN 28434-01-7), 3,4,5,6-tetrahydro phthalimidomethyl (1RS)-cis-trans-chrysanthemate (tetramethrin, CAS RN 7696-12-0), 3 phenoxybenzyl-d,l-cis,trans 2,2-dimethyl-3-(2-methylpropenyl)cyclopropane carboxylate (phenothrin, CAS RN 26002 80-2), (empenthrin, CAS RN 54406-48-3), (cyphenothrin, CAS RN 39515-40-7), (prallethrin, CAS RN 23031-36-9), (imiprothrin, CAS RN 72963-72-5), (RS)-3 allyl-2 methyl-4 oxcyclopent 2-enyl-(1S,3R, 1R 3S)-2,2-dimethyl-3-(2 methylprop-1-enyl)cyclopropanecarboxylate (allethrin, CAS RN 584-79-2), (bioallethrin, CAS RN 584-79-2), and (ZXI8901, CAS RN 160791-64-0)

19 The method of claim 17, wherein the pyrethroid comprises a member selected from the group consisting of tefluthrin, lambda cyhalothrin, bifenthrin, permethrin and cyfluthrin

20 The method of claim 15, wherein the pesticide comprises an oxidiazine insecticide that is selected from the group consisting of 5-(2-chloropyrid-5-ylmethyl)-3-methyl-4-nitroiminoperhydro 1,3,5-oxadiazine, 5-(2-chlorothiazol-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1,3,5-oxadiazine, 3-methyl-4-nitroimino-5-(1-oxido-3-pyridinomethyl)perhydro-1,3,5 oxadiazine, 5-(2-chloro 1-oxido-5 pyridiniomethyl)-3 methyl-4-nitroiminoperhydro-1,3,5-oxidiazine, and 3-methyl-5-(2-methylpynd-5-ylmethyl)-4-nitroiminoperhydro-1,3,5-oxadiazine

21 The method of claim 15, wherein the pesticide comprises a neonicotinoid insecticide that is selected from the group consisting of acetamiprid, imidacloprid thiamethoxam clothianidin, dinotefuran, flonicamid nithiazine, and thiacloprid

22 The method of claim 15, wherein the pesticide comprises a neonicotinoid that is selected from the group consisting of thiamethoxam (CAS RN 153719-23-4) acetamiprid ((E)-N [(6-chloro-3-pyridinyl)methyl]-N'-cyano-N-methyleneimidamide, CAS RN 135410-20-7), imidacloprid (1-[(6-chloro 3 pyridinyl)methyl]-N-nitro-2 imidazolidinimime, CAS RN 138261-41-3), nitenpyram (N-[(6-chloro-3 pyridinyl)methyl]-N-ethyl-N'-methyl-2 nitro-1,1-ethenediamine, CAS RN 120738-89-8), clothianidin (TI-435 (N-[(2-chloro-5 thiazoyl)methyl]-N'-methyl-N"-nitro,[C(E)]-(9Cl)-guanidine, CAS RN 210880-92-5)

23 The method of claim 15, wherein the pesticide comprises a pyrrol, pyrazole, or phenyl pyrazole that is selected from the group consisting ofchlorfenapyr (4-bromo 2 (4-chlorophenyl)-1-ethoxymethyl-5 trifluoromethylpyrrole-3-carbonitrile, CAS RN 122453-73-0), fenpyroximate ((E)-1,1-dimethylethyl-4[[[[(1,3-dimethyl-5-phenoxy-1H-pyrazole-4-yl)methylene]amino]oxy]methyl]benzoate, CAS RN 111812-58-9), tebufenpyrad (4-chloro-N[[4-1,1 dimethylethyl)phenyl]methyl]-3-ethyl-1-methyl-1H-pyrazole 5-carboxamide CAS RN 119168-77-3), and fipronil (5-amino-[2,6-dichloro-4 (trifluoromethyl)phenyl]-4-[(1R,S)-(trifluoromethyl)sulfinyl]-1H-pyrazole-3-carbonitrile, CAS RN 120068-37-3)

24 The method of claim 15, wherein the pesticide comprises a diacylhydrazine that is selected from the group consisting of halofenozide (4-chlorobenzoate 2-benzoyl-2-(1,1 dimethylethyl)-hydrazide, CAS RN 112226 61-6), methoxyfenozide (RH 2485, N tert-butyl-N'-(3-methoxy-o-toluoyl)-3,5-xylohydrazide, CAS RN 161050-58-4), and tebufenozide (3 5 dimethylbenzoic acid 1 (1,1-dimethylethyl)-2 (4-ethylbenzoyl)hydrazide, CAS RN 112410-23-8)

25 The method of claim 15, wherein the pesticide comprises a triazole selected from the group consisting of amitrole (CAS RN 61-82 5)

and nazamate (ethyl-[[1 [(dimethylamino)carbonyl]-3-(1,1-dimethylethyl)-1H-1,2,4 triazol-5-yl]thio]acetate, CAS RN 112143-82-5)

26 The method of claim 15, wherein the pesticide comprises a biological/fermentation products selected from the group consisting of avermectin (abamectin, CAS RN 71751-41-2) and spinosad (XDE-105, CAS RN 131929-60-7)

27 The method of claim 15, wherein the pesticide comprises an organophosphate insecticide selected from the group consisting of acephate (CAS RN 30560-19-1), chlorpyrifos (CAS RN 2921-88-2), chlorpyrifos-methyl (CAS RN 5598-13-0), diazinon (CAS RN 333-41-5), fenamiphos (CAS RN 22224 92-6), and malathion (CAS RN 121-75-5)

28 The method of claim 15 wherein the pesticide comprises a carbamate insecticide selected from the group consisting of aldicarb (CAS RN 116-06-3), carbaryl (CAS RN 63-25-2), carbofuran (CAS RN 1563-66-2), oxamyl (CAS RN 23135 22-0) and thiodicarb (CAS RN 59669-26-0)

29 The method of claim 14, wherein the pesticide comprises a fungicide

30 The method of claim 29, wherein the fungicide comprises a triazole fungicide selected from the group consisting of amitrol, azaconazole, bitertanol, bromuconazole climbazole, clotrimazole, cyproconazole, diclobutrazol, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, etaconazole fenbuconazole, fluquinconazole, fluotrimazole, flusilazole, flutriafol, furconazole, furconazole-cis, hexaconazole, imibenconazole, ipconazole, metconazole myclobutanil, paclobutrazol, penconazole, propiconazole, quinconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triazbutil, triticonazole, 1-(4-fluorophenyl) 2 (1H-1,2,4-triazole-1-yl)ethanone and mixtures thereof

31 The method according to claim 29, wherein the fungicide comprises fluquinconazole, simeconazole, tebuconazole, tetraconazole, triticonazole, 1-(4-fluorophenyl)-2-(1H-1,2,4-triazole-1-yl)ethanone, or mixtures thereof

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32 The method according to claim 29, wherein the fungicide comprises fluquinconazole

33 The method according to claim 29, wherein the fungicide comprises simeconazole

34 The method according to claim 29, wherein the fungicide comprises tebuconazole

35 The method according to claim 29, wherein the fungicide comprises tetraconazole

36 The method according to claim 29, wherein the fungicide comprises triticonazole

37 The method according to claim 29, wherein the fungicide comprises 1 (4 fluorophenyl)-2-(1H-1,2 4-triazole-1-yl)ethanone

38 The method according to claim 29, wherein the fungicide comprises a diazole selected from the group consisting of imazalil, oxpoconazole, pefurazoate, prochloraz, triflumizole, and mixtures thereof

39 The method according to claim 29 wherein the fungicide comprises a strobilurin type fungicide selected from the group consisting of azoxystrobin, dimoxystrobin, famoxadone, kresoxim-methyl, metominostrobin, picoxystrobin, pyraclostrobin, trifloxystrobin, and mixtures thereof

40 The method according to claim 29, wherein the fungicide comprises a member selected from the group consisting of tebuconazole, simeconazole, fludioxonil, fluquinconazole, difenoconazole, 4,5-dimethyl-N-(2 propenyl)-2-(trimethylsilyl)-3-thiophenecarboxamide (silthiofam), hexaconazole, etaconazole, propiconazole triticonazole, flutriafol, epoxiconazole, fenbuconazole, bromuconazole, penconazole, imazalil, tetraconazole, flusilazole, metconazole, diniconazole, myclobutanil, triadimenol, bitertanol, pyremethanil, cyprodinil, tridemorph, fenpropimorph, kresoxim-methyl, azoxystrobin, ZEN90160, fenpiclonil, benalaxyl, furalaxyl, metalaxyl, R-metalaxyl, ofurace, oxadixyl, carboxin, prochloraz, triflumizole, pyrifenox, acibenzolar-S-methyl, chlorothalonil, cymoaxnil, dimethomorph, famoxadone, quinoxyfen, fenpropidine,

spiroxamine, triazoxide, BAS50001F, hymexazole pencycuron, fenamidone, guazatine, and cyproconazole

41 The method according to claim 29 wherein the fungicide comprises silthiofam

42 The method according to claim 29, wherein the pesticide comprises silthiofam and the polymer comprises polyvinylacetate

43 The method according to claim 14 wherein the pesticide comprises silthiofam and the polymer comprises methocel

44 The method according to claim 1 wherein the treatment comprises the steps

a providing a seed,

b contacting the seed with a latex comprising the polymer;

c forming a polymer coating on the seed before treating the seed with a phytotoxic agent, wherein the coating is free of the phytotoxic agent and wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination, and

d contacting the polymer coated seed with the phytotoxic agent

45 The method according to claim 44, wherein the polymer coating is applied so that it directly contacts the seed without intervening material between the coating and the seed

46 Phytotoxic agent treated plant seed having an improved germination rate, each seed comprising a plant seed having a phytotoxic agent deposited thereupon, and having a polymer coating which is free of the phytotoxic agent located between the seed and the phytotoxic agent, wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental

conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination

47 A plant that is grown from a seed that is treated by the method according to claim 1

48 A method of producing an agronomic crop, the method comprising the steps

a providing plant seeds of the agronomic crop that have been treated by the method according to claim 1,

b planting the seeds and

c cultivating the planted seeds and plants that sprout from the seeds

ABSTRACT

A method of improving germination rate in pesticide-treated plant seeds involves forming a pesticide-free polymer coating on a plant seed before treating the seed with a pesticide, where the type of polymer and the coating thickness are designed to block phytotoxic contact of the pesticide with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination, and then treating the coated plant seed with a pesticide Seeds that have been treated by this method, and plants that are grown from the treated seeds are also described

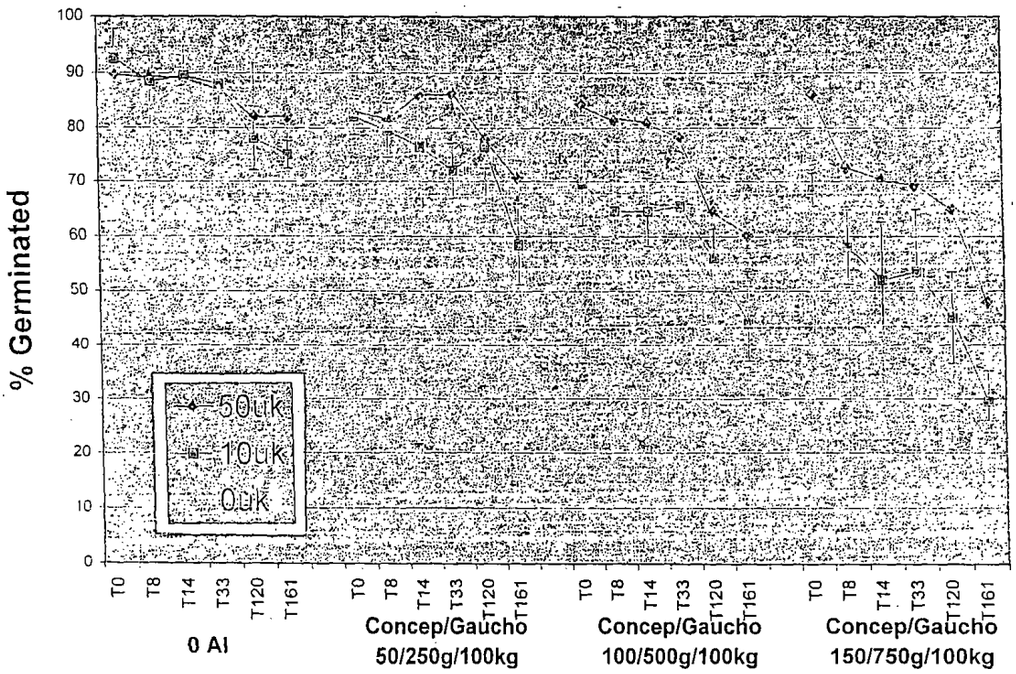

% Germinated
100
90
80
70
60
50
40
30
20
10
0
50uk
10uk
0uk
T0
T8
T14
T33
T120
T161
0 AI
Concep/Gaucho
50/250g/100kg
Concep/Gaucho
100/500g/100kg
Concep/Gaucho
150/750g/100kg

FIGURE 1.

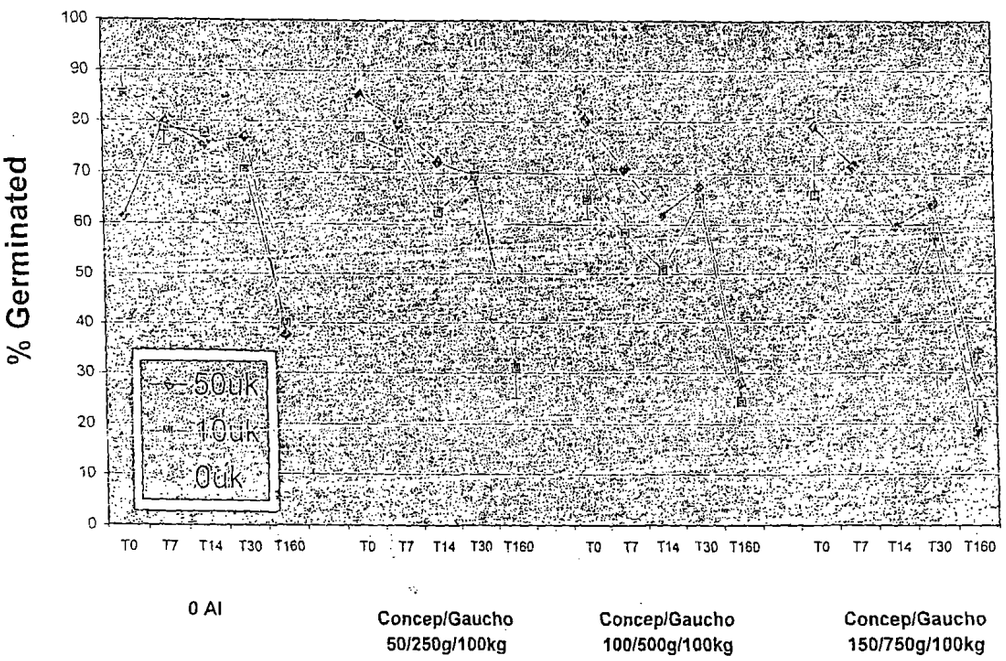

% Germinated
100
90
80
70
60
50
40
30
20
10
0
50uk
10uk
0uk
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
T0 T7 T14 T30 T160
0 AI
Concep/Gaucho 50/250g/100kg
Concep/Gaucho 100/500g/100kg
Concep/Gaucho 150/750g/100kg

FIGURE 2.

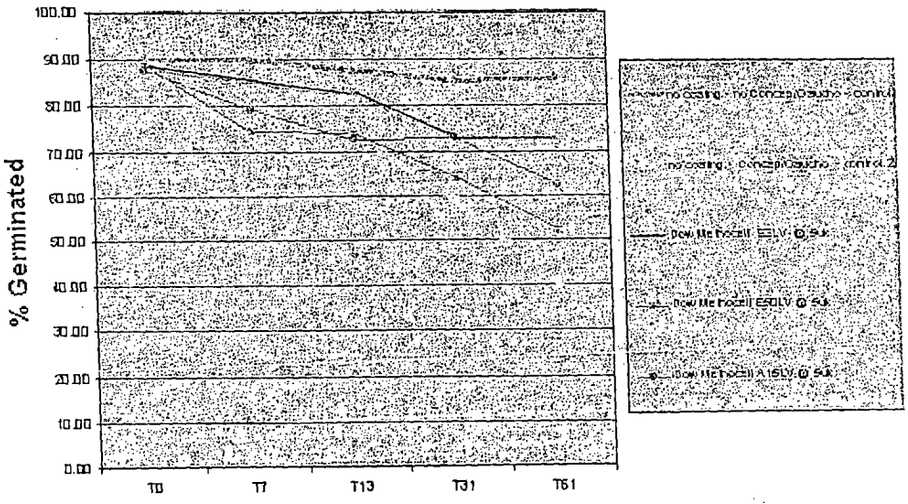

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50.00
40.00
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% Germinated
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T13
T31
T61

FIGURE 3.

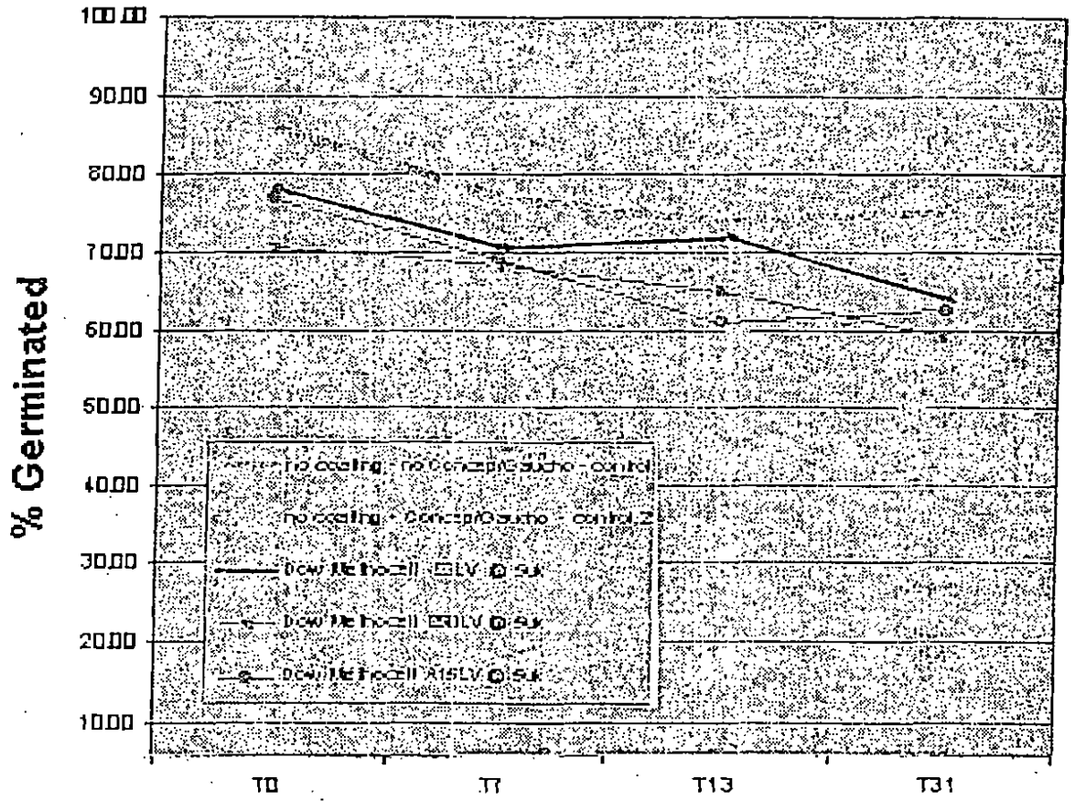

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T31

FIGURE 4.

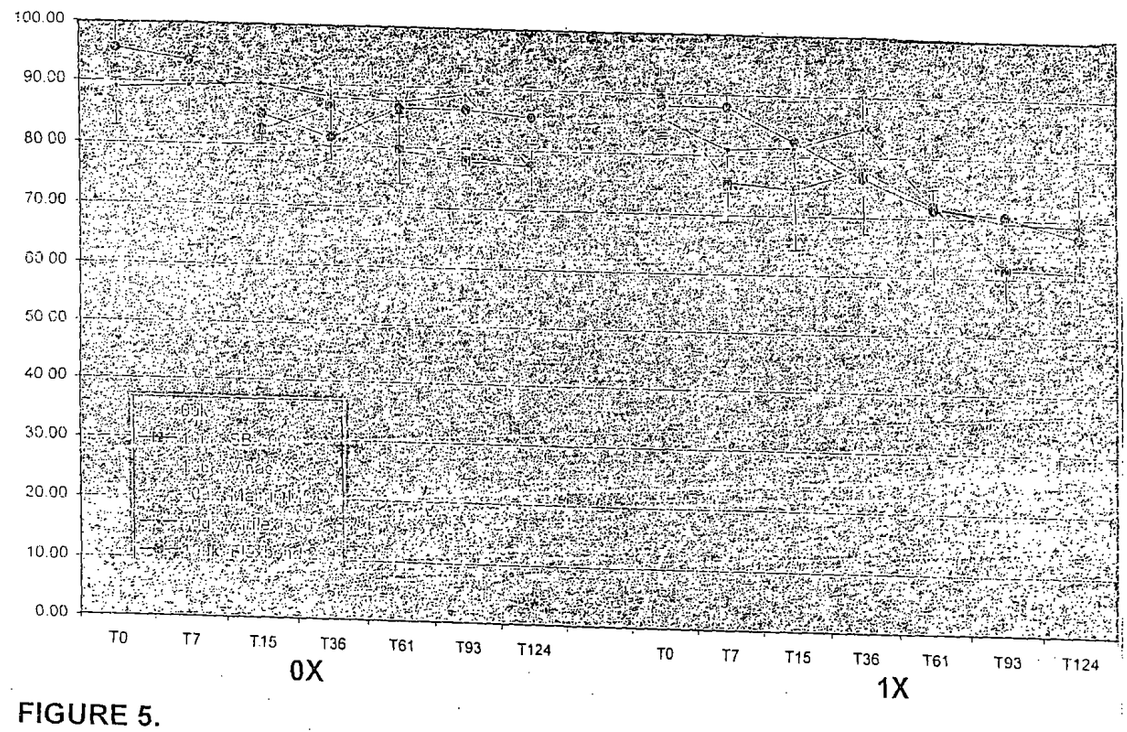

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T15
T36
T61
T93
T124
0X
T0
T7
T15
T36
T61
T93
T124
1X

FIGURE 5.

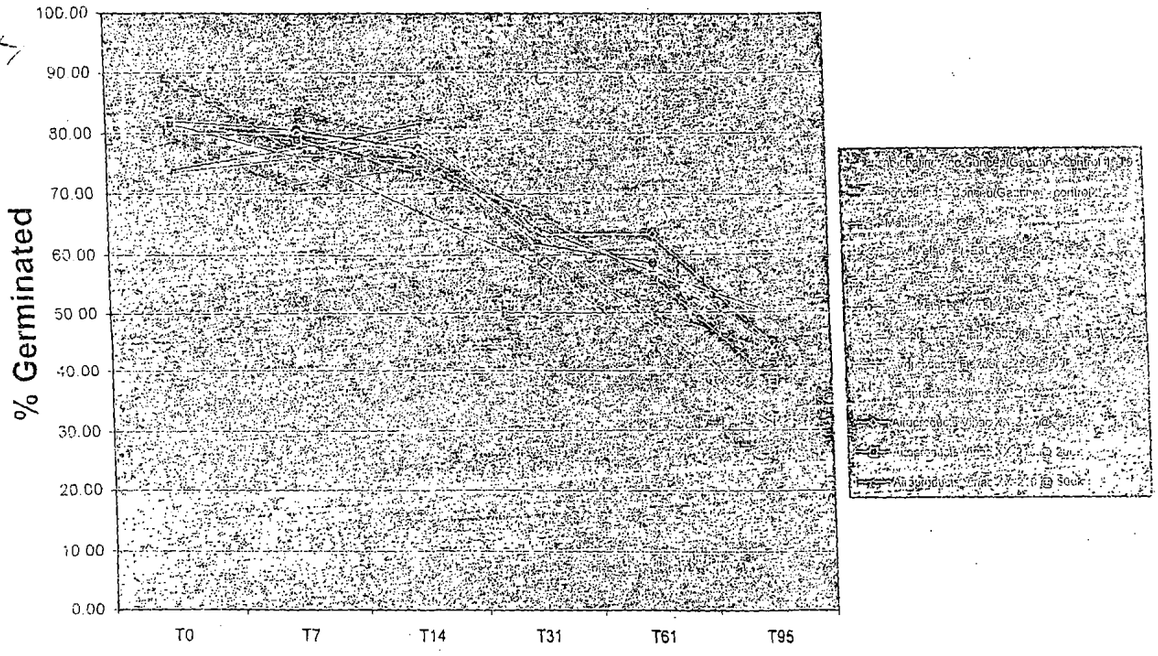

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% Germinated
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T14
T31
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T95

FIGURE 6.

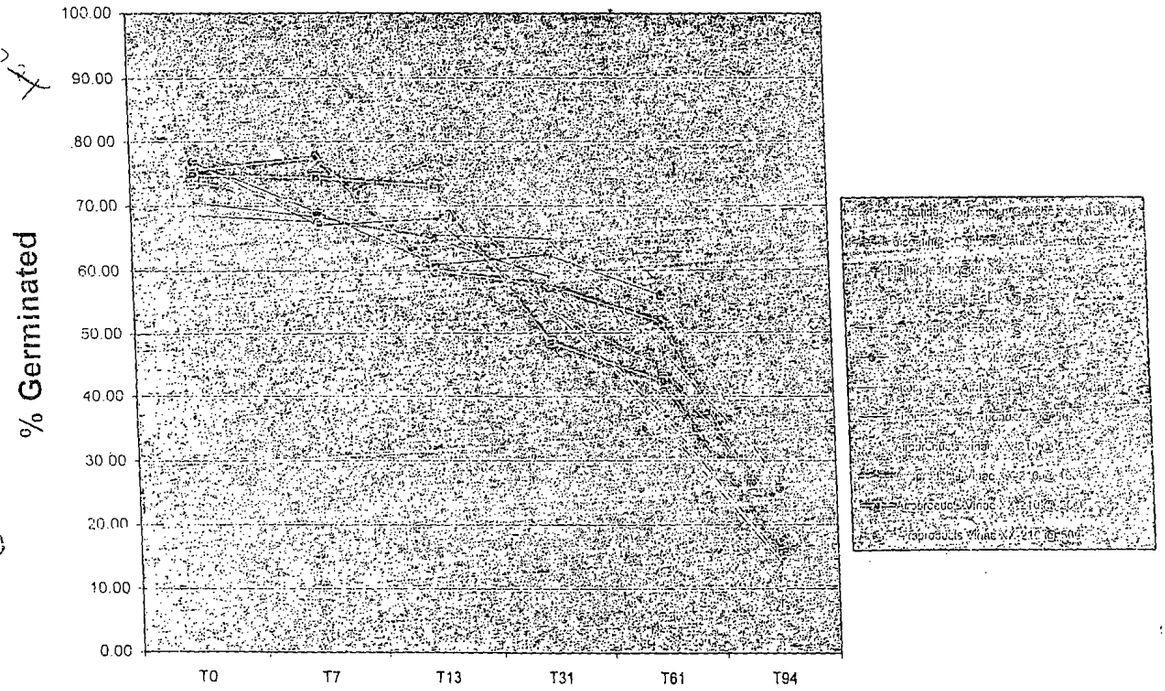

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T31
T61
T94

FIGURE 7.

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The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below.

IPEA/ EP

7/19/2004 J
FAX: 1) C Lewis J
Russell
Mullins
(17396/
09181 PCT
2) GAB

PCT

DEMAND

under Article 31 of the Patent Cooperation Treaty

CHAPTER II

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty

RECEIVED

JUL 20 2004

NELSON MULLINS
COLUMBIA OFFICE

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference: 51-21(52837)

International application No.	International filing date (day/month/year)	(Earliest) Priority date (day/month/year)
PCT/US03/36178	14 November 2003	3 December 2002

Title of invention: Method of protecting seeds treated with a phytotoxic agent

Box No. II APPLICANT(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)

Monsanto Technology LLC
800 North Lindbergh Boulevard
St Louis, MO 63167
United States of America

Telephone No.: 314 694 1000
Facsimile No.: 314 694 9058
Teleprinter No.:
Applicant's registration No. with the Office:

State (that is, country) of nationality: US
State (that is, country) of residence: US

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)

ASRAR, Jawed
14949 Royal Brook
Chesterfield MO 63017
United States of America

State (that is, country) of nationality: US
State (that is, country) of residence: US

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)

BEKKER, Vladimir O
32 Forsythia Lane
Olivette MO 63132
United States of America

JUL 19 2004

State (that is, country) of nationality: US
State (that is, country) of residence: US

☒ Further applicants are indicated on a continuation sheet.

Form PCT/IPEA/401 (first sheet) (January 2004) — See Notes to the demand form

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Sheet No. 2

International application No.
PCT/US03/36178

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

DING Yiwei
423 Castle Pines Court
Ballwin MO 63021
United States of America

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
US	US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

☐ Further applicants are indicated on another continuation sheet.

Form PCT/IPEA/401 (continuation sheet) (January 2004) *See Notes to the demand form*

International application No
PCT/US03/36178

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Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative

and ☐ has been appointed earlier and represents the applicant(s) also for international preliminary examination.

☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

☒ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BOSCH Henry
Monsanto Services International
270-272 avenue de Tervuren
1150 Brussels
Belgium

Telephone No.
32 2 776 7602

Facsimile No.
32 2 776 7644

Teleprinter No.

Agent's registration No. with the Office

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments*

1 The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed

the description:
☐ as originally filed
☐ as amended under Article 34

the claims:
☐ as originally filed
☐ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34

the drawings:
☐ as originally filed
☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of the applicable time limit under Rule 69.1(d).

4. ☐ The applicant expressly wishes the international preliminary examination to start earlier than at the expiration of the applicable time limit under Rule 54bis.1(a).

Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.

☐ which is the language of a translation furnished for the purposes of international search.

☐ which is the language of publication of the international application.

☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

See Notes to the demand form

HP 188

Sheet No. 4

International application No.
PCT/US03/36178

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV for the purposes of international preliminary examination.		For International Preliminary Examining Authority use only: received	not received
1 translation of international application	sheets	☐	☐
2. amendments under Article 34	sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	sheets	☐	☐
4. copy (or where required, translation) of statement under Article 19	sheets	☐	☐
5 letter	sheets	☐	☐
6. other *(specify)*	sheets	☐	☐

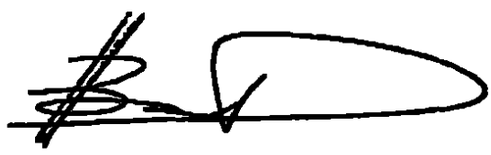
The demand is also accompanied by the item(s) marked below:

1 ☒ fee calculation sheet
2. ☐ original separate power of attorney
3 ☐ original general power of attorney
4. ☒ copy of general power of attorney; reference number, if any:
5 ☐ statement explaining lack of signature
6. ☐ sequence listing in computer readable form
7 ☐ tables in computer readable form related to a sequence listing
8. ☐ other *(specify)*:

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

BOSCH Henry



For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5 below does not apply.
   ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the time limit of 19 months from the priority date as extended by virtue of Rule 80.5
5 ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.
6. ☐ The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54*bis* 1(a) and item 7 or 8, below does not apply.
7 ☐ The date of receipt of the demand is WITHIN the time limit under Rule 54*bis* 1(a) as extended by virtue of Rule 80.5.
8. ☐ Although the date of receipt of the demand is after the expiration of the time limit under Rule 54*bis*.1(a), the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

Form PCT/IPEA/401 (last sheet) (January 2004)

See Notes to the demand form

CHAPTER II

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. PCT/US03/36178	For International Preliminary Examining Authority use only
Applicant's or agent's file reference 61-21(52837)	Date stamp of the IPEA

Applicant
Monsanto Technology LLC

CALCULATION OF PRESCRIBED FEES

1	Preliminary examination fee	€1530 P	
2	Handling fee (Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)	€159 H	
3.	Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	€1689 TOTAL	

MODE OF PAYMENT

☒	authorization to charge deposit account with the IPEA (see below)	☐	cash
☐	cheque	☐	revenue stamps
☐	postal money order	☐	coupons
☐	bank draft	☐	other (specify)

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT

(This mode of payment may not be available at all IPEAs)

IPEA/ EP

☒ Authorization to charge the total fees indicated above.

Deposit Account No.: 2802 0036

☒ *(This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)* Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.

Date: 1 July 2004

Name: Henry BOSCH

Signature:

PATENT COOPERATION TREATY

19 JUL 2004

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

RECEIVED

AUG 06 2004

NELSON MULLINS
COLUMBIA OFFICE

To:
Bosch, Henry
MONSANTO SERVICES INTERNATIONAL
Avenue de Tervuren 270-272
1150 Brussels
BELGIQUE

FAX: (17396/09181 PCT)

NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(c) and 61 1(b), first sentence, and Administrative Instructions, Section 602)

Applicant's or agent's file reference: 51-21(52837)	Date of mailing (day/month/year): 14-07-2004
	IMPORTANT NOTIFICATION

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/US03/36178	14/11/2003	03/12/2002

Applicant:
MONSANTO TECHNOLOGY LLC ET AL

1 The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application.

02/07/2004

2. This date of receipt is: AUG 5 2004

- [X] the actual date of receipt of the demand by this Authority (Rule 61 1(b)).
- [ ] the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(d)).
- [ ] the date on which this Authority has in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3 [ ] ATTENTION: That date of receipt is after the expiration of 19 months from the priority date. Consequently in respect of some Offices, the demand does not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)) and the acts for entry into the national phase must therefore be performed within 20 months from the priority date (or later in some Offices). However in respect of some other Offices, the time limit of 30 months (or later) may nevertheless apply. See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

[ ] *(If applicable)* This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0 Tx: 523656 epmu d Fax: (+49-89) 2399-4465	VON KEMPIS B G M Tel. (+49-89) 2399-8577

Form PCT/IPEA/402 (April 2002 reprint January 2004) (09/07/2004)

Office européen des brevets · Europäisches Patentamt · European Patent Office

UNITED STATES PATENT AND TRADEMARK OFFICE

197 191

17396109058

JULY 09 2003

PTAS

NELSON MULLINS RILEY & SCARBOROUGH
CHARLES E DUNLAP
1330 LADY STREET
KEENAN BUILDING THIRD FLOOR
COLUMBIA, SC 29201

Under Secretary of Commerce For Intellectual Property and
Director of the United States Patent and Trademark Office
Washington DC 20231
www.uspto.gov

102375253A

UNITED STATES PATENT AND TRADEMARK OFFICE
NOTICE OF RECORDATION OF ASSIGNMENT DOCUMENT

THE ENCLOSED DOCUMENT HAS BEEN RECORDED BY THE ASSIGNMENT DIVISION OF THE U S PATENT AND TRADEMARK OFFICE A COMPLETE MICROFILM COPY IS AVAILABLE AT THE ASSIGNMENT SEARCH ROOM ON THE REEL AND FRAME NUMBER REFERENCED BELOW

PLEASE REVIEW ALL INFORMATION CONTAINED ON THIS NOTICE THE INFORMATION CONTAINED ON THIS RECORDATION NOTICE REFLECTS THE DATA PRESENT IN THE PATENT AND TRADEMARK ASSIGNMENT SYSTEM IF YOU SHOULD FIND ANY ERRORS OR HAVE QUESTIONS CONCERNING THIS NOTICE YOU MAY CONTACT THE EMPLOYEE WHOSE NAME APPEARS ON THIS NOTICE AT 703-308-9723
PLEASE SEND REQUEST FOR CORRECTION TO U S PATENT AND TRADEMARK OFFICE ASSIGNMENT DIVISION, BOX ASSIGNMENTS CG-4 1213 JEFFERSON DAVIS HWY SUITE 320 WASHINGTON D C 20231

RECORDATION DATE 02/24/2003

REEL/FRAME 013781/0326
NUMBER OF PAGES 6

BRIEF ASSIGNMENT OF ASSIGNOR S INTEREST (SEE DOCUMENT FOR DETAILS)

ASSIGNOR
ASRAR JAWED

DOC DATE 10/04/2002

ASSIGNOR
BEKKER VLADIMIR O

DOC DATE 10/04/2002

ASSIGNOR
DING YIWEI

DOC DATE 10/04/2002

ASSIGNEE
MONSANTO TECHNOLOGY LLC
800 NORTH LINDBERGH BOULEVARD
ST LOUIS, MISSOURI 63167

SERIAL NUMBER 60430572
PATENT NUMBER

FILING DATE 12/03/2002
ISSUE DATE

RECEIVED
JUL 14 2003
NELSON MULLINS
COLUMBIA OFFICE

SHAREILL COLES EXAMINER
ASSIGNMENT DIVISION
OFFICE OF PUBLIC RECORDS

2-24-03

Practitioner's Docket No. 17396/09058 (52837)

PATENT

02-27-2003

IN THE UNITED STATES PAT

102375253

Box Assignments
Commissioner of Patents and Trademarks
Washington, D C 20231

ASSIGNMENT (DOCUMENT) COVER SHEET (37 C.F.R. § 3.31)

Attached please find an assignment (document) for recordal.

IDENTIFICATION OF APPLICATION(S) AND/OR PATENT(S) FOR ASSIGNMENT (DOCUMENT) RECORDAL (37 C.F.R. § 3.21 and 37 C.F.R. § 3.31(a)(4))

1 This assignment is for the following patent application and/or issued patent:

a. Provisional application. 60/430,572, filed on December 3 2002

FINANCE SECTION
2003 FEB 24 AM 9 40
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MAIL ROOM

TOTAL NUMBER OF APPLICATIONS AND/OR PATENTS AND TOTAL FEE

2. A. The total number of applications and/or patents identified in this cover sheet is

B The total fee is (37 C.F.R. Section 1.21(h))*

1 x $40 00 = $40 00

CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1 10*

(When using Express Mail, the Express Mail label number is mandatory, Express Mail certification is optional.)

I hereby certify that, on the date shown below this correspondence is being

MAILING

☒ deposited with the United States Postal Service in an envelope addressed to the Commissioner for Patents, Washington D.C. 20231
37 C.F.R. § 1.8(a)
☐ with sufficient postage as first class mail.
37 C.F.R. § 1.10*
☐ as "Express Mail Post Office to Addressee"
Mailing Label No _____ (mandatory)

TRANSMISSION

☐ facsimile transmitted to the Patent and Trademark Office, (703) _____

Anna A Von
Signature

02/25/2003 [illegible]
01 FC:[illegible] 40.00 [illegible]

Anna A. Von
(type or print name of person certifying)

*Only the date of filing (§ 1 6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1.8 continues to be taken into account in determining timeliness. See § 1 703(f). Consider "Express Mail Post Office to Addressee" (§ 1 10) or facsimile transmission (§ 1 6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.

X 199

C Payment of fee is made by

Attached is check # 22509 in the amount of $40 00

Charge any additional fees required by this paper or credit any overpayment to deposit account # 50-2548

A duplicate of this paper is attached.

NAME OF PARTIES CONVEYING INTEREST
(37 C.F.R. § 3.31(a)(1))

3 The parties conveying interest are

Jawed Asrar
Vladimir O Bekker
Yiwei Ding

NAME AND ADDRESS OF PARTY(IES) RECEIVING INTEREST
(37 C.F.R. § (a)(2))

4 The rights are being conveyed to

Monsanto Technology, LLC
800 North Lindbergh Boulevard
St. Louis, MO 63167

DESCRIPTION OF INTEREST CONVEYED OR TRANSACTION RECORDED (37 C.F.R. § 3.31(a)(3))

5 The accompanying document intends to accomplish an assignment.

NAME AND ADDRESS OF PARTY TO WHOM CORRESPONDENCE SHOULD BE MAILED (37 C.F.R. § 3.31 (a)(5))

6 Please address correspondence to

Name	Charles E Dunlap
Address	Nelson Mullins Riley & Scarborough
	Keenan Building, Third Floor
	1330 Lady Street
	Columbia, SC 29201
Telephone No	864-250-2238

145

DATE ASSIGNMENT (DOCUMENT) EXECUTED
(37 C.F R. § 3.31(a)(7))

7 The attached assignment (document) was executed by Jawed Asrar, Vladimir O Bekker and Yiwei Ding on October 4, 2002

LANGUAGE OF ASSIGNMENT (DOCUMENT) TO BE RECORDED

8 The attached document is in the English language

ORIGINAL DOCUMENT OR TRUE COPY SUBMITTED

9 Submitted herewith is the original document.

STATEMENT (37 C.F.R. § 3.31(a)(9)) AND
SIGNATURE (37 C.F.R. § 3.31(a)(10))

10 To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Feb. 18, 2003
Date

Charles E. Dunlap
Nelson Mullins Riley & Scarborough
Keenan Building, Third Floor
1330 Lady Street
Columbia, SC 29201

TOTAL NUMBER OF PAGES BEING SUBMITTED

11 The total number of pages being submitted, including documents is. 6

L96

ATTORNEY DOCKET 17396/09058
51-21 (52837)

ASSIGNMENT

WHEREAS I the undersigned have made certain invention or inventions which are disclosed in patent application(s) and/or provisional patent application(s) entitled

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

the specification of which is being filed herewith as a provisional application that is identified as practitioner's Docket No 17396/09058

WHEREAS MONSANTO TECHNOLOGY LLC, having its address at 800 North Lindbergh Blvd St Louis Missouri 63167 U S.A. a Corporation of the State of Delaware is desirous of acquiring the entire right, title and interest in and to said invention or inventions and any and all patents to be obtained therefor

NOW THEREFORE FOR GOOD AND VALUABLE CONSIDERATION the receipt of which is hereby acknowledged I do hereby sell assign and transfer to said MONSANTO TECHNOLOGY LLC its successors and assigns, the entire right title and interest in and to said invention or inventions in any form or embodiment thereof and in and to said application(s), and in and to any and all applications filed in any country based thereon, including the right to file application in countries other than the country of priority filing under the provisions of any international convention also in and to any and all improvements on said invention or inventions now or hereafter made by me/us as employee(s) agent(s) or contractor(s) of said MONSANTO TECHNOLOGY LLC, also the entire right, title and interest in and to any and all patents including reissues and extensions thereof to be obtained in any country upon said invention inventions or improvements and any and all continuing applications, including divisional continuation and continuation-in-part applications substitute applications, and applications claiming benefit of an earlier filed provisional application which may be filed upon said invention, inventions or improvements in any country and

I hereby authorize and request the issuing authority to issue any and all patents on said application or applications to said MONSANTO TECHNOLOGY LLC as assignee of the entire interest.

I further agree without any payment by MONSANTO TECHNOLOGY LLC, other than in reimbursement of reasonable expenses I may incur to communicate to said MONSANTO TECHNOLOGY LLC its representatives or agents any facts relating to said invention inventions or improvements, including evidence for purposes of interference, opposition or other legal proceedings whenever requested testify in any interference opposition or other legal proceedings whenever requested and execute and deliver, on request all lawful papers required to make any of the foregoing provisions effective

IN TESTIMONY WHEREOF I have hereto set my hand on the date set after my signature

Signature Jawed Asrar Date 10/4/02

Name Jawed Asrar

Residence 14949 Royal Brook, Chesterfield, MO 63017

State of Missouri)
County of St Louis)

On this 4th day of October, 2002 before me personally appeared Jawed Asrar to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed In testimony whereof I have hereto set my hand and official seal on the day last above-written

Carol D Stemmler
Notary Public

My Commission expires July 16 2005

CAROL D. STEMMLER
Notary Public-Notary Seal
State of Missouri
St Louis County
My Commission Expires Jul 16 2005

IN TESTIMONY WHEREOF I have hereto set my hand on the date set after my signature

Signature Vladimir O Bekker Date 10/04/2002

Name Vladimir O Bekker

Residence 32 Forsythia Lane, Olivette, MO 63132

State of Missouri)
County of St Louis)

On this 4th day of October, 2002 before me personally appeared Vladimir O Bekker to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed In testimony whereof I have hereto set my hand and official seal on the day last above-written

Carol D Stemmler
Notary Public

My Commission expires July 16, 2005

CAROL D STEMMLER
Notary Public-Notary Seal
State of Missouri
St Louis County
My Commission Expires Jul 16 2005

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IN TESTIMONY WHEREOF, I have hereto set my hand on the date set after my signature

Signature _____ Date 10/04/02

Name Yiwei Ding

Residence 423 Castle Pines Court, MO 63021

State of Missouri)
County of St-louis)

On this 4th day of October, 2002 before me personally appeared Yiwei Ding, to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed in testimony whereof I have hereto set my hand and official seal on the day last above-written

Carol D Stemmler
Notary Public

CAROL D. STEMMLER
Notary Public-Notary Seal
State of Missouri
St Louis County
My Commission Expires Jul 16, 2006

Practitioner's Docket No. 17396/09058 (52837) PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Assignments
Commissioner of Patents and Trademarks
Washington, D C 20231

ASSIGNMENT (DOCUMENT) COVER SHEET (37 C F.R. § 3.31)

Attached please find an assignment (document) for recordal.

IDENTIFICATION OF APPLICATION(S) AND/OR PATENT(S)
FOR ASSIGNMENT (DOCUMENT) RECORDAL
(37 C.F.R. § 3.21 and 37 C.F.R. § 3.31(a)(4))

1 This assignment is for the following patent application and/or issued patent:

a. Provisional application 60/430 572, filed on December 3 2002

TOTAL NUMBER OF APPLICATIONS AND/OR PATENTS
AND TOTAL FEE

2 A. The total number of applications and/or patents identified in this cover sheet is 1

B. The total fee is (37 C.F.R. Section 1.21(h))

1 x $40 00 = $40 00

CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1.10*
*(When using Express Mail, the Express Mail label number is mandatory,
Express Mail certification is optional.)*

I hereby certify that, on the date shown below, this correspondence is being:

MAILING

☒ deposited with the United States Postal Service in an envelope addressed to the Commissioner for Patents, Washington D.C. 20231
37 C.F.R. § 1.8(a)
☒ with sufficient postage as first class mail.

☐ as "Express Mail Post Office to Addressee"
37 C.F.R. § 1.10*
Mailing Label No _____ (mandatory)

TRANSMISSION

☐ facsimile transmitted to the Patent and Trademark Office, (703) _____

Signature

Date: February 18, 2003

Anna A. Von
(type or print name of person certifying)

** Only the date of filing (§ 1 6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1 8 continues to be taken into account in determining timeliness. See § 1 703(f). Consider Express Mail Post Office to Addressee (§ 1 10) or facsimile transmission (§ 1 6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.*

C. Payment of fee is made by

Attached is check # 22509 in the amount of $40 00

Charge any additional fees required by this paper or credit any overpayment to deposit account # 50-2548

A duplicate of this paper is attached

NAME OF PARTIES CONVEYING INTEREST
(37 C.F.R. § 3.31(a)(1))

3 The parties conveying interest are

Jawed Asrar
Vladimir O Bekker
Yiwei Ding

NAME AND ADDRESS OF PARTY(IES) RECEIVING INTEREST
(37 C.F.R. § (a)(2))

4 The rights are being conveyed to

Monsanto Technology, LLC
800 North Lindbergh Boulevard
St. Louis, MO 63167

DESCRIPTION OF INTEREST CONVEYED OR TRANSACTION RECORDED (37 C.F.R. § 3.31(a)(3))

5 The accompanying document intends to accomplish an assignment.

NAME AND ADDRESS OF PARTY TO WHOM CORRESPONDENCE SHOULD BE MAILED (37 C.F.R. § 3.31 (a)(5))

6 Please address correspondence to

Name:	Charles E. Dunlap
Address	Nelson Mullins Riley & Scarborough
	Keenan Building, Third Floor
	1330 Lady Street
	Columbia, SC 29201
Telephone No	864-250-2238

DATE ASSIGNMENT (DOCUMENT) EXECUTED
(37 C.F R. § 3.31(a)(7))

7 The attached assignment (document) was executed by Jawed Asrar, Vladimir O Bekker, and Yiwei Ding on October 4 2002

LANGUAGE OF ASSIGNMENT (DOCUMENT) TO BE RECORDED

8 The attached document is in the English language.

ORIGINAL DOCUMENT OR TRUE COPY SUBMITTED

9 Submitted herewith is the original document.

STATEMENT (37 C.F.R. § 3.31(a)(9)) AND
SIGNATURE (37 C.F.R. § 3.31(a)(10))

10 To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Feb 18, 2003
Date

Charles E Dunlap
Nelson Mullins Riley & Scarborough
Keenan Building, Third Floor
1330 Lady Street
Columbia, SC 29201

TOTAL NUMBER OF PAGES BEING SUBMITTED

11 The total number of pages being submitted, including documents is 6.

Practitioner's Docket No. 17396/09058 (51-21(52837))

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Jawed Asrar Vladimir O Bekker and Yiwei Ding

Application No. 60/430,572 Group No _____
Filed 12/03/2002 Examiner _____
For: Method of Protecting Seeds Treated with a Phytotoxic Agent

Box Assignment
Commissioner for Patents
Washington, D C 20231

CERTIFICATE OF MAILING UNDER 37 C F R. § 1.8(a)

I hereby certify that the attached correspondence comprising

1 Fee Transmittal Sheet (1 page)
2 Assignment (Document) Cover Sheet with duplicate (3 pages each)
3 Assignment (Document) (3 pages)
4 Check No 22509 for $40 00 (1 page)
5 Return Postcard (1 page)

is being deposited with the United States Postal Service, with sufficient postage, as first class mail in an envelope addressed to

Box Assignment
Commissioner for Patents
Washington, D C 20231

on Feb. 18, 2003

Anna A. Von

Signature of person mailing paper

203

PTO/SB/17 (10-01)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

FEE TRANSMITTAL for FY 2002

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 40 00

Complete If Known	
Application Number	60/430 572
Filing Date	12/03/2002
First Named Inventor	Asrar et al
Examiner Name	Not Known
Group Art Unit	
Attorney Docket No.	17396/09058

METHOD OF PAYMENT

1 ☑ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to.

Deposit Account Number: 50-2548

Deposit Account Name: Nelson Mullins Riley & Scarborough

☑ Charge Any Additional Fee Required Under 37 CFR 1 16 and 1 17

☐ Applicant claims small entity status. See 37 CFR 1 27

2. ☑ Payment Enclosed

☑ Check ☐ Credit card ☐ Money Order ☐ Other

FEE CALCULATION

1 BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	740	201	370	Utility filing fee	
106	330	206	165	Design filing fee	
107	510	207	255	Plant filing fee	
108	740	208	370	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($)

2. EXTRA CLAIM FEES

	Extra Claims		Fee from below	Fee Paid
Total Claims	-20** =	X		
Independent Claims	3** =	X		
Multiple Dependent				

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	84	202	42	Independent claims in excess of 3
104	280	204	140	Multiple dependent claim, if not paid
109	84	209	42	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0 00

**or number previously paid, if greater. For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1 840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	920	217	460	Extension for reply within third month	
118	1,440	218	720	Extension for reply within fourth month	
128	1,960	228	980	Extension for reply within fifth month	
119	320	219	160	Notice of Appeal	
120	320	220	160	Filing a brief in support of an appeal	
121	280	221	140	Request for oral hearing	
138	1,510	138	1 510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,280	241	640	Petition to revive - unintentional	
142	1,280	242	640	Utility issue fee (or reissue)	
143	460	243	230	Design issue fee	
144	620	244	310	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Processing fee under 37 CFR 1 17(q)	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	40 00
146	740	246	370	Filing a submission after final rejection (37 CFR § 1 129(a))	
149	740	249	370	For each additional invention to be examined (37 CFR § 1 129(b))	
179	740	279	370	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	
Other fee (specify)					

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 40 00

SUBMITTED BY				Complete (if applicable)	
Name (Print/Type)	Charles E. Dunlap	Registration No. (Attorney/Agent)	35 124	Telephone	(864)250-2238
Signature				Date	02/18/2003

WARNING Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer U S. Patent and Trademark Office Washington, DC 20231 DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231

Practitioner's Docket No. 17396/09058 PATENT

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN NATIONAL STAGE OF PCT SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR C-I-P)

As a below named inventor I hereby declare that.

TYPE OF DECLARATION

This declaration is for an original application.

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name I believe that I am an original, first and joint inventor of the subject matter that is claimed, and for which a patent is sought on the invention entitled

TITLE OF INVENTION

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

SPECIFICATION IDENTIFICATION

The specification was filed on November 10 2003 as Serial No 10/705 062, and is identified as Nelson Mullins Riley & Scarborough attorney reference number 17396/09058

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37 Code of Federal Regulations, § 1.56

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S) (35 U.S C § 119(e))

I hereby claim the benefit under Title 35 United States Code, § 119(e) of any United States provisional application(s) listed below

PROVISIONAL APPLICATION NUMBER	FILING DATE
60/438,572	12/03/02

205

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith

APPOINTED PRACTITIONER(S)	REGISTRATION NUMBER(S)
Charles E. Dunlap	35 124
T K. Ball	42,287
George R. Beck	21 180
Gary M Bond	29,283
Grace L. Bonner	32,963
Forchuaha M. Davis	48,371
Dennis R. Hoerner Jr	30,914
Lawrence M. Lavin, Jr	30,768
Thomas P McBride	32,706
Michael J Roth	29 342
Joseph A. Schaper	30,493
Brian K Stierwalt	33,213
Frederick M Tnebe	52,300
Thomas E Kelley	29,938
Bradley S Kurtz	53 165
E. Clifford Lawson	46,860
Haisheng Lu	53,241
Donna E. Scherer	34 719
Pamela J Sisson	53,600
Martha J Yates	47 194
Mark C Dukes	32,343
Neil C. Jones	35,561
Craig N Killen	35,218
Lloyd G Parr	38,446
Michael E Wever	43,984
Wesley D Few	47,560
Kyle M. Globerman	46 730
Robert S Thomas	52,284
Chad S Stover	54,471

SEND CORRESPONDENCE TO

Charles E Dunlap
Nelson Mullins Riley & Scarborough, LLP
P O Box 11070
Columbia, SC 29211-1070

DIRECT TELEPHONE CALLS TO

Charles E Dunlap
864-250-2238

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon

SIGNATURE(S)

Jawed Asrar
Inventor's signature _____
Date 12/09/2003 Country of Citizenship US
Residence 14949 Royal Brook, Chesterfield, MO 63017
Post Office Address

Vladmir O Bekker
Inventor's signature _____
Date _____ Country of Citizenship US
Residence 32 Forsythia Lane, Olivette, MO 63132
Post Office Address

Yiwei Ding
Inventor s signature _____
Date _____ Country of Citizenship US
Residence 423 Castle Pines Court, Ballwin, MO 63021
Post Office Address

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN NATIONAL STAGE OF PCT SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR C-I P)

As a below named inventor I hereby declare that.

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PROVISIONAL APPLICATION NUMBER	FILING DATE
60/438,572	12/03/02

28 2C8

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Michael J Roth	29,342
Joseph A. Schaper	30,493
Brian K. Stierwalt	33,213
Frederick M Triebe	52,300
Thomas E. Kelley	29 938
Bradley S Kurtz	53 165
E. Clifford Lawson	46,860
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Martha J Yates	47 194
Mark C Dukes	32,343
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Craig N Killen	35,218
Lloyd G Farr	38,446
Michael E. Wever	43 984
Wesley D Few	47,560
Kyle M Globerman	46,730
Robert S Thomas	52,284
Chad S Stover	54,471

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Charles E. Dunlap
Nelson Mullins Riley & Scarborough LLP
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Columbia, SC 29211 1070

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SIGNATURE(S)

Jawed Asrar
Inventor's signature _____
Date _____ Country of Citizenship US
Residence 14949 Royal Brook, Chesterfield, MO 63017
Post Office Address

Vladmir O Bekker
Inventor's signature Vladimir O. Bekker
Date 11/15/03 Country of Citizenship US
Residence 32 Forsythia Lane, Olivette, MO 63132
Post Office Address

Yiwei Ding
Inventor's signature _____
Date _____ Country of Citizenship US
Residence 423 Castle Pines Court, Ballwin, MO 63021
Post Office Address

Practitioner's Docket No. 17396/09058

PATENT

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN NATIONAL STAGE OF PCT SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR C-I-P)

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SPECIFICATION IDENTIFICATION

The specification was filed on November 10, 2003 as Serial No. 10/705,062, and is identified as Nelson Mullins Riley & Scarborough attorney reference number 17396/09058

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PROVISIONAL APPLICATION NUMBER	FILING DATE
60/438,572	12/03/02

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Bradley S Kurtz	53 165
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Donna E. Scherer	34,719
Pamela J Sisson	53,600
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Kyle M Globerman	46 730
Robert S Thomas	52,284
Chad S Stover	54,471

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Nelson Mullins Riley & Scarborough, LLP
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Columbia, SC 29211-1070

DIRECT TELEPHONE CALLS TO

Charles E. Dunlap
864-250-2238

DECLARATION

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SIGNATURE(S)

Jawed Asrar
Inventor's signature _____
Date _____ Country of Citizenship US
Residence 14949 Royal Brook, Chesterfield, MO 63017
Post Office Address

Vladmir O Bekker
Inventor's signature _____
Date _____ Country of Citizenship US
Residence 32 Forsythia Lane, Olivette, MO 63132
Post Office Address

Yiwei Ding
Inventor's signature _____
Date 11/25/03 Country of Citizenship US
Residence 423 Castle Pines Court, Ballwin MO 63021
Post Office Address

213

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
Washington, DC 20231
www.uspto.gov

APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE RECD	ATTY.DOCKET.NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
60/430 572	12/03/2002		160	17396/09058	7		

CONFIRMATION NO 2422

Charles E Dunlap
Keenan Building Third Floor
1330 Lady Street
Columbia SC 29201

FILING RECEIPT

OC00000000009314405

Date Mailed 01/02/2003

Receipt is acknowledged of this provisional Patent Application It will not be examined for patentability and will become abandoned not later than twelve months after its filing date Be sure to provide the U S APPLICATION NUMBER FILING DATE NAME OF APPLICANT and TITLE OF INVENTION when inquiring about this application Fees transmitted by check or draft are subject to collection Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination s Filing Receipt Corrections, facsimile number 703 746-9195 Please provide a copy of this Filing Receipt with the changes noted thereon If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate)

Applicant(s)

Jawed Asrar Chesterfield MO
Vladimir O Bekker Olivette MO
Yiwei Ding Ballwin MO

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JAN 06 2003
NELSON MULLINS
COLUMBIA OFFICE

If Required Foreign Filing License Granted 12/31/2002

Projected Publication Date None application is not eligible for pre-grant publication

Non Publication Request No

Early Publication Request No

"Docketed for"
08 d NO3 - FF Hr
03 DB 03 - FF/ convert deadline
PGS AV✓

Title

Method of protecting seeds treated with a phytotoxic agent

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5 11 & 5.15

GRANTED

2/A

The applicant has been granted a license under 35 U S C 184 If the phrase "IF REQUIRED FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5 15 The scope and limitations of this license are set forth in 37 CFR 5 15(a) unless an earlier license has been issued under 37 CFR 5 15(b) The license is subject to revocation upon written notification The date indicated is the effective date of the license unless an earlier license of similar scope has been granted under 37 CFR 5 13 or 5 14

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked This license is automatically transferred to any related applications(s) filed under 37 CFR 1 53(d) This license is not retroactive

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data Licensees should apprise themselves of current regulations especially with respect to certain countries of other agencies particularly the Office of Defense Trade Controls Department of State (with respect to Arms Munitions and Implements of War (22 CFR 121 128)) the Office of Export Administration Department of Commerce (15 CFR 370 10 (j)) the Office of Foreign Assets Control Department of Treasury (31 CFR Parts 500+) and the Department of Energy

NOT GRANTED

No license under 35 U S C 184 has been granted at this time If the phrase "IF REQUIRED FOREIGN FILING LICENSE GRANTED DOES NOT appear on this form Applicant may still petition for a license under 37 CFR 5 12 if a license is desired before the expiration of 6 months from the filing date of the application If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U S C 181 the licensee may foreign file the application pursuant to 37 CFR 5 15(b)

215

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPL NO	FILING OR 371 (c) DATE	ART UNIT	FIL FEE RECD	ATTY.DOCKET NO	DRAWINGS	TOT CLMS	IND CLMS
10/705 062	11/10/2003	3643	1440	17396/09058	7	49	2

CONFIRMATION NO 3869

Charles E Dunlap
P O Box 11070
Columbia SC 29211-1070

CORRECTED FILING RECEIPT

OC000000012369893

Date Mailed 04/15/2004

Receipt is acknowledged of this regular Patent Application It will be considered in its order and you will be notified as to the results of the examination Be sure to provide the U S APPLICATION NUMBER FILING DATE NAME OF APPLICANT and TITLE OF INVENTION when inquiring about this application Fees transmitted by check or draft are subject to collection Please verify the accuracy of the data presented on this receipt If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination s Filing Receipt Corrections facsimile number 703 746-9195 Please provide a copy of this Filing Receipt with the changes noted thereon If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice When the USPTO processes the reply to the Notice the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate)

Applicant(s)

Jawed Asrar Chesterfield MO
Vladimir O Bekker Olivette MO
Yiwei Ding Ballwin MO

Assignment For Published Patent Application

Monsanto Technology L L C St Louis MO

Domestic Priority data as claimed by applicant

This appln claims benefit of 60/430 572 12/03/2002

Foreign Applications

If Required, Foreign Filing License Granted 02/10/2004

Projected Publication Date 06/24/2004

Non-Publication Request No

Early Publication Request No

Title

Method of protecting seeds treated with a phytotoxic agent

RECEIVED
APR 19 2004
NELSON MULLINS
COLUMBIA OFFICE

"Do [illegible]
24 JN 04- Pub.
BE

Preliminary Class
047

716

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5 11 & 5 15

GRANTED

The applicant has been granted a license under 35 U S C 184 If the phrase IF REQUIRED FOREIGN FILING LICENSE GRANTED followed by a date appears on this form Such licenses are issued in all applications where the conditions for issuance of a license have been met regardless of whether or not a license may be required as set forth in 37 CFR 5 15 The scope and limitations of this license are set forth in 37 CFR 5 15(a) unless an earlier license has been issued under 37 CFR 5 15(b) The license is subject to revocation upon written notification The date indicated is the effective date of the license unless an earlier license of similar scope has been granted under 37 CFR 5 13 or 5 14

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked This license is automatically transferred to any related applications(s) filed under 37 CFR 1 53(d) This license is not retroactive

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data Licensees should apprise themselves of current regulations especially with respect to certain countries of other agencies particularly the Office of Defense Trade Controls Department of State (with respect to Arms Munitions and Implements of War (22 CFR 121-128)) the Office of Export Administration Department of Commerce (15 CFR 370 10 (j)) the Office of Foreign Assets Control Department of Treasury (31 CFR Parts 500+) and the Department of Energy

NOT GRANTED

No license under 35 U S C 184 has been granted at this time If the phrase IF REQUIRED FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form Applicant may still petition for a license under 37 CFR 5 12 If a license is desired before the expiration of 6 months from the filing date of the application If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U S C 181 the licensee may foreign file the application pursuant to 37 CFR 5 15(b)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable item 5 below
17396/09181		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US 03/36178	14/11/2003	03/12/2002
Applicant		
MONSANTO TECHNOLOGY LLC		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau

This International Search Report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1 Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed unless otherwise indicated under this item

[ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing

[ ] contained in the international application in written form

[ ] filed together with the international application in computer readable form

[ ] furnished subsequently to this Authority in written form

[ ] furnished subsequently to this Authority in computer readable form

[ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

[ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] Certain claims were found unsearchable (See Box I)

3. [ ] Unity of invention is lacking (see Box II)

4. With regard to the title,

[X] the text is approved as submitted by the applicant.

[ ] the text has been established by this Authority to read as follows.

5. With regard to the abstract,

[X] the text is approved as submitted by the applicant.

[ ] the text has been established, according to Rule 38.2(b) by this Authority as it appears in Box III The applicant may within one month from the date of mailing of this international search report, submit comments to this Authority

6 The figure of the drawings to be published with the abstract is Figure No

[ ] as suggested by the applicant.

[ ] because the applicant failed to suggest a figure.

[ ] because this figure better characterizes the invention.

[X] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/36178

A CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01C1/06

21A

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal WPI Data, PAJ

C DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 199 318 B1 (BALACHANDER NATARAJAN ET AL) 13 March 2001 (2001-03-13) cited in the application column 2, line 7-10 column 13, line 52 -column 17, line 38	1-48
Y	US 4 383 391 A (THOMAS NORMAN W ET AL) 17 May 1983 (1983-05-17)	1-46
X	column 1, line 66 -column 5, line 44	47,48
Y	WO 02/080675 A (MONSANTO TECHNOLOGY LLC ,ASRAR JAWED (US), DING YIWEI (US)) 17 October 2002 (2002-10-17)	1-46
X	page 5, line 16 -page 22, line 18	47,48
A	US 5 876 739 A (CHEN YUGUANG ET AL) 2 March 1999 (1999-03-02)	1-46
X	column 1, line 29 -column 8, line 23	47,48

-/—

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 April 2004	13/05/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Schlichting, N

1

Form PCT/ISA/210 (second sheet) (January 2004)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 091 213 A (FMC CORP) 12 October 1983 (1983-10-12)	1-46
X	page 3, line 23 -page 4, line 22	47,48
A	FR 2 777 421 A (SEPPIC SA) 22 October 1999 (1999-10-22)	1-46
X	page 5, line 3 -page 9, line 9	47,48

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 03/36178

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 6199318	B1	13-03-2001	AU	5697298 A	03-07-1998
			CA	2274643 A1	18-06-1998
			DE	69716125 D1	07-11-2002
			DE	69716125 T2	05-06-2003
			DK	949975 T3	10-02-2003
			EP	1238714 A1	11-09-2002
			EP	0949975 A1	20-10-1999
			JP	2001507726 T	12-06-2001
			WO	9825710 A1	18-06-1998
			US	2003147946 A1	07-08-2003
			US	2001014310 A1	16-08-2001
US 4383391	A	17-05-1983	NONE		
WO 02080675	A	17-10-2002	BR	0208147 A	02-03-2004
			EP	1370136 A1	17-12-2003
			WO	02080675 A1	17-10-2002
			US	2002134012 A1	26-09-2002
US 5876739	A	02-03-1999	US	5849320 A	15-12-1998
			US	2002177526 A1	28-11-2002
EP 0091213	A	12-10-1983	AT	37469 T	15-10-1988
			AU	555539 B2	02-10-1986
			AU	1311783 A	13-10-1983
			BG	41996 A3	15-09-1987
			BR	8301568 A	06-12-1983
			DE	3378100 D1	03-11-1988
			EP	0091213 A2	12-10-1983
			ES	8504431 A1	16-07-1985
			GR	78154 A1	26-09-1984
			HU	196687 B	30-01-1989
			MX	161138 A	07-08-1990
			RO	87228 A1	30-12-1985
			ZA	8302408 A	28-12-1983
FR 2777421	A	22-10-1999	FR	2777421 A1	22-10-1999

PATENT COOPERATION TREATY

From the RECEIVING OFFICE

To.
CHARLES E. DUNLAP
NELSON MULLINS RILEY & SCAROROUGH LLC
P O BOX 11070
COLUMBIA, SOUTH CAROLINA 29211

PCT

NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE

(PCT Rule 20.5(c))

Date of mailing *(day/month/year)*	21 JAN 2004
Applicant s or agent s file reference: 17396/09181	IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US03/36178	14 Nov 2003	03 Dec 2002

Applicant: MONSANTO TECHNOLOGY LLC

Title of the invention: METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

1 The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application 21 JAN 2004

- [x] was transmitted to the International Bureau on _____
- [ ] has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau*
  - [ ] because the necessary national security clearance has not yet been obtained.
  - [ ] because *(reason to be specified)*

* The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB/301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

3 FOREIGN TRANSMITTAL LICENSE INFORMATION Completed by MH

- [ ] Additional license for foreign transmittal not required. This subject matter is covered by a license already granted or the equivalent U.S. national application. Refer to that license for information concerning its scope.
- [ ] License for foreign transmittal not required. 37 CFR. 5.11(e)(1) or 37 CFR 5.11(e)(2). However a license may be required for additional subject matter See 37 CFR 5.15(b).
- [x] Foreign transmittal license granted. 35 U.S.C. 184, 37 CFR 5.11 on 15 Jan 2004 (date)
  - [ ] 37 CFR 5.15(a)
  - [x] 37 CFR 5.15(b)

Name and mailing address of the receiving Office	Authorized officer
Mail Stop PCT Commissioner for Patents P.O Box 1450, Alexandria, VA 22313-1450	Marnie Holmes
Facsimile No. 703-305-3230	Telephone No. 703-305-3884

Form PCT/RO/105 (July 1992)

12

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF RECEIPT OF RECORD COPY

(PCT Rule 24.2(a))

RECEIVED

To

NELSON MULLINS RILEY & SCARBOROUGH LLC
P O Box 11070
Columbia SC 29211
United States of America

Date of mailing (day/month/year)	IMPORTANT NOTIFICATION
30 January 2004 (30.01 2004) FEB 17 2004	
Applicant's or agent's file reference NELSON MULLINS COLUMBIA OFFICE	**International application No.**
17396/09181	PCT/US2003/036178

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below

Name(s) of the applicant(s) and State(s) for which they are applicants

MONSANTO TECHNOLOGY LLC (for all designated States except US)
ASRAR, Jawed et al (for US)

International filing date	14 November 2003 (14 11 2003)
Priority date(s) claimed	03 December 2002 (03 12.2002)
Date of receipt of the record copy by the International Bureau	23 January 2004 (23 01 2004)

List of designated Offices

AP BW GH GM KE,LS MW MZ,SD SL,SZ,TZ,UG,ZM,ZW
EA AM,AZ,BY KG KZ,MD RU TJ TM
EP AT BE BG,CH CY CZ,DE,DK,EE,ES FI FR GB GR HU IE IT LU MC,NL,PT RO SE,SI,SK,TR
OA BF BJ CF CG CI CM GA,GN GQ,GW ML,MR,NE,SN TD TG
National AE,AG,AL,AM,AT,AU,AZ,BA,BB BG,BR BW BY BZ,CA,CH CN CO CR CU CZ,DE,DK,DM DZ,EC EE,EG ES FI GB GD GE,GH GM HR HU ID IL,IN,IS,JP KE,KG KP KR KZ,LC LK,LR LS, LT LU LV MA,MD MG MK,MN MW MX,MZ,NI NO NZ,OM PG PH PL,PT,RO RU SC SD SE,SG,SK,SL, SY,TJ TM TN TR TT TZ,UA,UG,US UZ,VC VN YU,ZA,ZM,ZW

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the International application, the applicant should immediately inform the International Bureau

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to

- [X] time limits for entry into the national phase see updated Important Information (as of April 2002)
- [ ] confirmation of precautionary designations (if applicable)
- [X] requirements regarding priority documents (if applicable)

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Hélène CAMPIN (Fax 338 8970)
Facsimile No. (41-22) 338.89.70	Telephone No. (41 22) 338 8716

Form PCT/IB/301 (April 2002) 008079365

INFORMATION N TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated on the cover sheet of this Notification by paying national fees and furnishing translations, as prescribed by Articles 22 and 39 and the applicable national laws. In addition the applicant may also have to comply with other special requirements applicable in certain Offices. It is the applicant's responsibility to ensure the necessary steps to enter the national phase are taken in a timely fashion. Most Offices do not issue reminders to applicants in connection with the entry into the national phase.

The applicable time limit for entering the national phase will subject to what is said in the following paragraph, be 30 MONTHS from the priority date not only in respect of any elected Office where a demand for international preliminary examination is filed before the expiration of 19 months from the priority date (see Article 39(1)) but also in respect of any designated Office, in the absence of filing of such demand, where Article22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see PCT Gazette No. 44/2001 of 1 November 2001 pages 19928, 19932 and 19934, as well as the PCT Newsletter October and November 2001 and February 2002 issues.

In practice time limits other than the 30-month time limit will continue to apply for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21 30 or 31 months, or other time limit), Office by Office, refer to the PCT Gazette("Section IV" part published on a weekly basis), to the PCT Newsletter (on a monthly basis) and to the relevant National Chapters in Volume II of the PCT Applicant's Guide (the paper version of which is updated usually twice a year and the Internet version of which is updated usually on a weekly basis). Finally a cumulative table of all applicable time limits for entering the national phase is available from WIPO's Internet site, via links from various pages the site including those of the Gazette, Newsletter and Guide, at http //www wipo.int/pct/en/index.html.

Information about the requirements for filing a demand for international preliminary examination is set out in the PCT Applicant's Guide, Volume I/A, Chapter IX. Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II)

CONFIRMATION OF PRECAUTIONARY DESIGNATIONS

This notification lists only specific designations made under Rule 4.9(a) in the request. It is important to check that these designations are correct. Errors in designations can be corrected where precautionary designations have been made under Rule 4.9(b). The applicant is hereby reminded that any precautionary designations may be confirmed according to Rule 4.9(c) before the expiration of 15 months from the priority date (this time limit may not be extended) If it is not confirmed, it will automatically be regarded as withdrawn by the applicant. There will be no reminder and no invitation. Confirmation of a designation consists of the filing of a notice specifying the designated State concerned (with indication of the kind of protection or treatment desired) and the payment of the designation and confirmation fees. The Notice of confirmation and payment must reach the receiving Office within the 15-month time limit.

REQUIREMENTS REGARDING PRIORITY DOCUMENTS

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ('the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau before the expiration of 16 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application in which case that document will be considered to have been received by the International Bureau on the last day of the 16-month time limit (Rule 17 1(a)).

Where the priority document is issued by the receiving Office, the applicant may instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 16-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17 1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity upon entry into the national phase to furnish the priority document within the time limit which is reasonable under the circumstances.

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 16-month time limit is the filing date of the earliest application whose priority is claimed.

RECEIVED
FEB 17 2004
NELSON MULLINS
COLUMBIA OFFICE

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

To

NELSON MULLINS RILEY &
SCARBOROUGH LLC
P O Box 11070
Columbia SC 29211
United States of America

NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

Date of mailing (day/month/year) 05 February 2004 (05 02 2004)	
Applicant's or agent's file reference 17396/09181 WJW/pb	IMPORTANT NOTIFICATION
International application No. PCT/US2003/036178	International filing date (day/month/year) 14 November 2003 (14.11 2003)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 03 December 2002 (03 12 2002)
Applicant MONSANTO TECHNOLOGY, LLC et al	

1 By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR" in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17 1(a) or (b).

2 (If applicable) The letters "NR" appearing in the right-hand column denote a priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau under Rule 17 1(a) or (b). Where, under Rule 17 1(a) the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17 1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

3. (If applicable) An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17 1(a) or (b) (the priority document was received after the time limit prescribed in Rule 17 1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17 1(b)). Even though the priority document was not furnished in compliance with Rule 17 1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as priority document, Rule 17 1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
03 Dece 2002 (03 12 2002)	60/430 572	US	22 Janu 2004 (22 01 2004)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 338.89.70

Authorized officer
Frédéric DAENGER (Fax 338 8970)

Telephone No. (41-22) 338 9999

PATENT COOPERATION TREATY

RECEIVED

AUG 2 0 2004

NELSON MULLINS
COLUMBIA OFFICE

From the INTERNATIONAL BUREAU

PCT

INFORMATION CONCERNING ELECTED OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

To:

BOSCH, Henry
Monsanto Services International
270-272, avenue de Tervuren
B 1150 Brussels
Belgium

Date of mailing (day/month/year): 30 July 2004 (30.07.2004)	
Applicant's or agent's file reference: 17396/09181 (Monsanto 61-31 (55837) PCT)	IMPORTANT INFORMATION
International application No.: PCT/US2003/036178	International filing date (day/month/year): 14 November 2003 (14.11.2003)
Priority date (day/month/year): 03 December 2002 (03.12.2002)	
Applicant: MONSANTO TECHNOLOGY LLC et al	

1 The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election.

EP AT,BE,BG,CH,CY,CZ,DE,DK,EE,ES,FI,FR,GB,GR,HU IE,IT,LU,MC NL,PT RO,SE,
SI,SK,TR
National BG,CA,CN,CZ,DE,JP,KP KR MN,NO,PL,RO RU,SK,US

2. The following Offices have waived the requirement for the notification of their election, the notification will be sent to them by the International Bureau only upon their request:

AP BW,GH,GM KE,LS,MW,MZ,SD,SL,SZ,TZ UG,ZM,ZW
EA AM,AZ,BY,KG KZ,MD RU,TJ,TM
OA BF,BJ,CF,CG,CI,CM GA,GN,GQ,GW ML,MR,NE,SN,TD,TG
National AE,AG,AL,AM,AT,AU,AZ,BA,BB BR,BW,BY,BZ,CH,CO,CR,CU DK,DM,DZ,EC,
EE,EG ES,FI,GB,GD,GE,GH,GM HR,HU ID IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU
LV MA,MD,MG MK,MW MX,MZ,NI,NZ,OM,PG,PH,PT,SC,SD,SE,SG,SL,SY,TJ TM TN,TR,
TT TZ,UA,UG,UZ,VC,VN,YU,ZA,ZM,ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

8/19/2004
1) Charles Dunlap / Nelson Mullins (17396/09181 PCT)
2) (JRB) - Enhancement

FAX'd

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: Hélène CAMPIN (Fax 338 8970)
Facsimile No. (41-22) 338.88.70	Telephone No. (41-22) 338 8718

Form PCT/IB/332 (September 1997) 8376447

15

ZZX 226

Form PTO-1449	Docket Number Optional	Application Number
INFORMATION DISCLOSURE CITATION IN AN APPLICATION (*Use several sheets if necessary*)	17396/09058	10/705,082
	Applicant: Asrar et al	Filing Date: November 10, 2003
	Examiner: Unknown	Group Art Unit: 3643

U S PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	6 3 2 9 3 1 9	12/11/01	Publisi, et al	504	100	
	6 2 3 5 9 1 6	5/22/01	Thames et al	554	219	
	6 2 3 0 4 3 8	5/15/01	Zaychuk, et al	47	57 6	
	6 2 0 2 3 4 6	3/20/01	Lyons et al	47	57 6	
	6 1 9 9 3 1 8	3/13/01	Steward, et al	47	57 6	
	6 1 5 6 6 9 9	12/5/00	Johnson, et al	504	100	
	6 0 9 6 6 8 6	8/1/00	Gressel et al	504	100	
	5 9 3 9 3 5 6	8/17/99	Welnghoff	504	100	
	5 9 1 8 4 1 3	7/6/99	Otani, et al	47	57 6	
	5 8 7 6 7 3 9	3/2/99	Tumblad et al	424	408	
	5 8 7 6 7 3 9	3/2/99	Tumblad, et al	424	408	
	5 8 4 9 3 2 0	12/15/98	Tumblad, et al	424	410	
	5 7 5 0 4 6 6	5/12/98	Wedegaertner, et al	504	100	
	5 6 6 1 1 0 3	8/26/97	Harms, et al	504	147	
	5 5 8 6 4 1 1	12/24/96	Gleddle, et al	47	57 6	
	5 5 2 5 1 3 1	6/11/96	Asano	47	57 6	
	5 3 8 7 4 5 0	2/7/95	Stewart	428	40 4	
	5 3 2 8 9 4 2	7/12/94	Akhtar, et al	524	35	
	5 3 0 0 1 2 7	4/5/94	Williams	47	57 6	
	5 1 2 9 1 8 0	7/14/92	Stewart	47	57 6	
	5 1 2 7 1 8 5	7/7/92	Kojimoto, et al	47	57 6	
	5 1 2 0 3 4 9	6/9/92	Stewart, et al	71	93	
	5 1 0 6 6 4 8	4/21/92	Williams	427	3	
	5 0 4 4 1 1 6	9/3/91	Gago, et al	47	57 6	
	5 0 0 6 1 4 9	4/9/91	Kiss, et al	71	81	
	4 8 7 9 8 3 9	11/14/89	Gago et al	47	57 6	
	4 8 0 8 4 3 0	2/28/89	Jouno	427	4	
	4 7 3 5 0 1 7	4/5/88	Gago et al	47	57 6	
	4 7 3 5 0 1 5	4/5/88	Schmolka	47	57 6	
	4 6 6 5 6 4 8	5/19/87	Branco, et al	47	57 6	
	4 4 9 5 7 2 4	1/29/85	Kirkland et al	47	57 6	
	4 4 9 3 1 6 2	1/15/85	Langan, et al	47	57 6	
	4 3 8 3 3 9 1	5/17/83	Thomas, et al	47	57 6	
	4 3 9 4 8 4 5	7/26/83	Porter, et al	118	303	
	4 2 7 2 4 1 7	6/9/81	Barker et al	260	22	
	4 2 5 1 9 5 2	2/24/81	Porter, et al	47	57 6	
	4 2 4 9 3 4 3	2/10/81	Dannelly	47	57 6	
	4 2 4 5 4 3 2	1/20/81	Dannelly	47	57 6	
	4 2 3 8 5 2 3	12/9/80	Porter, et al	427	4	
	4 1 6 9 9 0 2	10/2/79	De Long	427	4	
	4 0 6 8 6 0 2	1/17/78	Mickus et al	111	130	
	4 0 6 7 1 4 1	1/10/78	Matsunaga, et al	47	57 6	
	4 0 3 3 7 5 6	7/5/77	Hoffmann	71	118	

227 227

	3	9	9	1	5	1	7	11/16/76	Lewis	47	57 6
	3	9	5	0	8	9	1	4/20/76	Hinkes	47	57 6
	3	9	4	7	9	9	6	4/6/76	Watts	47	57 6
	3	9	0	5	1	5	2	9/16/75	Loperfido	47	57 6
	3	8	0	3	7	6	1	4/16/74	Watts, et al	47	57 6
	3	5	9	8	5	6	5	8/10/71	Graves	71	77
	3	1	1	3	3	9	9	12/10/63	Eversol et al	47	1

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	Translation YES	Translation NO

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*

		United States Defensive Publication T101,902, June 1, 1982
		Article from B-R NI Seedbiotics P O Box 609 Caldwell ID 83605 USA, entitled Alleviation of Seed Imbibitional Chilling Injury Using Polymer Film Coating
		Article from the Department of Horticultural Sciences New York State Agricultural Experiment Station Cornell University Geneva NY USA 14456, A G Taylor J Kwiatkowski entitled Polymer Film Coatings Decrease Water Uptake and Water Vapour Movement into Seeds and Reduce Imbibitional Chilling Injury

EXAMINER	DATE CONSIDERED

EXAMINER Initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

229 220

Form PTO-1449	Docket Number Optional	Application Number
SUPPLEMENTAL INFORMATION DISCLOSURE CITATION IN AN APPLICATION (*Use several sheets if necessary*)	17396/09068	10/706,052
	Applicant: Aarar et al.	Filing Date: November 10, 2003
	Examiner: Unknown	Group Art Unit: 3643

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	Translation YES	Translation NO
	EP 0 091 213A	12 10 83	Khan, Mir Naqui Ali	A01N	25/12	X	
	FR 2 777 421 A	22 10 99	Valile Claude	A01N	25/24		X
	WO 02/080675 A1	17 10 02	Ding, Yiwei, et al.			X	

OTHER DOCUMENTS (*Including Author, Title, Date, Pertinent Pages, Etc.*)

		PCT International Search Report, International Filing Date 14.11 03

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

AS: 97045

730 229

State of South Carolina
Office of the Secretary of State
The Honorable Mark Hammond

1205 PENDLETON STREET SUITE 506
COLUMBIA, SC 29201

Spencer Hewitt, Director
(803) 734 2119

P O BOX 11350
COLUMBIA, SC 29211

Patricia Hamby Co-Director
(803) 734 2512
PatHamby@infoave net

Apostille

(Convention de La Haye du 5 octobre 1961)

1 *Country* United States of America

This public document

2 has been signed by Melanie E Powell

3 acting in the capacity of Notary Public for the State of South Carolina

4 bears the seal / stamp of Melanie E Powell Notary Public for the State of South Carolina

Certified

5	At Columbia, South Carolina	6	Tuesday May 24 2005
7	by the Secretary of the State of South Carolina		
8	N° 937474		
9	Seal/stamp	10	Signature

Mark Hammond

Docket No 17396/09217
COLOMBIA

CERTIFICATION

I hereby certify that the attached paper constitutes a true copy of the original of a certain Assignment to Monsanto Technology, LLC by Jawed Asrar Vladimir O Bekker, and Yiwei Ding executed October 4 2002 of the subject matter disclosed in an application for Letters Patent of the United States entitled as follows

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

the specification of which was filed on December 3 2002 and given serial number 60/430 572

May 20, 2005
Date

Charles E Dunlap Attorney of Record

STATE OF South Carolina)
)
COUNTY OF Greenville)

Sworn to and subscribed before me on
May 20, 2005

Melanie E Powell Notary Public
My Commission Expires November 20 2012

UNITED STATES PATENT AND TRADEMARK OFFICE

232 231

17396109058

JULY 09 2003

PTAS

NELSON MULLINS RILEY & SCARBOROUGH
CHARLES E DUNLAP
1330 LADY STREET
KEENAN BUILDING THIRD FLOOR
COLUMBIA SC 29201

Under Secretary of Commerce For Intellectual Property and
Director of the United States Patent and Trademark Office
Washington DC 20231
www.uspto.gov

102375253A

UNITED STATES PATENT AND TRADEMARK OFFICE
NOTICE OF RECORDATION OF ASSIGNMENT DOCUMENT

THE ENCLOSED DOCUMENT HAS BEEN RECORDED BY THE ASSIGNMENT DIVISION OF THE U S PATENT AND TRADEMARK OFFICE A COMPLETE MICROFILM COPY IS AVAILABLE AT THE ASSIGNMENT SEARCH ROOM ON THE REEL AND FRAME NUMBER REFERENCED BELOW

PLEASE REVIEW ALL INFORMATION CONTAINED ON THIS NOTICE THE INFORMATION CONTAINED ON THIS RECORDATION NOTICE REFLECTS THE DATA PRESENT IN THE PATENT AND TRADEMARK ASSIGNMENT SYSTEM IF YOU SHOULD FIND ANY ERRORS OR HAVE QUESTIONS CONCERNING THIS NOTICE YOU MAY CONTACT THE EMPLOYEE WHOSE NAME APPEARS ON THIS NOTICE AT 703-308-9723
PLEASE SEND REQUEST FOR CORRECTION TO U S PATENT AND TRADEMARK OFFICE ASSIGNMENT DIVISION BOX ASSIGNMENTS CG-4 1213 JEFFERSON DAVIS HWY SUITE 320 WASHINGTON D C 20231

RECORDATION DATE 02/24/2003

REEL/FRAME 013781/0326
NUMBER OF PAGES 6

BRIEF ASSIGNMENT OF ASSIGNOR S INTEREST (SEE DOCUMENT FOR DETAILS)

ASSIGNOR
ASRAR JAWED

DOC DATE 10/04/2002

ASSIGNOR
BEKKER VLADIMIR O

DOC DATE 10/04/2002

ASSIGNOR
DING YIWEI

DOC DATE 10/04/2002

ASSIGNEE
MONSANTO TECHNOLOGY LLC
800 NORTH LINDBERGH BOULEVARD
ST LOUIS MISSOURI 63167

SERIAL NUMBER 60430572
PATENT NUMBER

FILING DATE 12/03/2002
ISSUE DATE

RECEIVED
JUL 14 2003
NELSON MULLINS
COLUMBIA OFFICE

233 232

SHAREILL COLES EXAMINER
ASSIGNMENT DIVISION
OFFICE OF PUBLIC RECORDS

2-24-03

233

Practitioner's Docket No. 17396/09058 (52837)

02-27-2003

PATENT

IN THE UNITED STATES PAT

102375253

Box Assignments
Commissioner of Patents and Trademarks
Washington, D.C. 20231

ASSIGNMENT (DOCUMENT) COVER SHEET (37 C.F.R. § 3.31)

Attached please find an assignment (document) for recordal.

IDENTIFICATION OF APPLICATION(S) AND/OR PATENT(S) FOR ASSIGNMENT (DOCUMENT) RECORDAL (37 C.F.R. § 3.21 and 37 C.F.R. § 3.31(a)(4))

1 This assignment is for the following patent application and/or issued patent:

a. Provisional application 60/430,572, filed on December 3 2002

FINANCE SECTION
2003 FEB 24 AM 9 40
PUBLIC RECORDS

TOTAL NUMBER OF APPLICATIONS AND/OR PATENTS AND TOTAL FEE

2 A The total number of applications and/or patents identified in this cover sheet is

B The total fee is (37 C F.R. Section 1 21(h)).

1 x $40 00 = $40 00

CERTIFICATION UNDER 37 C.F.R. §§ 1 8(a) and 1 10*

(When using Express Mail, the Express Mail label number is mandatory, Express Mail certification is optional.)

I hereby certify that, on the date shown below this correspondence is being:

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☒ deposited with the United States Postal Service in an envelope addressed to the Commissioner for Patents, Washington D.C. 20231
37 C.F.R. § 1.8(a)

☐ with sufficient postage as first class mail.

37 C.F.R. § 1 10*

☐ as "Express Mail Post Office to Addressee"
Mailing Label No _____ (mandatory)

TRANSMISSION

☐ facsimile transmitted to the Patent and Trademark Office, (703) _____

Signature

02/25/2003 [illegible]
01 FC:8021 40.00 OP

Anna A. Von

(type or print name of person certifying)

* Only the date of filing (§ 1 6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1 8 continues to be taken into account in determining timeliness. See § 1 703(f). Consider Express Mail Post Office to Addressee (§ 1 10) or facsimile transmission (§ 1 6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.

C Payment of fee is made by

23I / 23A

Attached is check # 22509 in the amount of $40 00

Charge any additional fees required by this paper or credit any overpayment to deposit account # 50-2548

A duplicate of this paper is attached.

NAME OF PARTIES CONVEYING INTEREST
(37 C.F.R. § 3.31(a)(1))

3 The parties conveying interest are:

Jawed Asrar
Vladimir O Bekker
Yiwei Ding

NAME AND ADDRESS OF PARTY(IES) RECEIVING INTEREST
(37 C.F.R. § (a)(2))

4 The rights are being conveyed to

Monsanto Technology, LLC
800 North Lindbergh Boulevard
St. Louis, MO 63167

DESCRIPTION OF INTEREST CONVEYED OR TRANSACTION RECORDED (37 C.F.R. § 3.31(a)(3))

5 The accompanying document intends to accomplish an assignment.

NAME AND ADDRESS OF PARTY TO WHOM CORRESPONDENCE SHOULD BE MAILED (37 C.F.R. § 3.31 (a)(5))

6 Please address correspondence to

Name:	Charles E Dunlap
Address	Nelson Mullins Riley & Scarborough
	Keenan Building, Third Floor
	1330 Lady Street
	Columbia, SC 29201
Telephone No	864-250-2238

DATE ASSIGNMENT (DOCUMENT) EXECUTED
(37 C.F R. § 3.31(a)(7))

7 The attached assignment (document) was executed by Jawed Asrar Vladimir O Bekker and Yiwei Ding on October 4, 2002

LANGUAGE OF ASSIGNMENT (DOCUMENT) TO BE RECORDED

8 The attached document is in the English language.

ORIGINAL DOCUMENT OR TRUE COPY SUBMITTED

9 Submitted herewith is the original document.

STATEMENT (37 C.F.R. § 3.31(a)(9)) AND
SIGNATURE (37 C.F.R. § 3.31(a)(10))

10 To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Feb 18, 2003
Date

Charles E. Dunlap
Nelson Mullins Riley & Scarborough
Keenan Building, Third Floor
1330 Lady Street
Columbia, SC 29201

TOTAL NUMBER OF PAGES BEING SUBMITTED

11 The total number of pages being submitted, including documents is: 6.

ATTORNEY DOCKET 17396/09058
51-21 (52837)

ASSIGNMENT

WHEREAS I, the undersigned, have made certain invention or inventions which are disclosed in patent application(s) and/or provisional patent application(s) entitled

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

the specification of which is being filed herewith as a provisional application that is identified as practitioner's Docket No 17396/09058

WHEREAS, MONSANTO TECHNOLOGY LLC having its address at 800 North Lindbergh Blvd St. Louis Missouri 63167, U S.A a Corporation of the State of Delaware, is desirous of acquiring the entire right title and interest in and to said invention or inventions and any and all patents to be obtained therefor;

NOW, THEREFORE FOR GOOD AND VALUABLE CONSIDERATION the receipt of which is hereby acknowledged, I do hereby sell, assign and transfer to said MONSANTO TECHNOLOGY LLC its successors and assigns, the entire right, title and interest in and to said invention or inventions in any form or embodiment thereof and in and to said application(s) and in and to any and all applications filed in any country based thereon including the right to file application in countries other than the country of priority filing under the provisions of any international convention also in and to any and all improvements on said invention or inventions now or hereafter made by me/us as employee(s) agent(s) or contractor(s) of said MONSANTO TECHNOLOGY LLC also the entire right, title and interest in and to any and all patents, including reissues and extensions thereof to be obtained in any country upon said invention, inventions or improvements, and any and all continuing applications including divisional, continuation and continuation-in-part applications substitute applications and applications claiming benefit of an earlier filed provisional application, which may be filed upon said invention inventions or improvements in any country and

I hereby authorize and request the issuing authority to issue any and all patents on said application or applications to said MONSANTO TECHNOLOGY LLC, as assignee of the entire interest

I further agree, without any payment by MONSANTO TECHNOLOGY LLC other than in reimbursement of reasonable expenses I may incur to communicate to said MONSANTO TECHNOLOGY LLC its representatives or agents, any facts relating to said invention inventions or improvements including evidence for purposes of interference opposition or other legal proceedings, whenever requested testify in any interference, opposition or other legal proceedings whenever requested and execute and deliver, on request all lawful papers required to make any of the foregoing provisions effective

IN TESTIMONY WHEREOF I have hereto set my hand on the date set after my signature

Signature Jawed Asrar Date 10/4/02

Name Jawed Asrar

Residence 14949 Royal Brook, Chesterfield, MO 63017

State of MISSOURI)
)
County of St Louis)

On this 4th day of October, 2002 before me personally appeared Jawed Asrar, to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed In testimony whereof I have hereto set my hand and official seal on the day last above-written

Carol D Stemmler
Notary Public

My Commission expires July 14 2005

CAROL D. STEMMLER
Notary Public-Notary Seal
State of Missouri
St Louis County
My Commission Expires Jul 16 2005

IN TESTIMONY WHEREOF I have hereto set my hand on the date set after my signature

Signature Vladimir O Bekker Date 10/04/2002

Name Vladimir O Bekker

Residence 32 Forsythia Lane, Olivette, MO 63132

State of MISSOURI)
)
County of St Louis)

On this 4th day of October, 2002 before me personally appeared Vladimir O Bekker to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed In testimony whereof I have hereto set my hand and official seal on the day last above-written

Carol D Stemmler
Notary Public

My Commission expires July 16, 2005

CAROL D STEMMLER
Notary Public-Notary Seal
State of Missouri
St Louis County
My Commission Expires Jul 16 2005

239 238

IN TESTIMONY WHEREOF I have hereto set my hand on the date set after my signature

Signature Y.W. DS Date 10/04/02

Name Yiwei Ding

Residence 423 Castle Pines Court, MO 63021

State of Missouri)
County of St-Louis)

On this 4th day of October, 2002 before me personally appeared Yiwei Ding, to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed In testimony whereof I have hereto set my hand and official seal on the day last above-written

Carol D Stemmler
Notary Public

CAROL D STEMMLER
Notary Public-Notary Seal
State of Missouri
St Louis County
My Commission Expires Jul 16, 2005

240 239

Practitioner's Docket No. 17396/09058 (52837) *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Assignments
Commissioner of Patents and Trademarks
Washington, D C. 20231

ASSIGNMENT (DOCUMENT) COVER SHEET (37 C F.R. § 3.31)

Attached please find an assignment (document) for recordal

IDENTIFICATION OF APPLICATION(S) AND/OR PATENT(S) FOR ASSIGNMENT (DOCUMENT) RECORDAL (37 C.F.R. § 3.21 and 37 C.F.R. § 3.31(a)(4))

1 This assignment is for the following patent application and/or issued patent:

a. Provisional application 60/430,572, filed on December 3, 2002

TOTAL NUMBER OF APPLICATIONS AND/OR PATENTS AND TOTAL FEE

2 A. The total number of applications and/or patents identified in this cover sheet is 1

B The total fee is (37 C.F R. Section 1.21(h))

1 x $40 00 = $40 00

CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1 10*
(When using Express Mail the Express Mail label number is mandatory, Express Mail certification is optional.)

I hereby certify that, on the date shown below this correspondence is being:

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37 C.F.R. § 1.8(a)

☐ with sufficient postage as first class mail.

37 C.F.R. § 1.10*

☐ as "Express Mail Post Office to Addressee"
Mailing Label No _____ (mandatory)

TRANSMISSION

☐ facsimile transmitted to the Patent and Trademark Office, (703) _____ _____

Signature

Date: February 18, 2003

Anna A. Von

(type or print name of person certifying)

** Only the date of filing (§ 1 6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1 8 continues to be taken into account in determining timeliness. See § 1 703(f). Consider Express Mail Post Office to Addressee (§ 1 10) or facsimile transmission (§ 1 6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations*

C Payment of fee is made by

Attached is check # 22509 in the amount of $40 00

Charge any additional fees required by this paper or credit any overpayment to deposit account # 50-2548

A duplicate of this paper is attached.

NAME OF PARTIES CONVEYING INTEREST
(37 C.F R. § 3.31(a)(1))

3 The parties conveying interest are

Jawed Asrar
Vladimir O Bekker
Yiwei Ding

NAME AND ADDRESS OF PARTY(IES) RECEIVING INTEREST
(37 C.F.R. § (a)(2))

4 The rights are being conveyed to

Monsanto Technology, LLC
800 North Lindbergh Boulevard
St. Louis, MO 63167

DESCRIPTION OF INTEREST CONVEYED OR TRANSACTION RECORDED (37 C.F.R. § 3.31(a)(3))

5 The accompanying document intends to accomplish an assignment.

NAME AND ADDRESS OF PARTY TO WHOM CORRESPONDENCE SHOULD BE MAILED (37 C F.R. § 3.31 (a)(5))

6 Please address correspondence to

Name:	Charles E Dunlap
Address	Nelson Mullins Riley & Scarborough
	Keenan Building, Third Floor
	1330 Lady Street
	Columbia, SC 29201
Telephone No	864-250-2238

242 241

DATE ASSIGNMENT (DOCUMENT) EXECUTED
(37 C.F R. § 3.31(a)(7))

7 The attached assignment (document) was executed by Jawed Asrar, Vladimir O Bekker, and Yiwei Ding on October 4, 2002

LANGUAGE OF ASSIGNMENT (DOCUMENT) TO BE RECORDED

8 The attached document is in the English language.

ORIGINAL DOCUMENT OR TRUE COPY SUBMITTED

9 Submitted herewith is the original document.

STATEMENT (37 C.F.R. § 3.31(a)(9)) AND
SIGNATURE (37 C F.R. § 3.31(a)(10))

10 To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Feb. 18, 2003
Date

Charles E. Dunlap
Nelson Mullins Riley & Scarborough
Keenan Building, Third Floor
1330 Lady Street
Columbia, SC 29201

TOTAL NUMBER OF PAGES BEING SUBMITTED

11 The total number of pages being submitted, including documents is 6.

Practitioner's Docket No. 17396/09058 (51-21(52837)) *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of Jawed Asrar Vladimir O Bekker and Yiwei Ding

Application No 60/430 572 Group No _____
Filed. 12/03/2002 Examiner _____
For Method of Protecting Seeds Treated with a Phytotoxic Agent

Box Assignment
Commissioner for Patents
Washington, D C 20231

CERTIFICATE OF MAILING UNDER 37 C.F R. § 1.8(a)

I hereby certify that the attached correspondence comprising

1 Fee Transmittal Sheet (1 page)
2 Assignment (Document) Cover Sheet with duplicate (3 pages each)
3 Assignment (Document) (3 pages)
4 Check No 22509 for $40 00 (1 page)
5 Return Postcard (1 page)

is being deposited with the United States Postal Service, with sufficient postage, as first class mail in an envelope addressed to

Box Assignment
Commissioner for Patents
Washington, D C 20231

on Feb 18, 2003

Anna A. Von
Signature of person mailing paper

PTO/SB/17 (10-01)
Approved for use through 10/31/2002. OMB 0651-0032
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FEE TRANSMITTAL for FY 2002

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 40 00

Complete If Known	
Application Number	60/430,572
Filing Date	12/03/2002
First Named Inventor	Asrar et al
Examiner Name	Not Known
Group Art Unit	
Attorney Docket No.	17396/09058

METHOD OF PAYMENT

1 ☑ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number: 50-2548

Deposit Account Name: Nelson Mullins Riley & Scarborough

☑ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☐ Applicant claims small entity status. See 37 CFR 1.27

2. ☑ Payment Enclosed

☑ Check ☐ Credit card ☐ Money Order ☐ Other

FEE CALCULATION

1 BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	740	201	370	Utility filing fee	
106	330	206	165	Design filing fee	
107	510	207	255	Plant filing fee	
108	740	208	370	Reissue filing fee	
114	160	214	80	Provisional filing fee	

SUBTOTAL (1) ($)

2 EXTRA CLAIM FEES

	Extra Claims		Fee from below	Fee Paid
Total Claims		-20** =		x =	
Independent Claims		3** =		x =	
Multiple Dependent				=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	84	202	42	Independent claims in excess of 3
104	280	204	140	Multiple dependent claim, if not paid
109	84	209	42	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0 00

**or number previously paid, if greater. For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	920	217	460	Extension for reply within third month	
118	1,440	218	720	Extension for reply within fourth month	
128	1,960	228	980	Extension for reply within fifth month	
119	320	219	160	Notice of Appeal	
120	320	220	160	Filing a brief in support of an appeal	
121	280	221	140	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,280	241	640	Petition to revive - unintentional	
142	1,280	242	640	Utility issue fee (or reissue)	
143	460	243	230	Design issue fee	
144	620	244	310	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Processing fee under 37 CFR 1.17(q)	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	40 00
146	740	246	370	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	740	249	370	For each additional invention to be examined (37 CFR § 1.129(b))	
179	740	279	370	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	
Other fee (specify)					

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 40 00

SUBMITTED BY				Complete (if applicable)	
Name (Print/Type)	Charles E. Dunlap	Registration No. (Attorney/Agent)	35 124	Telephone	(864)250-2238
Signature				Date	02/18/2003

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Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231

TRADUCCION AL ESPAÑOL de la cesión de patente a **Monsanto Technology, LLC** firmada por los cedentes y el cesionario

---

Estado de Carolina del Sur
Oficina del Secretario de Estado
El Honorable Mark Hammond

1205 PENDLETON STREET SUITE 506
COLUMBIA, SC 29201

CASILLA POSTAL 11350
COLUMBIA, SC 29211

Spencer Hewitt, Director
(803) 734-2119

Patricia Hamby Codirectora
(803) 734-5212
PatHamby@infosave net

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

1 *País* Estados Unidos de América
Este documento público
2 ha sido firmado por Melanie E Powell
3 actuando en capacidad de Notario Público por el Estado de Carolina del Sur
4 lleva el sello/timbre de Melanie E Powell Notario Público para el estado de Carolina del Sur

Certificado

5 en Columbia Carolina del Sur 6 Martes 24 de Mayo de 2005
7 por el Secretario de Estado de Carolina del Sur
8 N° 937474
9 Sello/timbre 10 Firma

Mark Hammond (firma)
Mark Hammond Secretario de Estado

246 215

Expediente No 17396/09217
COLOMBIA

CERTIFICADO

Por la presente certifico que el documento anexo constituye una copia verdadera de original de cierta cesión a Monsanto technology, LLC por Jawed Asrar Vladimir O Bekker y Yiwei Ding ejecutada el 4 de Octubre de 2002, de la materia divulgada en una solicitud de patente de los Estados Unidos titulada como sigue **METODO PARA PROTEGER SEMILLAS TRATADAS CON UN AGENTE FITOTOXICO**

La descripción de la cual se presentó el 3 de Diciembre de 2002 y se le concedió el numero de serie 60/430 571

Mayo 20 de 2005 (Firma)
Fecha Charles E Dunlap Abogado Registrado

ESTADO DE Carolina del Sur)
)
CONDADO DE Greenville)

Jurado y suscrito ante mi el
20 de Mayo de 2005

(Firma)
Melanie E Powell Notario Público
Mi comisión expira 20 de Noviembre de 2012

09 de Julio de 2003

NELSON MULLINS RILEY & SCARBOROUGH
CHARLES E DUNLAP
1330 LADY STREET
KEENAN BUILDING THIRD FLOOR
COLUMBIA SC 29201

OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS
INFORME DE GRABACIÓN DE DOCUMENTO DE CESION

EL DOCUMENTO ADJUNTO HA SIDO GRABADO POR LA DIVISIÓN DE CESIONES DE LA OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS HAY DISPONIBLE UNA COPIA COMPLETA EN MICROFILME EN EL CUARTE DE BUSQUEDA DE CESIONES EN EL NUMERO DE ROLLO Y CUADRO REFERENCIADOS ABAJO

POR FAVOR REVISE TODA LA INFORMACIÓN CONTENIDA EN ESTE INFORME LA INFORMACIÓN CONTENIDA EN ESTE INFORME DE GRABACIÓN REFLEJA LOS DATOS PRESENTES EN EL SISTEMA DE ASIGNACIÓN DE PATENTES Y MARCAS SI USTED ENCUENTRA CUALQUIER ERROR O TIENE PREGUNTAS CONCERNIENTES A ESTE INFORME PUEDE CONTACTAR AL EMPLEADO CUYO NOMBRE APARECE EN ESTE INFORME AL 703-308-9723 POR FAVOR ENVÍE LA SOLICITUD DE CORRECCIÓN A. OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS DIVISIÓN DE CESIONES ASIGNACIÓN DE CASILLAS CG-4 1213 JEFFERSON DAVIS HWY SUITE 320 WASHINGTON D C 20231

FECHA DE GRABACIÓN 02/24/2003 ROLLO/CUADRO 013781/0326
NUMERO DE PÁGINAS 6

RESUMEN CESIÓN DE INTERÉS DEL CEDENTE (VER DOCUMENTO PARA DETALLES)

CEDENTE
ASRAR JAWED FECHA DE DOC 10/04/2002

CEDENTE
BEKKER VLADIMIR O FECHA DE DOC 10/04/2002

CEDENTE
DING YIWEI FECHA DE DOC 10/04/2002

CESIONARIO
MONSANTO TECHNOLOGY LLC
800 NORTH LINDBERGH BOULEVARD
SAN LOUIS MISSOURI 63167

NUMERO DE SERIE 60430572 FECHA DE PRESENTACIÓN 12/03/2002
NUMERO DE PATENTE FECHA DE EMISIÓN

SHAREILL COLES EXAMINADOR
DIVISIÓN DE CESIONES
OFICINA DE REGISTROS PUBLICOS

Expediente del Solicitante No 17396/09058

EN LA OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS

Casilla de Cesiones
Comisionado de Marcas y Patentes
Washington D C 20231

PORTADA DE (DOCUMENTO) DE CESION (37 C F R § 3 31)

Anexo encontrará una cesión (documento) para registro

**IDENTIFICACION DE SOLICITUD(ES) Y/O PATENTE(S)
PARA REGISTRO DE (DOCUMENTO) DE CESION
(37 C F R § 3.21 Y 37 C F R § 3.31(A)(4))**

1 Esta cesión es para la siguiente solicitud de patente y/o patente emitida

a Solicitud provisional 60/430 572 presentada el 3 de Diciembre de 2002

**NUMERO TOTAL DE SOLICITUDES Y/O PATENTES
Y TARIFA TOTAL**

2 A El número total de solicitudes y/o patentes identificadas en esta portada es 1

B La tarifa total es (37 C F R Sección 1 21(h))

1 x $40 00 = $40 00

CERTIFICADO BAJO 37 C F R. §§1 8(A) Y 1 10*
(Cuando use correo expreso el número de marquilla de correo expreso es obligatorio la certificación por correo expreso es opcional)

Certifico que en la fecha que se muestra debajo esta correspondencia

ENVIO POR CORREO

☒ es depositada en el Servicio Postal de los Estados Unidos en un sobre dirigido al Comisionado para Patentes, Washington D C. 20231

37 C F R. § 1 8(a)

☒ con sellos postales como correo de primera clase

37 C.F R. § 1 10*

☐ como "Correo Expreso de Oficina Postal a Destinatario"
Marquilla de correo No _____ (obligatoria)

TRANSMISION

☐ Transmitido por facsímile a la Oficina de Marcas y Patentes, (703) _____ _____

(Firma)
Firma

Anna A. Von
(nombre en letra imprenta de quien certifica)

** Solo la fecha de presentación (§ 1 6) será la fecha utilizada en un cálculo de ajuste de término de patente aunque la fecha en cualquier certificado de correo o transmisión bajo § 1 8 continúa tomándose en cuenta al determinar la puntualidad Ver §1 703(f) Considere "Correo expreso de oficina postal a destinatario (§1 10) o transmisión de facsímile (§1 6(d)) para la respuesta que será acordada como la fecha más temprana posible de presentación en cálculos de ajuste del término de la patente*

RJO 249

C El pago de la tarifa se hace por
Se adjunta el cheque #22509 por el monto de $40 00

Cargue cualquier tarifa adicional requerida por este documento o acredite cualquier sobrepago a la cuenta de depósito # 50-2548

Se anexa un duplicado de este documento

NOMBRE DE LAS PARTES QUE CEDEN EL INTERES
(37 C F R §3 31(A)(1))

3 Las partes que ceden el interés son

Jawed Asrar
Vladimir O Bekker
Yiwei Ding

NOMBRE Y DIRECCIÓN DE LA(S) PARTE(S) QUE RECIBE(N) EL INTERES
(37 C F R. § (a)(2))

4 Los derechos se están cediendo a

Monsanto Technology LLC
800 North Lindbergh Boulevard
San Louis MO 63167

DESCRIPCION DEL INTERES CEDIDO O
TRANSACCION REGISTRADA (37 C F R §3 31(a)(3))

5 El documento acompañante tiene el propósito de lograr una cesión

NOMBRE Y DIRECCION DE LA PARTE A QUIEN
DEBE ENVIARSE LA CORRESPONDENCIA (37 C F R. §3 31(a)(5))

6 Por favor dirija la correspondencia a

Nombre	Charles E Dunlap
Dirección	Belson Mullins Riley & Scarborough
	Keenan Building Third Floor
	1330 Lady Street
	Columbia SC 29201
No telefónico	864-250-2238

FECHA EN LA QUE SE EJECUTO LA (DOCUMENTO) CESION
(37 C F R. § 3 31(a)(7))

7 La cesión (documento) adjunta fue ejecutada por Jawed Asrar Vladimir O Bekker y Yiwei Ding el 4 de Octubre de 2002

IDIOMA DE LA CESION (DOCUMENTO) A SER REGISTRADA

8 El documento adjunto se encuentra en el idioma Inglés

SE PRESENTA DOCUMENTO ORIGINAL O COPIA AUTENTICA

9 Con la presente se presenta el documento original

DECLARACION (37 C F R. §3 31(a)(9)) Y
FIRMA (37 C F R. §3.31(a)(10))

10 Hasta donde sé y creo la información anterior as veraz y correcta y cualquier copia adjunta es una copia auténtica del documento original

Fecha 18 de Febrero de 2003

(firma)
Charles E Dunlap
Belson Mullins Riley & Scarborough
Keenan Building Third Floor
1330 Lady Street
Columbia SC 29201

NUMERO TOTAL DE PAGINAS QUE SE PRESENTAN

11 El número total de páginas que se presentan Incluyendo los documentos es 6

EXPEDIENTE DE AB GAD 17396/09058
51 – 21 (52837)

CESION

CONSIDERANDO QUE, yo el suscrito he hecho cierta invención o invenciones las cuales se divulgan en la(s) solicitud(es) de patente y/o solicitud(es) provisional(es) de patente titulada(s)

METODO PARA PROTEGER SEMILLAS TRATADAS CON UN AGENTE FITOTOXICO

la descripción de la cual se presenta con la presente como una solicitud provisional que es identificada como el Expediente de practicante No 17396/09058

CONSIDERANDO QUE MONSANTO TECHNOLOGY LLC quien tiene su dirección en 800 North Lindbergh Blvd , San Louis Missoun 63167 Estados Unidos de América una corporación del Estado de Delaware esta deseosa de adquinr la totalidad del derecho título e interés en y para dicha invención o invenciones y cualquiera y todas las patentes que se obtenga para la misma,

AHORA POR LO TANTO POR LA CONSIDERACION BUENA Y VALIOSA el recibo de la cual se reconoce por la presente vendo cedo y transfiero a dicha MONSANTO TECHNOLOGY LLC sus sucesores y cesionarios la totalidad del derecho e interés en y para dicha invención o invenciones, en cualquier forma o modalidad de las mismas, y en y para dicha(s) solicitud(es) y en y para cualquiera y todas las solicitudes presentadas en cualquier país basadas en las mismas incluyendo el derecho a presentar solicitud en países diferentes al país donde se presentó la prioridad bajo las previsiones de cualquier convenio internacional también en y para cualquiera y todas las mejoras sobre dicha invención o invenciones hechas ahora o en adelante por mi/nosotros como empleado(s), agente(s) o contratista(s) de dicha MONSANTO TECHNOLOGY LLC, también todo el derecho título e interés en y para cualquiera y todas las patentes incluyendo reemisiones y extensiones de la misma a ser obtenidas en cualquier país sobre dicha invención invenciones o mejoras y cualquiera y todas las solicitudes a continuación, incluyendo solicitudes divisionales continuaciones y continuaciones parciales solicitudes de reemplazo y solicitudes que reivindican el beneficio de una solicitud provisional presentada anteriormente las cuales pueden ser presentadas sobre dicha invención invenciones o mejoras en cualquier país y

Por la presente autorizo y solicito a la autoridad emisora que emita cualquiera y todas las patentes sobre dicha solicitud o solicitudes a dicha MONSTANO TECHNOLOGY LLC, como cesionario de la totalidad del interés

Además acepto sin pago alguno por MONSANTO TECHNOLOGY LLC diferente a un reembolso de gastos razonables en los que pueda incurrir, comunicar a dicha MONSANTO TECHNOLOGY LLC sus representantes o agentes, cualquier hecho relacionado con dicha invención invenciones o mejoras incluyendo evidencia para propósitos de interferencia oposición u otros procedimientos legales siempre que sea solicitado testificar en cualquier interferencia oposición u otros procedimientos legales siempre que sea solicitado, y ejecutar y entregar por solicitud todos los documentos legales requeridos para hacer cualquiera de las condiciones anteriores efectivas

EN TESTIMONIO DE LO CUAL he puesto mi firma en el presente en la fecha al lado de mi firma

Firma (Firma) Fecha 10/4/02

Nombre Jawed Asrar

Residencia 14949 Royal Brook, Chesterfield, MO 63017

Estado de MISSOURI)
)
Condado de San Louis)

En este 4 de Octubre de 2002 ante mí personalmente apareció Jawed Asrar a quien conozco como la persona que ejecutó el instrumento anterior y quien reconoció que ejecutó el mismo de su libre voluntad y albedrío en testimonio de lo cual he puesto mi firma y sello oficial en el día escrito arriba

(Firma)
Notario Público

Mi comisión expira Julio 16 de 2005

Hay un sello que dice
CAROL D STEMMLER
Notario Público – Sello de Notario
Estado de Missouri
Condado de San Louis
Mi comisión expira el 16 de Julio de 2005

EN TESTIMONIO DE LO CUAL he puesto mi firma en el presente en la fecha al lado de mi firma

Firma (Firma) Fecha 10/04/02

Nombre Vladimir O Bekker

Residencia 32 Forsythia Lane, Olivette, MO 63132

Estado de MISSOURI)
)
Condado de San Louis)

En este 4 de Octubre de 2002 ante mí personalmente apareció Vladimir O. Bekker, a quien conozco como la persona que ejecutó el instrumento anterior y quien reconoció que ejecutó el mismo de su libre voluntad y albedrío en testimonio de lo cual he puesto mi firma y sello oficial en el día escrito arriba

(Firma)
Notario Público

Mi comisión expira Julio 16 de 2005

Hay un sello que dice
CAROL D STEMMLER
Notario Publico – Sello de Notario
Estado de Missouri
Condado de San Louis
Mi comisión expira el 16 de Julio de 2005

EN TESTIMONIO DE LO CUAL he puesto mi firma en el presente en la fecha al lado de mi firma

Firma (Firma) Fecha 10/04/02

Nombre Yiwei Ding

Residencia 423 Castle Pines Court, MO 63021

Estado de MISSOURI)
)
Condado de San Louis)

En este 4 de Octubre de 2002 ante mí personalmente apareció Yiwei Ding, a quien conozco como la persona que ejecutó el instrumento anterior y quien reconoció que ejecutó el mismo de su libre voluntad y albedrío en testimonio de lo cual he puesto mi firma y sello oficial en el día escrito arriba

(Firma)
Notario Público

Mi comisión expira Julio 16 de 2005

Hay un sello que dice
CAROL D STEMMLER
Notario Público – Sello de Notario
Estado de Missouri
Condado de San Louis
Mi comisión expira el 16 de Julio de 2005

295 254

Expediente del Solicitante No 17396/09058 (52837) PATENTE

EN LA OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS

Casilla de Cesiones
Comisionado de Marcas y Patentes
Washington D C 20231

PORTADA DE (DOCUMENTO) DE CESION (37 C F R § 3 31)

Anexo encontrará una cesión (documento) para registro

**IDENTIFICACION DE SOLICITUD(ES) Y/O PATENTE(S)
PARA REGISTRO DE (DOCUMENTO) DE CESION
(37 C F R § 3.21 Y 37 C F R § 3.31(A)(4))**

12 Esta cesión es para la siguiente solicitud de patente y/o patente emitida

a Solicitud provisional 60/430 572 presentada el 3 de Diciembre de 2002

**NUMERO TOTAL DE SOLICITUDES Y/O PATENTES
Y TARIFA TOTAL**

13 A El número total de solicitudes y/o patentes identificadas en esta portada es 1

B La tarifa total es (37 C F R Sección 1 21(h))

1 x $40 00 = $40 00

CERTIFICADO BAJO 37 C F R. §§1 8(A) Y 1 10*

(Cuando use correo expreso, el número de marquilla de correo expreso es obligatorio la certificación por correo expreso es opcional)

Certifico que en la fecha que se muestra debajo esta correspondencia

ENVIO POR CORREO

☒ es depositada en el Servicio Postal de los Estados Unidos en un sobre dirigido al Comisionado para Patentes Washington D C 20231
37 C F R. § 1.8(a)

☒ con sellos postales como correo de primera clase

37 C.F R. § 1 10*

☐ como Correo Expreso de Oficina Postal a Destinatario*
Marquilla de correo No. _____ (obligatoria)

TRANSMISION

☐ Transmitido por facsímile a la Oficina de Marcas y Patentes, (703) _____ _____

(Firma)
Firma

Fecha 18 de Febrero de 2003

Anna A. Von
(nombre en letra imprenta de quien certifica)

** Solo la fecha de presentación (§ 1 6) será la fecha utilizada en un cálculo de ajuste de término de patente aunque la fecha en cualquier certificado de correo o transmisión bajo § 1 8 continúa tomándose en cuenta al determinar la puntualidad Ver §1 703(f) Considere Correo expreso de oficina postal a destinatario (§1 10) o transmisión de facsímile (§1 6(d)) para la respuesta que será acordada como la fecha más temprana posible de presentación en cálculos de ajuste del término de la patente*

D El pago de la tarifa se hace por
Se adjunta el cheque #22509 por el monto de $40 00

Cargue cualquier tarifa adicional requerida por este documento o acredite cualquier sobrepago a la cuenta de depósito # 50-2548

Se anexa un duplicado de este documento

NOMBRE DE LAS PARTES QUE CEDEN EL INTERES
(37 C F R. §3 31(A)(1))

14 Las partes que ceden el interés son

Jawed Asrar
Vladimir O Bekker
Yiwei Ding

NOMBRE Y DIRECCIÓN DE LA(S) PARTE(S) QUE RECIBE(N) EL INTERES
(37 C F R § (a)(2))

15 Los derechos se están cediendo a

Monsanto Technology LLC
800 North Lindbergh Boulevard
San Louis MO 63167

DESCRIPCION DEL INTERES CEDIDO O
TRANSACCION REGISTRADA (37 C F R §3 31(a)(3))

16 El documento acompañante tiene el propósito de lograr una cesión

NOMBRE Y DIRECCION DE LA PARTE A QUIEN
DEBE ENVIARSE LA CORRESPONDENCIA (37 C F R. §3 31(a)(5))

17 Por favor dirija la correspondencia a

Nombre	Charles E Dunlap
Dirección	Belson Mullins Riley & Scarborough
	Keenan Building Third Floor
	1330 Lady Street
	Columbia SC 29201
No telefónico	864-250-2238

~~257~~ 256

FECHA EN LA QUE SE EJECUTO LA (DOCUMENTO) CESION
(37 C F R. § 3 31(a)(7))

18 La cesión (documento) adjunta fue ejecutada por Jawed Asrar Vladimir O Bekker y Yiwei Ding el 4 de Octubre de 2002

IDIOMA DE LA CESION (DOCUMENTO) A SER REGISTRADA

19 El documento adjunto se encuentra en el idioma Inglés

SE PRESENTA DOCUMENTO ORIGINAL O COPIA AUTENTICA

20 Con la presente se presenta el documento original

DECLARACION (37 C F R §3.31(a)(9)) Y
FIRMA (37 C F R. §3.31(a)(10))

21 Hasta donde sé y creo la información anterior as veraz y correcta y cualquier copia adjunta es una copia auténtica del documento original

Fecha 18 de Febrero de 2003

(firma)
Charles E Dunlap
Belson Mullins Riley & Scarborough
Keenan Building Third Floor
1330 Lady Street
Columbia SC 29201

NUMERO TOTAL DE PAGINAS QUE SE PRESENTAN

El número total de páginas que se presentan Incluyendo los documentos es 6

256
257

Expediente del practicante No 17396/09058 (51-21(52837)) **PATENTE**

EN LA OFICINA DE MARCAS Y PATENTES DE LOS ESTADOS UNIDOS

En el proceso de solicitud de Jawad Asrar Vladimir O Bekker y Yiwei Ding

Solicitud No 60/430 572 Grupo No _____
Presentada 12/03/2002 Examinador _____
Para Método para proteger semillas tratadas con un agente fitotóxico

Casilla de Cesiones
Comisionado para Patentes
Washington D C 20231

CERTIFICADO DE ENVIO POR CORREO BAJO EL 37 C F R. § 1 8(a)

Certifico por la presente que la correspondencia adjunta comprende

1 Hoja de transmisión de la tarifa (1 página)
2 Hoja de portada de Cesión (documento) con duplicado (3 paginas cada uno)
3 Cesión (Documento) (3 páginas)
4 Cheque No 22509 por $40 00 (1 página)
5 Postal de regreso (1 página)

se está depositando con el Servicio Postal de los Estados Unidos con suficiente importe como correo de primera clase en un sobre dirigido a

Casilla de Cesiones
Comisionado para Patentes
Washington D C 20231

el 18 de Febrero de 2003

Anna A Von

(Firma)
Firma de la persona que envía el documento

3F#258

Apostill

(Convention de La Haye du 5 octobre 1961)

1 Country United States of America

This public document
2 has been signed by CAITLIN E. MACAGY

3 acting in the capacity of NOTARY PUBLIC

4 bears the seal/stamp of CAITLIN E. MACAGY NOTARY PUBLIC-STATE OF MISSOURI

Certified

5 at Jefferson City Missoun

6 the 28th day of JANUARY, 2002

7 by Matt Blunt, Secretary of State State of Missoun

8 No. 70695

9 Seal/Stamp

10 Signature

Matt Blunt

Comm. 48 (12-2000)

27 OCT 2003

OSCAR ALARCON NUNEZ

3c0048
260-259

COLOMBIA

PODER

El abajo firmado

Nombra por el presente a

a los apoderados que él o ellos designen nuestro representante legal y verdadero en Bogotá con facultades para recibir notifica ciones y nombrar apoderados judiciales o extrajudiciales con el fin de dar cum plimiento al párrafo lo del Articulo 543 del Decreto 410 de 1971 quedando especial mente facultados para representarnos ante las autoridades Colombianas administrati vas judiciales o de policía en todos los trámites relativos a la Propiedad Industrial a cuyo efecto les facultamos para dar ante dichas autoridades todos los pasos necesa rios al objeto indicado elevar solicitudes declaraciones y reclamos formular descrip ciones enmiendas oposiciones y apelacio nes instaurar cancelaciones abonar todos los impuestos y cuotas y efectuar todo otro pago determinado por la ley recibir todos los documentos y valores dando el des cargo respectivo llenar cualesquiera otros requisitos y tomar en fin todas las medidas que creyen conducentes al resguardo de nuestros intereses y en caso de producirse oposición pasar los antecedentes a los tri bunales quedando facultado para intervenir como demandante ó demandado ante los Jueces que sean competentes pudiendo transar someter a arbitros desistir percibir y apelar con todas las demás facultades que resulten necesarias y por el presente declaramos desde ahora válido y bueno cuanto dicho representante y/o los apodera dos que el nombre hicieren en nuestro bene ficio

Asimismo facultamos a los abogados arriba indicados para solicitar en la Oficina de Propiedad Industrial la protocolización de este documento y de cualquier poder que otorguen a nombre nuestro

POWER OF ATTORNEY

The undersigned MONSANTO TECHNOLOGY LLC a Delaware Limited Liability company located at 800 North Lindbergh Boulevard St Louis Missouri United States of America

hereby appoint Ramiro Castro Duque y/o Juan Pablo Cadena Sarmiento y/o Beatríz Jaramillo S

or the agents appointed by him or them our true and legal representative in Bogota with power to receive notifications and to appoint judicial or extrajudicial agents so as to comply with paragraph 1 Article 543 of Decree 410 of 1971 and they are especially empowered to represent us before the administrative judicial or police authorities of Colombia in all proceedings pertaining to industrial property for which purpose we authorize them to take before the said authorities all the necessary steps to the said end to file petitions declarations claims cancellations and administrative injunction proceedings to draw up specifications to make amend ments oppositions and appeals to pay all installments and effect all other payments prescribed by law to receive proper re ceipts to comply with all other requirements and in short to take all those measures which may deem fit for the protection of our interests and in case of opposition where the proceedings be passed over to the courts we authorize said agent(s) to act on our behalf as complainant(s) as well as defendant(s) before the competent judges with full powers to make arrangements to submit to arbitrators to desist to collect to appeal and in short with all such further powers as may be required and we hereby declare from now on as valid and good all that said representative and/or the agents by him ap pointed may do for our benefit

We also authorize said attorneys to apply for protocolization of this document and any power of attorney [illegible] in our name before the Office [illegible] Property as well as [illegible] presente

27 OCT 2003

OSCAR ALARCON [illegible]
NOTARIO CUARENTA Y SIES

Given and signed at (Dado y firmado en) St Louis, [illegible]

this (a los) 9th day of(dias de) January of (de) 2002

MONSANTO TECHNOLOGY LLC

Por (By) Barbara Bunning-Stevens

Titulo (Title)

Barbara Bunning-Stevens,
Intellectual Property Counsel
Authorized to sign this document for
Monsanto Technology LLC
by action of sole member
dated April 1, 2001

260 260

NOTARIAL CERTIFICATE (CORPORATION)

Estados Unidos de América	)	
Estado de	)	SS
Condado de	)	

Hoy de de 20 compareció a quien conozco y de quien me consta que firmó el anterior documento y quien debidamente juramentado declaró y dijo que él es

de

la compañía nombrada en el documento que antecede una sociedad debidamente organizada y existente conforme a las leyes del Estado de

Estados Unidos de America domiciliada en la ciudad de
Condado de
Estado de Estados Unidos de América y legalmente constituida para un período de duración que aún no ha determinada que el declarante está autorizado por dicha Compañía para conferir este poder que el sello estampado por él al pie de tal poder en nombre y en representación de la expresada Compañía es el sello oficial de ella y que el objeto para el cual se confiere este instrumento está comprendido dentro del de la sociedad

El suscrito notario ha visto los estatutos de incorporación firmados en
Estado de
con fecha y certifica que de conformidad con la legislación de dicho Estado la anterior declaración juramentada es prueba suficiente de que los hechos sobre que ella versa son ciertos o verdaderos de lo cual da de

CERTIFICADO NOTARIAL (SOCIEDAD)

United States of America	)	
State of Missouri	)	SS
County of St Louis	)	

On this 9th day of January of 20 04 personally came

Barbara Bunning Stevens

to me known and known to me to be the person who signed the foregoing instrument who being by me duly sworn did depose and say that she is the Intellectual Property Counsel

of Monsanto Technology LLC

the company named within a limited liability company organized and existing under the laws of the State of Delaware United States of America domiciled at the City of Creve Coeur

County of St Louis
State of Missouri
United States of America and legally constituted for a period of tenure not yet expired that the deponent is authorized by said Limited Liability Company to confer this power of attorney that the seal affixed hereunto by the deponent in the name and on behalf of said Limited Liability Company is the seal thereof and that the purpose for which this instrument is granted is included within the corporate purposes of the Limited Liability Company

The undersigned Notary Public has seen the Certificate of Formation of the said Limited Liability Company executed at Wilmington State of Delaware under date of March 2 2000 and hereby certifies that under the laws of said State the foregoing acknowledgment is sufficient proof that the facts therein contained are true which she attests

(Seal)

CAITLIN E MACAGY
St. Louis County
My Commission Expires
January 21 2006

Caitl E Macagy

Notary Public
(Notario Público)

/2

NOTARIA CUARENTA Y SEIS DEL CIRCULO DE SANTAFE DE BOGOTA, HAGO CONSTAR QUE ESTA COPIA FOTOSTATICA CONCUERDA CON EL ORIGINAL QUE HE TENIDO A LA VISTA.
SANTAFE DE BOGOTA D.C. REPUBLICA DE COLOMBIA
27 OCT 2003
OSCAR ALARCON NUÑEZ
NOTARIO CUARENTA Y SEIS

206 261

REPUBLICA DE COLOMBIA

GAVIRIA

ORGANIZACION ELECTORAL
REGISTRADURÍA NACIONAL DEL ESTADO CIVIL

REGISTRO CIVIL DE DEFUNCIÓN

Indicativo Serial 5562241

Datos de la oficina de registro

Clase de oficina	Registraduría		Notaría	X	Consulado		Corregimiento		Insp. de Policía		Código	9795

País - Departamento - Municipio - Corregimiento o/o Inspección de Policía

COLOMBIA CUNDINAMARCA BOGOTA D.C NOTARIA 32.

Datos del inscrito

Apellidos y nombres completos

CASTRO DUQUE RAMIRO

Documento de identificación (Clase y número)	Sexo (en Letras)
C.C. No. 179324 DE BOGOTA	MASCULINO

Datos de la defunción

Lugar de la Defunción País Departamento Municipio Corregimiento o/o Inspección de Policía

COLOMBIA CUNDINAMARCA BOGOTA D.C

Fecha de la defunción										Hora	Número de certificado de defunción
Año	2	0	0	4	Mes	1	0	Día	3	0	04:10 PM	A- 2094375.

Presunción de muerte

Juzgado que profiere la sentencia	Fecha de la sentencia			
	Año	Mes	Día	

Documento presentado				Nombre y cargo del funcionario
Autorización judicial		Certificado Médico	X	ABURTO DIAZ CAMPOS.- R.N. No. 79982662

Datos del denunciante

Apellidos y nombres completos

EDGAR DAVID REGINO II.

Documentos de identificación (Clase y número)	Firma
C.C.No. 15.030.154 DE LORICA/ CORDOBA	

Primer testigo

Apellidos y nombres completos

Documentos de identificación (Clase y número)	Firma

Segundo testigo

Apellidos y nombres completos

Documentos de identificación (Clase y número)	Firma

Fecha de inscripción										Nombre y firma del funcionario que autoriza
Año	2	0	0	4	Mes	1		Día	0	2	BLANCA [illegible] RESTREPO

ESPACIO PARA NOTAS

PADRES: ALFONSO CASTRO
MERCEDES DUQUE.

ORIGINAL PARA LA OFICINA DE REGIST

NOTARIA 32
DEL CIRCULO DE SANTA FE DE BOGOTA, D C

Germán Eleázar Moreno L.
Notario

COMO SECRETARIO DELEGADO DE LA NOTARIA TREINTA Y DOS (32) DEL CIRCULO DE BOGOTA

CERTIFICO : QUE

La presente acta es fiel copia del original tomada del registro civil de defunciones serial indicativa número: 5762201

que expido en la ciudad de Bogotá D C , hoy 05 NOV 2004

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April 29, 2005

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 ***60/430,572***
FILING DATE ***December 03, 2002***

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

M SIAS
Certifying Officer

27 263

60430572.120302

12-04-02 A Prov

JC560 U.S. PTO 10/306,104

Practitioner's Docket No. 17396/09058 (51-21(52837)) ***PATENT***

Preliminary Classification
Proposed Class 47

JC912 U.S. PTO 60/430572 12/03/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of Jawed Asrar Vladimir O Bekker and Yiwei Ding

For METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

Box Provisional Patent Application
Commissioner for Patents
Washington D C 20231

COVER SHEET FOR FILING PROVISIONAL APPLICATION
(37 C F R. § 1.51(c)(1))

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 C F.R. § 1 51(c)(1)(i). The following comprises the information required by 37 C F R. § 1 51(c)(1).

1 The following comprises the information required by 37 C F R.§ 1 51(c)(1)

2 The names of the inventors are (37 C F R § 1 51(c)(1)(ii))

1 Jawed Asrar
2 Vladimir O Bekker
3 Yiwei Ding

3. Residence addresses of the inventors, as numbered above (37 C F R. § 1 51(c)(1)(iii))

EXPRESS MAILING UNDER 37 C F R. § 1 10*
Express Mail label number is mandatory
(Express Mail certification is optional)

I hereby certify that this paper along with any document referred to, is being deposited with the United States Postal Service on this date December 3 2002 in an envelope addressed to the Box Provisional Patent Application Commissioner for Patents, Washington D C 20231 as Express Mail Post Office to Addressee" Mailing Label No. EU131964444US

Anna A Von
Type or print name of person mailing paper

Date: December 3 2002

Signature of person certifying

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1 14949 Royal Brook
Chesterfield MO 63017

2 32 Forsythia Lane
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3 423 Castle Pines Court
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4. The title of the invention is (37 C F R. § 1 51(c)(1)(iv))

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

5 The name, registration customer and telephone numbers of the practitioner are (37 C F R. § 1 51(c)(1)(v))

Name of practitioner	Charles E. Dunlap
Reg. No	35 124
Tel	864 250-2238

6. The docket number used to identify this application is (37 C F R § 1 51(c)(1)(vi))

Docket No 17396/09058

7 The correspondence address for this application is (37 C F R § 1 51(c)(1)(vii))

Charles E Dunlap
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8. Statement as to whether invention was made by an agency of the U S Government or under contract with an agency of the U S Government. (37 C F R § 1 51(c)(1)(viii))

This invention was NOT made by an agency of the United States Government, or under contract with an agency of the United States Government

9 Identification of documents accompanying this cover sheet

A Documents required by 37 C F R § 1 51(c)(2)-(3)

Specification	No of pages	44
Drawings	No of sheets	7

B. Additional documents

Claims	No of claims	60
Title Page	No of pages	1
Abstract	No of pages	1
Express Mail Certificate	No of pages	1

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Fee Transmittal Sheet.	No of pages	1
Combined Declaration and Power of Attorney (unsigned)	No of pages	3
Patent Application Data Sheet.	No of pages	5
Check No 22198 ($160 00)	No of pages	1
Return Postcard	No of pages	1

10. Fee

The filing fee for this provisional application as set in 37 C F R § 1 16(k), is $160 00 for other than a small entity

11 Fee payment

Fee payment in the amount of $160 00 is being made at this time (Check Number 22198)

12 Method of fee payment

Check Number 22198 in the amount of $160 00

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Date December 3, 2002

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DOCKET NO 17396/09058
51-21(52837)

UNITED STATES PROVISIONAL PATENT APPLICATION

OF

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FOR

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

ASSIGNED TO
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17396/09058
51-21(52837)

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to a method of protecting seeds that are to be treated with a phytotoxic agent and in particular to a method for improving the germination rate of phytotoxic agent-treated seeds Also included are seeds that have been treated by the subject method and plants that grow from such seeds

(2) Description of the Related Art

A significant fraction of plant seed is now treated with one or more agrochemicals such as pesticides inoculants growth factors and fertilizers in order to control pests and diseases to provide nutrients stimulate germination and enhance the growth of the seedling Some of the agrochemicals that are useful in controlling pests and diseases can also be toxic to the seed and to the plant that sprouts from the seed Such phytotoxic activity limits the amount of these agrochemicals that can safely be applied to the seed

One undesirable effect of phytotoxicity is the reduction of the germination rate of seeds that have been treated Typically the germination rate of seeds that are treated with a phytotoxic agent decreases with time after the agent has been applied thereby limiting the shelf life of the treated seeds Sometimes extraordinary measures such as in-field seed treatment or treatment immediately before planting are required to avoid serious damage to the crop It has also been recognized that phytotoxic damage to seed by agrochemical agents may be exacerbated by exposure of the seed to environmental stresses such as cold drought and the like

Phytotoxicity of agrochemicals has been dealt with in several ways The inclusion of safeners – chemicals which ameliorate the phytotoxic affects of agrochemicals such as herbicides – along with the seed is

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widely used but this requires the application of an additional often expensive chemical component to the seed

Another way to overcome the phytotoxic effect is to encapsulate the agrochemical agent in a matrix often a polymer which limits the movement of the agent See *e g* U S Patent 6 329 319 to Puglisi *et al* This method can limit the contact of the agent with the seed and the emerging seedling while permitting the agent to become available later during germination and initial plant growth as the agent is released from the polymer matrix The proper operation of encapsulation technology depends on careful matching of the physical and chemical properties of the agrochemical and the encapsulating matrix Neither one polymer matrix nor one encapsulation process is suitable for encapsulation of all agrochemical agents now in use for seed treatment

Agrochemical agents can also be included in seed coatings which can limit the mobility of the agent See *e g* U S Patent No 6 199 318 to Stewart *et al* U S Patent No 5 129 180 to Stewart, U S Patent No 5 127 185 to Kojimoto *et al* U S Patent No 5 044 116 to Gago *et al* and U S Patent No 3 947 906 to Watts However because the active agent is distributed throughout the coating some finite amount of the agent by necessity comes in contact with the surface of the seed Moreover like encapsulation the chemical and physical parameters of the matrix material must be matched with the properties of the active agent in order to obtain the proper homogeneity for the coating and to avoid cracking

It is known to apply polymer coatings to seeds for the purpose of reducing imbibitional chilling injury See Ni B-R Alleviation of seed imbitional chilling injury using polymer film coating *British Crop Protection Council Symposium Proceedings* No 76 Pp 73-82 (2001) also Taylor A G *Bean Improvement Cooperative 30* 30-31 (1987) Taylor *et al J Horticultural Scl 62*:183-189 (1987) Taylor A. G and J Kwiatkowski Polymer film coatings decrease water uptake and water vapor movement into seeds and reduce imbibitional chilling injury West *et al Crop Science 25*:941-944 (1985) But the combination of such coatings with

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subsequent seed treatment with phytotoxic agrochemicals was not described

It would be useful therefore to provide a method for reducing phytotoxic injury to seeds from phytotoxic seed treatment agents which method can be used with a broad range of agrochemical agents and applied to a broad range of seed types

SUMMARY OF THE INVENTION

Briefly therefore the present invention is directed to a novel method of improving the germination rate of plant seeds which are treated with a phytotoxic agent the method comprising forming a polymer coating on the plant seed before treating the seed with the phytotoxic agent where the coating is free of the phytotoxic agent and where the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed s viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination and treating the coated plant seed with the phytotoxic agent

The present invention is also directed to a novel phytotoxic agent-treated plant seed having an improved germination rate each seed comprising a plant seed having a phytotoxic agent deposited thereupon and having a polymer coating which is free of the phytotoxic agent located between the seed and the phytotoxic agent wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed s viability and enable its germination

The present invention is also directed to a novel plant that is grown from a seed that is treated by the method described above

The present invention is also directed to a novel method of producing an agronomic crop the method comprising the steps

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a providing plant seeds of the agronomic crop that have been treated by the method described above

b planting the seeds and

c cultivating the planted seeds and plants that sprout from the seeds

Among the several advantages found to be achieved by the present invention therefore may be noted the provision of a method for reducing phytotoxic injury to seeds from phytotoxic seed treatment agents which can be used with a broad range of agrochemical agents and applied to a broad range of seed types

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment, for seeds having no coating and having 10μ and 50μ coatings of Vinac XX-210 polymer followed by treatment with a Concep III safener and with imidacloprid at levels of 0 250 g 500 g and 750 g per 100 kg of seeds

Figure 2 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment for seeds having no coating and having 10μ and 50μ coatings of Vinac XX-210 polymer followed by treatment with a Concep III safener and with imidacloprid at levels of 0 250 g 500 g and 750 g per 100 kg of seeds

Figure 3 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment for seeds having no coating and having 5μ coatings of three different Methocel polymers where the coatings were followed by treatment with a Concep III safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds

Figure 4 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment for seeds having no coating and having 5μ coatings of three different Methocel polymers where the coatings were followed by treatment with a Concep III safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds

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Figure 5 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment for seeds having no coating and having 10μ coatings of either SB-2000 polymer Vinac XX-210 Maltrin MO40 Airflex 500 or Flexbond 289 polymers where the coatings were followed by treatment with a Concep III safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds

Figure 6 is a graph showing the germination rate of sorghum seeds in a warm germination test as a function of days after treatment for seeds having no coating and having 5μ coatings of Maltrin MO40 Methocel E3LV Methocel E50LV Methocel A15LV Airflex 500 + 1% talc Flexbond 289 and 5μ 10μ 20μ and 50μ coatings of Vinac XX-210 where the coatings were followed by treatment with a Concep III safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds and

Figure 7 is a graph showing the germination rate of sorghum seeds in a cold germination test as a function of days after treatment for seeds having no coating and having 5μ coatings of Maltrin MO40 Methocel E3LV Methocel E50LV Methocel A15LV Airflex 500 + 1% talc Flexbond 289 and 5μ 10μ 20μ and 50μ coatings of Vinac XX-210 where the coatings were followed by treatment with a Concep III safener and with imidacloprid at levels of 0 and 250 g/ 100 kg of seeds

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with the present invention it has been discovered that the germination rate of seeds that are to be treated with a phytotoxic agent can be improved by forming a polymer coating which is free of the phytotoxic agent on a plant seed and then treating the seeds with the agent It is important that the type of polymer that is employed for the coating and the coating thickness are designed to block phytotoxic contact of the agent with the seed while allowing sufficient transfer of oxygen to maintain the seed s viability and sufficient transfer of moisture

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under environmental conditions normally encountered by the seed after planting to enable its germination

In the present method the terms phytotoxic agent' refer to an agricultural active ingredient that is phytotoxic As used herein the terms agricultural active ingredient" mean any chemical element molecule or compound or mixture thereof which has a biological activity in a seed a plant, or a disease or pest of a seed or plant Such agricultural active ingredients include but are not limited to pesticides herbicides fertilizers plant growth regulators drugs dyes biological attractants scents and pheromones Therefore pesticides herbicides fertilizers plant growth regulators drugs dyes biological attractants scents and pheromones that are phytotoxic are to be included as the phytotoxic agents of the present invention

As used herein an agent is "phytotoxic" if it causes harm or damage to a plant or seed with which it comes in contact Plant and seed damage or harm includes for example stunting chemical burning yield depression malformation discoloration lack of germination reduction in germination rate death and the like

The subject method has been found to be especially useful when the phytotoxic agent is a plant growth regulator a pesticide or a herbicide Examples of pesticides that can be used as the phytotoxic agent in the present invention are acaricides miticides insecticides insect repellants fungicides fungistats molluscicides rodenticides nematicides and bactericides

It is known that many of the most useful pesticides herbicides and plant growth regulators can be phytotoxic if they are allowed to contact plants or seeds and particularly if they are present in high concentrations Nonetheless it is often more effective if not necessary to provide such agents at high concentrations in order to obtain the maximum benefits that they can offer Consequently it has been particularly difficult to supply these phytotoxic agents in concentrated form such as in controlled release granules coatings or pellets due to the harmful effect that the

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agent can have upon the very seed or plant that it is designed to protect An important property of the present invention is that it permits the use of highly effective actives that are also phytotoxic Moreover the actives can be used at concentrations that are higher than would be possible without the use of the phytotoxic agent -free polymer coating

One function of the polymer coating is to reduce phytotoxic contact of the phytotoxic agent with the seed As used herein the terms "phytotoxic contact' means contact of an amount of an agent with a seed that is sufficient to cause a phytotoxic effect Because the phytotoxic agent-free polymer coating reduces phytotoxic contact of the agent with the seed it extends the time that treated seed can be stored Also the treatment can be carried out at a time well before the seed is planted preferably at a time that is economically attractive and convenient for the person applying the treatment By way of example when seeds are to be treated with a pesticide the present method can extend the shelf life of pesticide-treated seeds by a factor of three times or even more Furthermore the present method makes it possible to treat seeds with significantly higher levels of pesticides than can normally be used without incurring unacceptably low germination rates This can enhance the effectiveness of the pesticide and extend the time that the pesticide remains active after planting For example the present method permits the use of two-times three times or even higher levels of pesticide without incurring additional reduction in germination rates for treated seeds

It is another advantage of the present method that it can be used with a broad range of agrochemical agents irrespective of their chemical or physical compatibility with the coating polymer The aspect of applying a phytotoxic agent-free polymer coating to the seed before applying a phytotoxic agent eliminates the need for careful matching of the properties of the polymer and the agent

In the present method when it is said that a purpose is improving the germination rate of plant seed it is meant that plant seed that have

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been treated by the present method have a higher germination rate than similar plant seed that have been treated with the same amount and type of phytotoxic agent, but lack the phytotoxic agent-free polymer coating that is a feature of the present method, when both types of seeds are exposed to the same environmental conditions and tested under the same protocol for the measurement of germination rate. Methods for the measurement of germination rate are well known to those having skill in the art of seed science, and are described in more detail below.

In the present method, a phytotoxic agent-free polymer coating is formed on a plant seed before treating the seed with the phytotoxic agent. The type of polymer and the coating thickness are designed to reduce phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed's viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination. After the polymer coating has been formed, the coated seed is treated with a phytotoxic agent. In preferred embodiments, the phytotoxic agent is a pesticide.

Although the subject method can be used to treat the seed of any type of plant, it is preferred that the seed is the seed of an agronomic plant. As those terms are used herein, "agronomic plant" refers to any plant that is cultivated by man, or from which is harvested parts or products that are used by man. Agronomic plants can be a gymnosperm, a dicotyledon, or a monocotyledon.

Examples of agronomic plants which are useful in the present invention include, without limitation, cereals (wheat, barley, rye, oats, rice, sorghum, related crops, etc.), beet, pear-like fruits, stone fruits, and soft fruits (apple, pear, plum, peach, Japanese apricot, prune, almond, cherry, strawberry, raspberry, black berry, tomato, pepper, etc.), legumes (kidney bean, lentil, pea, soybean), oil plants (rape, canola, mustard, poppy, olive, sunflower, coconut, castor, cocoa bean, peanut, soybean, corn, etc.), Cucurbitaceae (pumpkin, cucumber, melon, etc.), citrus (orange, lemon, grape fruit, mandarin, Watson pomelo (citrus natsudaidai), etc.),

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vegetables (lettuce cabbage celery cabbage Chinese radish carrot onion potato etc) camphor trees (avocado cinnamon camphor etc) corn tobacco nuts coffee sugar cane tea grapevine hop and banana

In preferred embodiments the agronomic plant can be rice wheat barley rye corn potato carrot sweet potato, sugar beet bean pea chicory lettuce cabbage cauliflower broccoli turnip radish spinach asparagus onion garlic eggplant pepper celery canot squash pumpkin zucchini cucumber apple pear quince melon plum cherry peach nectarine apricot, strawberry grape raspberry blackberry pineapple avocado papaya mango banana, soybean tomato sorghum and raspberries banana and other such edible varieties It is more preferred that the agronomic plant is selected from corn soybeans cotton sorghum rape (canola) rice wheat barley and rye It is even more preferred that the agronomic plant is corn soybeans or cotton

An initial step in the present method is forming a phytotoxic agent-free polymer coating on a seed Any method that is known in the art of polymer science can be used to accomplish the formation of the coating on the seed In one preferred method the coating can be formed by providing a seed and contacting the seed with a polymer The contacting can be carried out in any one of several ways For example if the polymer is water soluble a water solution of the polymer can be prepared and the polymer solution can be applied to the seed – such as by spraying dipping misting or the like For non-water soluble polymers a liquid/polymer emulsion of the polymer can be formed and the emulsion can be applied to the seed It is preferred that the liquid in which the emulsion is formed is water and in that case the emulsion can be referred to as a polymer latex It is an important feature of the present method that the polymer-containing medium that is used for the application of the polymer to the seed is free of a phytotoxic agent in order that the application of the polymer to the seed results in the formation of a phytotoxic agent-free polymer coating on the seed

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When it is said that the polymer-containing medium or the polymer coating are "free of a phytotoxic agent' it is meant that any phytotoxic agent that might be present in the medium or the coating is present at a concentration that is below a phytotoxic level The concentration of a phytotoxic agent is considered to be below a phytotoxic level" if seed coated with a polymer coating containing the phytotoxic agent provide a warm-germ test germination rate at 30 days (as that test is described below) that is not more than 5% lower than the warm-germ test germination rate of similar seed having a similar polymer coating in which the concentration of the phytotoxic agent is zero

In preferred embodiments the polymer coating is applied directly to the seed without intervening material between the coating and the seed

It is preferred that the polymer of the subject coating be applied to the seed in the form of a film of a liquid suspension dispersion or emulsion As used herein when describing the coating the term "emulsion" will be understood to include all suspensions dispersions and emulsions When the liquid in which the polymer is distributed is water the emulsion can be termed a latex It will be understood that when the term "film" is used in this specification it generally applies to the film of the polymer emulsion in liquid form after application to the seed unless the context suggests otherwise Likewise the term "coating" applies to the coating on the seed that is formed from the curing of the film When a film containing the polymer is applied to the seed it is preferred that the film substantially covers the surface of the seed However while preferable such substantial coverage is not required in order to obtain the advantages of the invention

The polymer is added to the liquid under conditions that an emulsion is formed This can be done by the addition of finely milled particles of the polymer to the liquid or a liquid/ polymer mixture can be subjected to high shear to form the emulsion Such emulsion-forming techniques are well-known in the art

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The polymer can be added to the liquid in any amount but the concentration of the polymer in the emulsion that is used to form the film should be low enough to permit easy handling and application of the emulsion to the seed – such as by spraying – and thorough distribution of the film among the seeds so that the outer surface of each seed is substantially covered However the concentration should be high enough when used in combination with the other parameters of seed treatment to avoid the loss of polymer from the seeds by dripping or pooling of the emulsion It is preferred that the concentration of polymer in the emulsion at the time that a film of the emulsion is applied to the seeds is about 0 5% to about 50% by weight more preferred is a concentration of about 0 5% to about 20% by weight even more preferred is a concentration of about 2% to about 20% yet more preferred is a concentration of about 4% to about 15% by weight and even more preferred is a concentration of about 5% to about 11% by weight

The amount of the polymer emulsion or polymer solution that is added to the seeds is an amount that is sufficient to provide a coating of the desired thickness After the film of the polymer emulsion or solution has been applied to the seed it is cured to form the polymer coating When it is said that the film is "cured or when "curing the film" is referred to what is meant is that a solid coating of the polymer is formed from the polymer in the film Curing is often the result of drying of the liquid from the film but can also be carried out by chemical reaction adsorption sequestration or other forms of polymer curing that are known in the art

The subject coating is insoluble in water as described above and is present on at least some part of the outer surface of each seed It is preferred that the coating completely cover the outer surface of each seed

It is preferred that the polymer coating that is formed on the seed comprises a substantial amount of the polymer It is preferred that – after the coating is cured – the polymer coating contains a polymer or blend of polymers in an amount of over 10% by weight An amount of 50% by weight is more preferred 70% by weight is yet more preferred and 80%

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by weight is even more preferred In some instances it is preferred that the coating consists essentially of the polymer

If it is desirable the coating can contain non-phytotoxic materials other than the polymer in order to serve as plasticizers emulsifiers stabilizers fillers dyes safeners and the like Such materials are well known in the art

A feature of the phytotoxic agent-free polymer coating is that the type of polymer and the coating thickness are designed to reduce phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination

The types of polymer that are useful for the present coating include polymers that can be processed into an aqueous solution and polymers that can be processed into an aqueous latex emulsion Polymers that form aqueous latex emulsions are preferred It is preferred that the polymers that are used in the present coating can form a film that has good adhesion to the surface of the seed – that is the cured film adheres sufficiently tightly to the surface of the seed that it does not detach or abrade away during normal processing storage and handling It is further preferred that the polymers form films that are water insoluble but have sufficient permeability to moisture and oxygen to maintain seed viability and permit germination when the seed is planted

Furthermore it is preferred that the polymer that is used for the present coating be one having a minimum film-forming temperature (MFT) that is lower than a temperature that would harm the seeds being coated It is preferred that the polymer have a MTF of lower than 55°C more preferred of lower than 30°C and even more preferred of lower than 25°C Minimum film-forming temperature can be determined according to ASTM procedure No D-2354 See *e g* U S Patent No 6 235 916 B1 In a preferred embodiment the present method of coating the seed includes exposing the seed to a temperature that is higher than the MTF of the

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coating polymer in order to obtain an adherent and uniform film having few or no pinholes

Examples of the types of polymers that can be used in the present invention include water soluble polymers such as maltodextrins methylcellulose ethylcellulose hydroxypropylcellulose and hydroxypropyl/methylcellulose and water dispersible polymers such as vinyl acetate - ethylene polymers ethylene-vinyl chloride polymers vinyl acetate polymers vinyl-acrylic polymers starch-based polymers (such as SB-2000) polyvinyl acetate -vinyl chloride polymers vinyl chloride/ vinyl acetate/ ethylene copolymers and the like

A polymer that is useful in the present method is SB 2000 a starch-based functional polymer (available from Seedbiotics Caldwell ID) which has been reported to reduce imbibitional chilling injury to seeds when used as a seed coating prior to planting (See *e g* Taylor A G *et al* Polymer film coatings decrease water uptake and water vapour movement into seeds and reduce imbibitional chilling injury *British Crop Protection Council Symposium Proceedings* No 76 p 215-220 (2001) and Ni B-R pp 73-82 in *British Crop Protection Council Symposium Proceedings* No 76 (2001))

Other polymers that are suitable for use in the subject method include polymers that can provide temperature-sensitive water permeability of the type described in U S Patent Nos 5 120 349 5 129 180 and 5 387 450

As described above the thickness of the phytotoxic agent-free polymer coating in combination with the type of polymer that is used is designed to restrict the contact of the phytotoxic agent with the seed but to permit a certain level of moisture and oxygen transfer The thickness of the phytotoxic agent-free polymer coating refers to the thickness of the polymer coating after it has been cured or dried to form a film In other words it refers to the thickness of the final coating rather than to the coating of the polymer-containing solution or emulsion that is applied to the seed

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It has been found that the thickness of the polymer coating in the present invention should be less than about 500 microns It is preferred that the coating thickness is between about 1 micron and about 500 microns more preferred is between about 1 micron and about 480 microns yet more preferred is between about 2 microns and about 400 microns even more preferred is a coating thickness of between about 3 microns and about 300 microns yet more preferred is between about 5 microns and about 200 microns even more preferred is a coating thickness of between about 8 microns and about 100 microns and yet more preferred is between about 10 microns and about 50 microns

After a polymer coating has been formed on the seed the coated seed is then treated with a phytotoxic agent. In the present invention the phytotoxic agent can be any phytotoxic material that is applied to a seed including but not limited to pesticides fertilizers growth factors dyes and combinations thereof

In preferred embodiments the phytotoxic agent comprises one or more pesticides

Examples of pesticides that are useful in the present method include herbicides molluscicides insecticides nematocides acaricides fungicides bactericides and mixtures thereof

The pesticide can be selected from pyrethrins synthetic pyrethroids azoles oxadizine insecticides neonicotinoids diazoles triazoles strobilurin derivatives organophosphates pyrrols pyrazoles phenyl pyrazoles diacylhydrazines biological/fermentation products carbamates and mixtures thereof

Examples of the types of materials that are useful as pesticides in the present method include

a a pyrethroid or synthetic pyrethrin Examples of pyrethrins that are useful include 2-allyl-4 hydroxy-3-methyl-2-cyclopenten-1-one ester of 2 2-dimethyl-3-(2-methylpropenyl)-cyclopropane carboxylic acid (2-methyl 1-propenyl)-2-methoxy-4-oxo-3-(2-propenyl)-2-cyclopenten-1-yl ester and mixtures of cis and trans isomers thereof Examples of

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pyrethroids that are useful include (s)-cyano(3-phenoxyphenyl)methyl-4-chloro alpha (1-methylethyl)benzeneacetate (fenvalerate CAS RN 51630-58-1) (S)-cyano-(3-phenoxyphenyl)methyl (S)-4-chloro-alpha-(1-methylethyl)benzeneacetate (esfenvalerate CAS RN 66230 04-4) (3-phenoxyphenyl)-methyl(+)cis-trans-3-(2 2-dichoroethenyl)-2 2-dimethylcyclopropanecarboxylate (permethrin CAS RN 52645-53-1) (±) alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis trans-3-(2 2-dichloroethenyl)-2 2-dimethyl-cyclopropane carboxylate (cypermethrin CAS RN 52315-07-8) (beta-cypermethrin CAS RN 65731-84-2) (theta cypermethrin CAS RN 71697-59-1) S-cyano (3-phenoxyphenyl)methyl (±) cis/trans 3-(2 2-dichloroethenyl) 2 2 dimethylcyclopropane carboxylate (zeta-cypermethrin CAS RN 52315-07-8) (s)-alpha-cyano-3-phenoxybenzyl (1R 3R)-3-(2 2-dibromovinyl)-2 2-dimethylcyclopropanecarboxylate (deltamethrin CAS RN 52918-63-5) alpha-cyano-3-phenoxybenzyl 2 2 3 3 -tetramethyl cyclopropoanecarboxylate (fenpropathrin CAS RN 64257-84-7) (RS)-alpha-cyano-3-phenoxybenzyl(R)-2-[2-chloro-4-(trifluoromethyl)anilino]-3-methylbutanoate (tau-fluvalinate CAS RN 102851-06-9) (2 3 5 6-tetrafluoro-4-methylphenyl)methyl-(1-alpha 3-alpha)-(Z)-(±)-3-(2-chloro-3 3 3-trifluoro-1-propenyl)-2 2-dimethylcyclopropanecarboxylate (tefluthrin CAS RN 79538-32-2) (±)-cyano (3-phenoxyphenyl)methyl (±)-4-(difluoromethoxy)-alpha-(1-methyl ethyl)benzeneacetate (flucythrinate CAS RN 70124-77-5) cyano(4-fluoro-3-phenoxyphenyl)methyl 3-[2-chloro-2-(4-chlorophenyl)ethenyl]-2 2-dimethylcyclopropanecarboxylate (flumethrin CAS RN 69770-45-2) cyano(4-fluoro-3-phenoxyphenyl) methyl 3-(2 2-dichloroethenyl)-2 2-dimethyl-cyclopropanedarboxylate (cyfluthrin CAS RN 68359-37-5) (beta cyfluthrin CAS RN 68359-37-5) (transfluthrin CAS RN 118712-89-3) (S)-alpha-cyano-3-phenoxybenzyl(Z)-(1R-cis)-2 2-dimethyl-3-[2-(2 2 2-trifluoro-trifluoromethyl-ethoxycarbonyl)vinyl]cyclopropane carboxylate (acrinathrin CAS RN 101007-06-1) (1R cis) S and (1S cis) R enantiomer isomer pair of alpha-cyano-3-phenoxybenzyl-3-(2 2-dichlorovinyl)-2 2-dimethylcyclopropane carboxylate (alpha-cypermethrin CAS RN 67375-30-8)

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[1R 3S)3(1 RS)(1 2 2' 2'-tetrabromoethyl)]-2 2-dimethylcyclopropanecarboxylic acid (s)-alpha-cyano-3-phenoxybenzyl ester (tralomethrin CAS RN 66841-25-6) cyano-(3-phenoxyphenyl)methyl 2 2-dichloro-1-(4-ethoxyphenyl)cyclopropane carboxylate (cycloprothrin CAS RN 63935-38-6) [1α 3α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl 3-(2-chloro-3 3 3-trifluoro-1-propenyl)-2 2-dimethylcyclopropanecarboxylate (cyhalothrin CAS RN 68085-85-8) [1-alpha (s) 3-alpha(z)]-cyano(3-phenoxyphenyl)methyl-3-(2-chloro-3 3 3-trifluoro-1-propenyl)-2 2-dimethylcyclopropanecarboxylate (lambda cyhalothrin CAS RN 91465-08-6) (2-methyl-[1 1 -biphenyl]-3 yl)methyl-3-(2-chloro-3 3 3-trifluoro-1-propenyl)-2 2-dimethyl-cyclopropanecarboxylate (bifenthrin CAS RN 82657-04-3) 5-1-benzyl-3-furylmethyl-d-cis(1R 3S E)2 2-dimethyl-3-(2-oxo -2 2 4 5 tetrahydro thiophenylidenemethyl)cyclopropanecarboxylate (kadethrin RU15525 CAS RN 58769-20-3) [5-(phenylmethyl)-3-furanyl]-3-furanyl-2 2-dimethyl-3-(2-methyl-1-propenyl)cyclopropane carboxylate (resmethrin CAS RN 10453-86-8) (1R-trans) [5-(phenylmethyl)-3-furanyl]methyl 2 2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate (bioresmethrin CAS RN 28434-01 7) 3 4 5 6-tetrahydro-phthalimidomethyl-(1RS)-cis-trans-chrysanthemate (tetramethrin CAS RN 7696-12-0) 3-phenoxybenzyl-d l-cis trans 2 2-dimethyl-3-(2-methylpropenyl)cyclopropane carboxylate (phenothrin CAS RN 26002-80-2) (empenthrin CAS RN 54406-48-3) (cyphenothrin CAS RN 39515-40-7) (prallethrin CAS RN 23031-36-9) (imiprothrin CAS RN 72963-72-5) (RS)-3-allyl-2-methyl-4-oxcyclopent-2-enyl-(1S 3R 1R 3S)-2 2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (allethrin CAS RN 584-79-2) (bioallethrin CAS RN 584-79-2) and (ZXI8901 CAS RN 160791-64-0) In preferred embodiments the pyrethroid comprises tefluthrin lambda cyhalothrin bifenthrin permethrin or cyfluthrin

b an oxidiazine insecticide such as 5-(2-chloropynd-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1 3 5-oxadiazine 5-(2-chlorothiazol-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1 3 5-oxadiazine 3-methyl-4-nitroimino-5-(1-oxido-3-pyridinomethyl)perhydro-1 3 5-

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oxadiazine 5-(2-chloro-1-oxido-5-pyridiniomethyl)-3-methyl-4-nitroiminoperhydro-1 3 5-oxidiazine or 3-methyl-5-(2-methylpyrid-5-ylmethyl)-4-nitroiminoperhydro-1 3 5-oxadiazine

c a neonicotinoid Examples of useful neonicotinoid pesticides include thiamethoxam (CAS RN 153719-23-4) acetamiprid ((E)-N-[(6-chloro-3-pyridinyl)methyl]-N -cyano-N-methyleneimidamide CAS RN 135410-20-7) imidacloprid (1-[(6-chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimime CAS RN 138261-41-3) nitenpyram (N-[(6-chloro-3-pyridinyl)methyl]-N-ethyl-N'-methyl-2-nitro-1 1-ethenediamine CAS RN 120738-89-8) clothianidin (TI-435 (N-[(2-chloro-5-thiazoyl)methyl]-N -methyl-N"-nitro [C(E)]-(9Cl) guanidine CAS RN 210880-92-5) In other preferred embodiments the pesticide comprises a neonicotinoid insecticide such as imidacloprid thiamethoxam clothianidin dinotefuran flonicamid nithiazine or thiacloprid

d a pyrrol pyrazole or phenyl pyrazole such as chlorfenapyr (4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-trifluoromethylpyrrole-3-carbonitrile CAS RN 122453-73-0) fenpyroximate ((E)-1 1-dimethylethyl-4[[[[(1 3-dimethyl-5-phenoxy-1H-pyrazole-4-yl)methylene]amino]oxy]methyl]benzoate CAS RN 111812-58-9) tebufenpyrad (4-chloro-N[[4-1 1-dimethylethyl)phenyl]methyl]-3-ethyl-1-methyl-1H-pyrazole-5-carboxamide CAS RN 119168-77-3) or fipronil (5-amino-[2 6-dichloro-4-(trifluoromethyl)phenyl]-4-[(1R S)-(trifluoromethyl)sulfinyl]-1H-pyrazole-3-carbonitrile CAS RN 120068-37-3)

e a diacylhydrazine such as halofenozide (4-chlorobenzoate-2-benzoyl-2-(1 1-dimethylethyl) hydrazide CAS RN 112226-61-6) methoxyfenozide (RH-2485 N-tert-butyl-N -(3-methoxy-o-toluoyl)-3 5-xylohydrazide CAS RN 161050-58-4) or tebufenozide (3 5-dimethylbenzoic acid 1-(1 1-dimethylethyl)-2-(4-ethylbenzoyl)hydrazide CAS RN 112410-23-8)

f a triazole such as amitrole (CAS RN 61-82-5) and nazamate (ethyl-[[1-[(dimethylamino)carbonyl]-3-(1 1-dimethylethyl)-1H-1 2 4-triazol-5-yl]thio]acetate CAS RN 112143-82-5)

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g a biological/fermentation products selected from the group consisting of avermectin (abamectin CAS RN 71751-41-2) and spinosad (XDE-105 CAS RN 131929-60-7)

h an organophosphate insecticide selected from the group consisting of acephate (CAS RN 30560-19-1) chlorpyrifos (CAS RN 2921-88-2) chlorpyrifos-methyl (CAS RN 5598-13-0) diazinon (CAS RN 333-41-5) fenamiphos (CAS RN 22224-92-6) and malathion (CAS RN 121-75-5)

i a carbamate insecticide selected from the group consisting of aldicarb (CAS RN 116-06-3) carbaryl (CAS RN 63-25-2) carbofuran (CAS RN 1563-66-2) oxamyl (CAS RN 23135-22-0) and thiodicarb (CAS RN 59669-26-0)

j a fungicide such as a triazole fungicide selected from the group consisting of amitrol azaconazole bitertanol bromuconazole climbazole clotrimazole cyproconazole diclobutrazol difenoconazole diniconazole diniconazole-M epoxiconazole etaconazole fenbuconazole fluquinconazole fluotrimazole flusilazole flutriafol furconazole furconazole-cis hexaconazole imibenconazole ipconazole metconazole myclobutanil paclobutrazol penconazole propiconazole quinconazole simeconazole tebuconazole tetraconazole triadimefon triadimenol triazbutil triticonazole 1-(4-fluorophenyl)-2-(1H-1 2 4-triazole-1-yl)ethanone and mixtures thereof

k a fungicide such as fluquinconazole simeconazole tebuconazole tetraconazole triticonazole 1-(4-fluorophenyl)-2-(1H-1 2 4-triazole-1-yl)ethanone or mixtures thereof In particular the fungicide can be fluquinconazole simeconazole tebuconazole tetraconazole triticonazole or 1-(4-fluorophenyl)-2-(1H-1 2 4-triazole-1-yl)ethanone

l a fungicide such as a diazole selected from the group consisting of imazalil oxpoconazole pefurazoate prochloraz trifulmizole and mixtures thereof

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m a strobilurin type fungicide such as azoxystrobin dimoxystrobin famoxadone kresoxim-methyl metominostrobin picoxystrobin pyraclostrobin trifloxystrobin or mixtures thereof

In preferred embodiments the fungicide can be tebuconazole simeconazole fludioxonil fluquinconazole difenoconazole 4 5-dimethyl-N-(2-propenyl)-2-(trimethylsilyl)-3-thiophenecarboxamide (silthiofam) hexaconazole etaconazole propiconazole triticonazole flutriafol epoxiconazole fenbuconazole bromuconazole penconazole imazalil tetraconazole flusilazole metconazole diniconazole myclobutanil triadimenol bitertanol pyremethanil cyprodinil tridemorph fenpropimorph kresoxim-methyl azoxystrobin ZEN90160 fenpiclonil benalaxyl furalaxyl metalaxyl R-metalaxyl orfurace oxadixyl carboxin prochloraz trifulmizole pyrifenox acibenzolar-S-methyl chlorothalonil cymoaxnil dimethomorph famoxadone quinoxyfen fenpropidine spiroxamine triazoxide BAS50001F hymexazole pencycuron fenamidone guazatine or cyproconazole In more preferred embodiments the fungicide comprises silthiofam

When a pesticide is described herein it is to be understood that the description is intended to include salt forms of the pesticide as well as any isomeric and/or tautomeric form of the pesticide that exhibits the same activity as the form of the pesticide that is described

The pesticides that are useful in the present method can be of any grade or purity that pass in the trade as such pesticide Other materials that accompany the pesticides in commercial preparations as impurities can be tolerated in the subject methods and compositions as long as such other materials do not destabilize the composition or significantly reduce or destroy the activity of any of the pesticide components against a target pest(s) One of ordinary skill in the art of the production of pesticides would be able to readily identify those impurities that can be tolerated and those that cannot

The phytotoxic agents that are useful in the present invention can be provided in solid or liquid form and can be provided as emulsions

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dispersions solutions or in particulate form The phytotoxic agents can be alone or can be in combination with other materials as long as such other materials do not destabilize or significantly reduce or destroy the activity of the agent

The phytotoxic agent-free polymer coated seed can be treated with the phytotoxic agent such as a pesticide by any method that is commonly known or used for treating seeds with a pesticide

When the phytotoxic agent is a pesticide the amount of the pesticide that is applied to the seed can be any amount but is preferably between about 0 5 gm of the pesticide active ingredient / 100 kg of seed and about 2 000 gm / 100 kg of seed more preferably between about 25 gm and about 1 000 gm / 100 kg of seed and even more preferably between about 100 gm and about 800 gm / 100 kg of seed

The phytotoxic agent can be applied to the seed in any form and such forms as capsule suspensions (CS) emulsifiable concentrates (EC) emulsions in oil or water (EO and EW) granules (GR) suspension concentrates (SC) soluble granules (SG) soluble concentrates (SL) soluble powders (SP) and water dispersible granules (WG) are suitable It is preferred to apply the agent to the seed in the form of a flowable liquid The agent can be in a true solution in the liquid or it can be present as small droplets or particles to form a suspension dispersion or emulsion Since many pesticides have low water solubility it is preferred that when water is the liquid an aqueous dispersion suspension or emulsion of the pesticide be used and that the pesticide be present in the dispersion suspension or emulsion in the form of small particles or droplets As used herein the term "suspension will be considered to include any form of liquid containing small particles and to include the terms dispersion and emulsion

The particles of pesticide in the liquid suspension can be of any size that permits the suspension to be applied to the seed by any means such as for example by spraying It is preferred that the particles of pesticide in the suspension have a number average nominal size of less than about

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10 microns more preferably of less than about 5 microns even more preferably of less than about 2 microns and even more preferably of less than about 1 micron (be "sub-micron" in size) It is believed that the use of such small particles causes the pesticide to form a more stable and homogenous suspension – thereby allowing a more even distribution of the pesticide over the surface of the seed and that the small particles are less subject to abrasion from the treated seed after the pesticide treatment has been applied

The phytotoxic agent can be applied to the seed in any type of conventional seed treatment or coating equipment Application in a seed treating machine having the characteristics of a CMS seed coating machine (Vector Corporation Marion IA) for example has been found to be suitable One method that has been found to be successful for applying a phytotoxic agent to seed is to mill the solid agent to 1 – 2 micron or to sub-micron size and then to add the small particles of the agent to water to form an aqueous suspension A mill that is capable of reducing solids to fine particles such as a Mirco-Jet Pulverizer air mill available from Fluid Energy Processing and Equipment Company Hatfield PA can be used for the size reduction

When the phytotoxic agent is a pesticide the concentration of the pesticide in the suspension should be low enough to permit easy handling and application of the suspension to the coated seed – such as by spraying – and thorough distribution of the pesticide among the coated seeds so that the outer surface of each seed is substantially covered However the concentration should be high enough that when used in combination with the other parameters of seed treatment to avoid the loss of pesticide from the seeds by dripping or pooling of the treating liquid suspension Pesticide concentrations of between about 0 1% and about 50% by weight are useful for such suspensions preferred are concentrations between about 0 5% and 15% by weight even more preferred are concentrations between about 0 6% and about 5% and yet more preferred are concentrations of the pesticide between about 1% and

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3% by weight of the suspension Sticking agents and dyes can also be added to the pesticide suspension to promote the adherence of the suspension to the coated seeds and to identify the seeds as having been treated

A desired amount of the suspension of the pesticide can be sprayed into the seed in for example a CMS seed treater over a period of time that is long enough to permit thorough distribution of the suspension over the seed but short enough so that the treated seed do not completely dry It is believed that if the treated seed are allowed to remain in a heated seed treater until the suspension is completely dry the danger of loss of the pesticide by abrasion increases By way of example when the exit temperature of the heated air circulating through the CMS machine is held to about 95 °F and the aqueous suspension contains about 1 6% by weight imidacloprid and 8% by weight of a sticking agent an application time of between about 3 minutes and about 20 minutes is suitable and an application time of between about 5 and about 15 minutes is preferred

Seeds that have been treated by the subject method can be stored handled and planted like any other seeds Similar methods and conditions can be used as are used with any other treated or non-treated seeds and the same handling and planting equipment can be used that is used for conventional seeds

The coated and treated seeds of the present invention can be overcoated with one or more coatings applied after the seeds have been treated with the phytotoxic agent These later coatings can contain dyes binders absorbents and other useful materials and can be applied for the purpose of safety protection abrasion resistance or the like

The following examples describe preferred embodiments of the invention Other embodiments within the scope of the claims herein will be apparent to one skilled in the art from consideration of the specification or practice of the invention as disclosed herein It is intended that the specification together with the examples be considered to be exemplary only with the scope and spirit of the invention being indicated by the

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claims which follow the examples In the examples all percentages are given on a weight basis unless otherwise indicated

GENERAL PROCEDURES

Method of coating seed with a polymer

Seeds were coated with polymers in a CMS Seed Treater model PSC-0 5 In the normal procedure 750 g of corn seed or 500g of sorghum seed was added to the revolving drum of the CMS Treater Water soluble polymers that were to be used for the coating were placed into solution in water Non-water soluble polymers were dispersed into water to form a polymer latex dispersion Polymer solutions and polymer latexes that are obtained directly from a supplier can also be used with or without further modification A measured amount of the polymer solution r latex dispersion was sprayed onto the seeds to provide a polymer coating of the thickness that was desired The polymer coating was dried by hot air blowing through the tumbling seed bed to form a cured polymer coating having a certain pre-determined thickness All machine settings were according to the manufacturer's recommendations and within normal limits as would be understood by one having skill in the art of seed coating

Method of treating seed with a pesticide

Agrochemical agents normally a pesticide with a herbicide safener were applied to polymer-coated seeds in a Hege Model 11 seed treater When a herbicide safener was applied as a part of the seed treatment regimen Concep III (having 74 3% fluxofenin as its active ingredient available from Novartis Crop Protection Inc. Greensboro NC) was used

Seeds to be treated were placed in the bowl of the Hege 11 machine the Hege motor was turned on and the premixed Concep III and pesticide were applied into the bed of tumbling seed via syringe Mixing was allowed to continue for about 40 sec

Warm germination test

This test was used to determine the maximum germination potential of untreated seeds and seeds that were subjected to treatment

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50 sheets of regular weight size 12 in X 18 in germination testing towels were soaked overnight in 840 ml of tap water 50 seeds were placed on a wet sheet using Hoffman Manufacturing germination trays The sheet with seeds was covered with a second towel and rolled up Four replicates were run for each sample

The rolled towels were placed in an upright position in a 1000 ml beaker which was covered with a polyethylene bag to prevent drying The container was placed in an alternating temperature germination incubator set for providing cycles of 20°C for 16 hrs followed by 30°C for 8 hrs

Final count of germinated seeds was made after 7 days Percent germination was determined as the average number of seeds which had germinated within the test period minus any abnormal seeds divided by the total number of original seeds times 100

Cold germination test

This test was designed to measure the ability of seeds to germinate under adverse condition associated with high soil moisture low soil temperature and microbial activity

A soil mixture was prepared by thoroughly mixing 6 liters of medium grade sand 6 liter of sifted peat moss and 1 liter of water One-half inch of the soil mixture was placed in the bottom of a tray and leveled One hundred (100) seeds were placed on top of the soil and an additional 1/2 in of soil is placed over the seeds and leveled Four replicates each having 100 seeds were run for each sample

The containers were placed in a cold (10°C) dark room for 7 days After 7 days containers were moved to a warm (25°C) dark room for 3 days Emerging seedlings were evaluated as either normal or abnormal and counted Germination rate was determined as described above

COMPARATIVE EXAMPLE 1

This example illustrates the properties of coatings of several polymers formed on corn seeds

Coatings of 21 different polymers and one wax emulsion were formed on corn seeds by the method described above Table 1 lists the

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different polymers that were tested and describes the chemical makeup of the polymer the pH of the polymer emulsion the average particle size of the solids in the emulsion the glass transition temperature of the polymer (T_g) the minimum film-forming temperature of the polymer (MFT) and the type of surfactant (if any) that was provided with the emulsion by the manufacturer It was noticed that the MFT was roughly related to the T_g for the polymers for which this data was available but that these values did not always correlate precisely

Table 2 shows the physical properties of coatings on corn seed that were formed from the polymer emulsions described in Table 1 The moisture content of the seeds after treatment (Water %) was reported and the quality of the film was analyzed according to three parameters

The integrity of the coating coverage of the seed was estimated by visual inspection (under magnification if needed) Coverage was rated according to the following scale

+++++ = No visual holes are observed

++++ = There are some small holes on the coating and the size of the holes is about 1 mm or above

+++ = 70-95% of the seed surface is covered with the coating

++ = 50-70% of the seed surface is covered with the coating

+ = <50% of the seed surface is covered with the coating

The adhesion of the coating to the seed was tested by adhering a piece of Scotch® brand adhesive tape to a part of a seed that was covered by a coating and then peeling off the tape and determining how much of the coating was removed from the seed The degree of adhesion was described according to the following scale

+++++ = No coating comes off

++++ = 10-20% of the coating from taped area comes off

+++ = 30-50% of the coating from taped area comes off

++ = >50% of the coating from taped area comes off

The quality of the film (Film) was evaluated by the appearance of the coating on the surface of the seed according to visual inspection

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Table 1 Physical properties of polymers and polymer emulsions

	Name	Type of Materials	pH	Particle Size (um)	Tg (C)	MFT (C)	Surfactant Type	Comment
1	Vinamul 18132	PVA						
2	Vinac XX-210	PVA	4 5-6 0		35		PVOH	
3	Polymer 208	St-Acrylate						
4	Vinamul 6975	P(VA-Veo)	4 0-5 0	0 5	22	15	Cell Ether	
5	Mowilith DM2452	P(VA-Veo-Acryl)	5 0-7 0	15	16	12		
6	Mowilith LDM2110	P(VA-Veo)	3 5-5	0 1 1 0	17	8		
7	Mowilith LDM1355	P(VA-E Veo)	3 0-5 0	0 5	7	0		
8	Mowilith DM778	P(Acryle)	7 5-8 5	12	28	20		
9	Mowilith LDM2340	P(VA-Veo)	5 5-6 5	0 19	27	16		
10	Premafresh 50-V	Carnauba wax emulsion						Wax emulsion from Pace International Ltd
11	Airflex 4500	P(E VC)	7 0-9 0	0 12	3	4	Anionic	Contained Amide Group
12	Airflex4514	P(E-VC)	7 0-9 0	0 12	12	14	Anionic	Contained Amide Group
13	Airflex4530	P(E-VC)	7 0-9 0	0 11	29	50	Anionic	Contained Amide Group
14	Airflex500	P(VA-E)	5 0-6 0	0 17	5	<0	Nonionic	
15	Flexbond289	St-Acrylate			65			
16	Flexbond 381	P(VA-BA)	4 0-6 0	0 3	13	6	Nonionic	
17	Latex 32	PVF	3 0-6 0		High			
18	PolycotsC							
19	CP620NA S/B Latex	S/B	6 0	0 175		15		Carboxylation Low
20	PB 6820 NA S/A Latex	S/A	7 0	0 16	28	28		Carboxylation Medium
21	FC 1040 S/B Latex	S/B	6 0	0 155		15		Carboxylation Medium
22	CP 6810 NA S/B Latex	S/A	6 5	0 155		<4		Carboxylation Medium

MFT Minimum Film Forming Temperature (deg C) Particle Size is average particle size Ether Cellulose Ether VA Vinylacetate E Ethylene St Styrene VC Vinylchloride BA Butyl Acrylate S/B Styrene-Butadiene S/A Styrene-Acrylate PVA = poly(vinyl acetate)

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Table 2: Properties of polymer coatings on corn seed.

	Name	Type of Materials	Manufacture	Adhesion	Coverage	Film	Water%	Tg ©
1	Vinamul 18132	PVA	Vinamual LTd.	++++	++++	+++++		
2	Vinac XX-210	PVA	Air-Product	+++	++	+++++		35
3	Polymer 208	St-Acrylate	Kannar	+++++	+++++	++++	12.35	
4	Vinamul 6975	P(VA-Veo)	Vinamual LTd.	++++	+++++	++++	13.01	22
5	Mowilith DM2452	P(VA-Veo-Acryl)	Clariant	+++	+++	+++	12.76	18
6	Mowilith LDM2110	P(VA-Veo)	Clariant	+++	++++	+++	13.25	17
7	Mowilith LDM1355	P(VA-E-Veo)	Clariant	+++++	+++	+++++	12.66	-7
8	Mowilith DM778	P(Acryls)	Clariant	+++	+++++	++++	13.23	28
9	Mowilith LDM2340	P(VA-Veo)	Clariant	+++++	++++	+++	12.69	27
10	Premafresh 50-V	Carnauba	Pace International	+++	+++	+	13.41	
11	Airflex 4500	P(E-VC)	Air-Product	+++++	++	++++	13.27	3
12	Airflex4514	P(E-VC)	Air-Product	+++++	+++++	++++	12.43	12
13	Airflex4530	P(E-VC)	Air-Product	++	++	+	12.57	29
14	Airflex500	P(VA-E)	Air-Product	+++++	++++	+++++	12.79	5
15	Flexbond289	St-Acrylate	Air-Product	+++	+++	++	11.48	85
16	Flrxbond 381	P(VA-BA)	Air-Product	++++	+++++	++++	13.35	13
17	Latex 32	PVF	Kynar	++	+++	+	12.52	High
18	PolycoteC		Subsahara	+++	++++	+++	13.04	
19	CP620NA S/B Latex	S/B	Dow	+++++	+++++	++++	12.68	
20	PB 6820 NA S/A Late)	S/A	Dow	++++	+++++	++++	12.6	28
21	FC 1040 S/B Latex	S/B	Dow	+++	+++++	++++	13.89	
22	CP 6810 NA S/B Late)	S/A	Dow	+++++	+++++	++++	13.63	

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(under magnification as needed) The quality was expressed according to the following scale

++++ = Coherent film having no unfused polymer particles

++++ = Less than 5% of unfused polymer particles

+++ = Unfused polymer particles (20-5%)+ film (80-95%)for the coating covered area

++ = Unfused polymer particles(50-80%) + film (50-20%) for the coating covered area

\+ = Unfused polymer particles on the surface of the seed

In general coatings that were formed from Polymer 208 Vinamul 6975 Mowilith LDM2110 Mowilith DM778 Premafresh 50-V Airflex 4514 Flexbond 381 CP620NA S/B Latex PB 6820 NA S/A Latex FC 1040 S/B Latex and CP 6810 NA S/B Latex provided coating properties that were superior to the other polymers tested

EXAMPLE 1

This example illustrates the coating of sorghum seeds with polyvinylacetate followed by treatment with different levels of imidacloprid and fluxofenin safener

Sorghum seeds were coated with 10 micron and 50 micron thick coatings of polyvinylacetate (Vinac XX-210 available from Air Products as a 55% d s emulsion in water) and then treated with three different rates of fluxofenin (Concep III available from Novartis Crop Protection Inc) and imidacloprid (available as Gaucho 600 containing 48 7% imidacloprid from Gustafson LLC Plano TX) Concep III/ Gaucho rates used were 50 / 250 gram 100 / 500 gram and 150 / 750 grams per 100 kg of seeds The germination rate of the seeds was tested by cold germination and warm germination tests on the day that the treatment was administered (T0) and the seeds were then stored at a temperature of 35°C to simulate accelerated aging In the warm germination test, treated seeds and untreated controls were again tested for germination rate after 8 days (T8) 14 days (T14) 33 days (T33) 120 days (T120) and 161 days

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(T161) Germination rates obtained from the warm germination test are shown in Figure 1 Germination rates for the cold germination test were determined at approximately the same time intervals and are shown in Figure 2

Figures 1 and 2 show the effects of time-after-treatment pesticide treatment rate and coating thickness on germination in warm and cold germination tests respectively It was seen that the presence of pesticide on the seed reduced the germination rate in both warm and cold germ tests and that without a polymer coating the reduction in germination rate was more pronounced for cold germination For both warm and cold germination it was found that increasing pesticide rates markedly reduced the germination rate Seeds having either a 10μ or a 50μ polymer coating prior to pesticide treatment had improved germination rates compared to seeds without any polymer coating Also the germination rate was increased as the coating thickness was increased from 10μ to 50μ

In the warm germination test at the highest level of pesticide treatment after 14 days of aging at 35°C seeds having 50μ coatings had a germination rate of 70% vs 40% for uncoated seeds with the same rate of pesticide treatment In the cold germination test for similar seeds and similar conditions coated seeds showed germination rates of 60% vs 30% for uncoated seeds

EXAMPLE 2

This example illustrates the effect of the properties of the polymer coating upon seed germination rate

Sorghum seeds were first coated as described above with a 5 micron thick coating of different blends of hydroxypropyl cellulose and methyl cellulose which contained different ratios of hydroxypropyl and methyl groups The polymers used were Methocel E50LV (a 2% w/w solution in water having a viscosity of 40 - 60 mPa at 25°C) Methocel E3LV (a 2% w/w solution in water having a viscosity of 2 4 - 3 6 mPa at 25°C) and Methocel A15LV (a 2% w/w solution in water having a viscosity of 12 - 18 mPa at 25°C) (all available from Dow Chemical Co Midland

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MI and used as 5% d s emulsions in water) Coated seeds were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed After treatment untreated and treated seeds were tested for warm germination and cold germination on the same day as the treatment (T0) and again after accelerated aging at 35°C for 7 days (T7) 14 days (T14) and 33 days (T33) The resulting data are shown in Figure 3 for the warm germination test, and in Figure 4 for the cold germination test

The data for both warm and cold germination tests show that the presence of the pesticide on uncoated seeds reduces the germination rate significantly compared with seeds having no pesticide treatment At 31 days for example the addition of the pesticide causes the warm germination rate to drop from about 86% to about 60% and the cold germination rate to drop from about 75% to about 49% The addition of any of the three polymer coatings provided significant protection to the seeds The coating comprising Methocel E3 LV performed best while the coating comprising Methocel A15LV performed next best, and the coating comprising Methocel E50LV performed least well of the three but still provided significant protection over pesticide treated seeds having no polymer coating This order of performance was the same for both the warm germination and the cold germination tests

Without being bound by this or any other theory it is believed that the viscosity of the water solutions of these polymers had an effect on the integrity of the films that were produced on the seeds It appeared that coating solutions having lower viscosities provided coatings that performed better than coating solutions that had higher viscosities

EXAMPLE 3

This example illustrates the effect of the type of polymer used for the coating and the rate of pesticide application upon seed germination rate

Sorghum seeds (DK40Y 1752 KXM from DeKalb Genetics) were coated as described above with a 10 micron thick coating of one of five different polymers Control seeds were prepared without any polymer

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coating The polymers used were SB-2000 (a proprietary starch-based polymer available from Seedbiotics Inc Caldwell ID) Vinac XX-210 (polyvinlyacetate in polyvinylalcohol-protected emulsion available from Air Products and Chemicals Inc Allentown PA) Maltrin MO40 (maltodextrin available from GPC Inc Muscatine IA) Airflex 500 (polyvinylacetate/ethylene copolymer available from Air Products and Chemicals Inc. Allentown PA) and Flexbond 289 (vinylacrylate polymer available from Air Products and Chemicals Inc Allentown PA) All polymers were used as water emulsions Coated seeds were either left untreated (0x treatment) or were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed (1x treatment) After treatment untreated and treated seeds were tested for warm germination rate on the same day as the treatment (T0) and again after accelerated aging at 35°C for 7 days (T7) 15 days (T15) 36 days (T36) 61 days (T61) 93 days (T93 and 124 days (T124) The resulting data are shown in Figure 5

The data for the warm germination rate test showed that the presence of any of the polymer coatings reduced the germination rate for seeds having no pesticide treatment The reduction was either negligible (less than about 5% below the germination rate for no coating at 124 days Flexbond 289 Vinac XX-210) moderate (less than about 8% reduction Maltrin MO40) or higher (less than about 10% reduction SB-2000 Airflex 500) When seeds were treated with Concep III / Gaucho at rate of 50/250 grams per 100 kg of seed the warm germination rate of uncoated seed was reduced from about 87% at 124 days (for non-pesticide treated seed) to just under 70% Seeds coated with 10μ coatings of Vinac XX-210 (having an MTF of about 35°C) and Maltrin MO40 had higher germination rates than uncoated seed indicating that the polymer coating provided protection for the seed Seeds coated with Airflex 500 (MFT of < 0°C) or Flexbond 289 performed at about the same germination level as uncoated seeds Germination rate of seeds coated with 10μ coatings of SB-2000 (having an MFT of about 50°C) was almost 10% lower than uncoated seeds

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This data indicated that different types of polymers differed in their ability to protect seeds from phytotoxicity of overcoated pesticides when applied to the untreated seed as 10μ coatings

EXAMPLE 4

This illustrates the effect the thickness and the type of polymer used for seed coating on the warm germination rate of seeds to be treated with a pesticide

Sorghum seeds (DeKalb DK40Y 1752KXM) were coated as described above with 5μ coatings of one of seven different polymers One of the polymers was used to form three additional coatings of increasing thicknesses – 10μ 20μ and 50μ) Control seeds were prepared without any polymer coating (control 1) The polymers used (and the coating thickness) were Maltrin MO40 (5μ) Methocel E3LV (5μ) Methocel E50LV (5μ) Methocel A15LV (5μ) Airflex 500 (5μ + 1% talc) Flexbond 289 (5μ) and Vinac XX-210 (at 5μ 10μ 20μ and 50μ) All polymers were used as water emulsions Coated seeds were either left untreated (control 2) or were treated with Concep III / Gaucho 600 at the rate of 50/250 grams per 100 kg of seed After treatment untreated and treated seeds were tested for warm germination rate on the same day as the treatment (T0) and again after accelerated aging at 35°C for 7 days (T7) 14 days (T14) 31 days (T31) 61 days (T61) and 95 days (T95) The resulting data are shown in Figure 6

The data for the germination rate test showed that after 95 days of aging the germination rate of uncoated seeds that were treated with pesticide had dropped to almost 24% vs about 85% for uncoated and untreated seeds All coated/treated seeds having 5μ polymer coatings had higher germination rates at 95 days than uncoated/treated seeds In order of improving germination rate at 95 days were coated/treated seeds having coatings of Vinac XX-210 (28% germination) Methocel E50LV (31%) Flexbond 289 (33%) Maltrin MO40 (41%) Methocel A15LV (44%) Airflex 500 + 1% talc (50%) and Methocel E3LV (64 5%) These data

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illustrated that different types of polymers provided different levels of protections when used at the same coating thickness In general it appeared that polymers that provided a coating solution or latex having low viscosity and having a low MFT gave better protection that did polymers having a high solution or latex viscosity and a high MFT

For seeds that had been treated with different coating thicknesses of Vinac XX-210 germination rates were 28 5% for 5μ 44 5% for 10μ 38% for 20μ and 43% for 50μ This showed that the beneficial effects of coating thickness did not simply increase with increasing coating thickness but seemed to reach a peak or maximum where further coating thickness did not result in further improvement of protection

EXAMPLE 5

This illustrates the effect the thickness and the type of polymer used for seed coating on the cold germination rate of seeds to be treated with a pesticide

This test substantially duplicated Example 4 except that a cold germination test was run on the treated seeds to determine the effects of the coatings under adverse germination/sprouting conditions The resulting data are shown in Figure 7

Compared with warm germination the cold germination test resulted in lower overall germination rates at the end of the test (94 days) Germination rate for uncoated/untreated control was about 60% vs 14% for uncoated/treated seeds All coatings except one provided protection for the seed and resulted in higher germination rates In order of improved germination rates the performance was Vinac XX-210 (10% germination) Methocel E50LV (14%) Flexbond 289 (15%) Maltrin MO40 (23 5%) Methocel A15LV (26%) and Methocel E3LV (34 5%) This was the same ranking as found in the warm germination test and indicated that polymer properties that determined suitability for the present use did not vary disproportionately as between the polymers tested over the temperature range spanned by the warm and cold germination tests In other words

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polymers that work well at warm temperatures also seem to work well at cold temperatures

For seeds that had been treated with different coating thicknesses of Vinac XX-210 germination rates were 10% for 5μ 18% for 10μ 16% for 20μ and 22 5% for 50μ As in Example 4 this showed that the beneficial effects of coating thickness did not simply increase with increasing coating thickness but seemed to reach a plateau where further coating thickness did not result in significant further improvement of protection

All references cited in this specification including without limitation all papers publications patents patent applications presentations texts reports manuscripts brochures books internet postings journal articles periodicals and the like are hereby incorporated by reference into this specification in their entireties The discussion of the references herein is intended merely to summarize the assertions made by their authors and no admission is made that any reference constitutes prior art Applicants reserve the right to challenge the accuracy and pertinency of the cited references

In view of the above it will be seen that the several advantages of the invention are achieved and other advantageous results obtained

As various changes could be made in the above methods and compositions without departing from the scope of the invention it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense

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WHAT IS CLAIMED IS

1 A method of improving the germination rate of plant seeds which are treated with a phytotoxic agent
the method comprising
forming a polymer coating on the plant seed before treating the seed with the phytotoxic agent where the coating is free of the phytotoxic agent and where the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen to maintain the seed s viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination and
treating the coated plant seed with the phytotoxic agent

2 The method according to claim 1 wherein the coating comprises a polymer in an amount of over 10% by weight

3 The method according to claim 2 wherein the coating comprises a polymer in an amount of at least about 50% by weight

4 The method according to claim 1 wherein the coating thickness is less than about 500 microns

5 The method according to claim 1 wherein the coating thickness is between about 1 micron and about 500 microns

6 The method according to claim 5 wherein the coating thickness is between about 1 micron and about 480 microns

7 The method according to claim 6 wherein the coating thickness is between about 2 micron and about 400 microns

8 The method according to claim 7 wherein the coating thickness is between about 3 micron and about 300 microns

9 The method according to claim 8 wherein the coating thickness is between about 5 micron and about 200 microns

10 The method according to claim 9 wherein the coating thickness is between about 8 micron and about 100 microns

11 The method according to claim 10 wherein the coating thickness is between about 10 micron and about 50 microns

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12 The method of claim 1 wherein the polymer is one having a minimum film-forming temperature of lower than 55°C

13 The method of claim 12 wherein the polymer comprises a material selected from the group consisting of maltodextrin methylcellulose ethylcellulose hydroxypropylcellulose hydroxypropyl/methylcellulose vinyl acetate - ethylene polymers ethylene-vinyl chloride polymers vinyl acetate polymers vinyl-acrylic polymers starch-based polymers SB-2000 polyvinyl acetate -vinyl chloride polymers vinyl chloride/ vinyl acetate/ ethylene copolymers styrene-acrylate copolymers vinylacetate polymers vinylbutyrate polymers styrene-vinylbutyrate copolymers acrylate polymers styrene-butadiene copolymers vinylacetate-vinylbutyrate copolymers vinylacetate-vinylversatate copolymers and polyvinylalcohol

14 The method of claim 12 wherein the polymer comprises polyvinylacetate

15 The method of claim 12 wherein the polymer comprises methocel

16 The method of claim 1 wherein the seed is the seed of an agronomic plant.

17 The method of claim 16 wherein the agronomic plant is selected from the group consisting of cereals (wheat barley rye oats rice sorghum related crops etc) beet pear-like fruits stone fruits and soft fruits (apple pear plum peach Japanese apricot prune almond cherry strawberry raspberry black berry tomato pepper etc) legumes (kidney bean lentil pea soybean) oil plants (rape canola mustard poppy olive sunflower coconut castor cocoa bean peanut soybean corn etc) Cucurbitaceae (pumpkin cucumber melon etc) citrus (orange lemon grape fruit mandarin Watson pomelo (citrus natsudaidai) etc) vegetables (lettuce cabbage celery cabbage Chinese radish carrot, onion potato etc) camphor trees (avocado cinnamon camphor etc) corn tobacco nuts coffee sugar cane tea grapevine hop and banana

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18 The method of claim 17 wherein the agronomic plant is selected from the group consisting of rice wheat barley rye corn potato carrot sweet potato, sugar beet bean pea chicory lettuce cabbage cauliflower broccoli turnip radish spinach asparagus onion garlic eggplant pepper celery canot squash pumpkin zucchini cucumber apple pear quince melon plum cherry peach nectarine apricot strawberry grape raspberry blackberry pineapple avocado papaya mango banana, soybean tomato sorghum and raspberries banana and other such edible varieties

19 The method of claim 18 wherein the agronomic plant is selected from corn soybeans cotton sorghum rape (canola) rice wheat barley and rye

20 The method of claim 19 wherein the agronomic plant is corn soybeans or cotton

21 The method of claim 1 wherein the phytotoxic agent is selected from the group consisting of pesticides fertilizers plant growth regulators drugs dyes biological attractants scents pheromones and mixtures thereof

22 The method of claim 21 wherein the phytotoxic agent comprises a pesticide selected from the group consisting of herbicides molluscicides insecticides nematocides acaricides fungicides bactericides and mixtures thereof

23 The method of claim 21 wherein the pesticide is selected from the group consisting of pyrethrins synthetic pyrethroids azoles oxadizine insecticides neonicotinoids diazoles triazoles strobilurin derivatives organophosphates pyrrols pyrazoles phenyl pyrazoles diacylhydrazines biological/fermentation products carbamates and mixtures thereof

24 The method of claim 22 wherein the pesticide comprises an insecticide

25 The method of claim 24 wherein the insecticide comprises a pyrethroid or synthetic pyrethrin

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26 The method of claim 25 wherein the pyrethrin comprises a member selected from the group consisting of 2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one ester of 2 2-dimethyl-3-(2-methylpropenyl)-cyclopropane carboxylic acid (2-methyl-1-propenyl)-2 methoxy-4-oxo-3-(2-propenyl)-2-cyclopenten-1-yl ester and mixtures of cis and trans isomers thereof

27 The method of claim 25 wherein the pyrethroid comprises a member selected from the group consisting of (s)-cyano(3-phenoxyphenyl)methyl-4-chloro alpha (1-methylethyl)benzeneacetate (fenvalerate CAS RN 51630 58-1) (S)-cyano-(3-phenoxyphenyl)methyl (S)-4-chloro-alpha-(1-methylethyl)benzeneacetate (esfenvalerate CAS RN 66230-04-4) (3-phenoxyphenyl)-methyl(+)cis-trans-3-(2 2-dichoroethenyl)-2 2-dimethylcyclopropanecarboxylate (permethrin CAS RN 52645-53-1) (±) alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis trans-3-(2 2-dichloroethenyl)-2 2-dimethyl-cyclopropane carboxylate (cypermethrin CAS RN 52315-07-8) (beta-cypermethrin CAS RN 65731-84-2) (theta cypermethrin CAS RN 71697-59-1) S-cyano (3-phenoxyphenyl)methyl (±) cis/trans 3-(2 2-dichloroethenyl) 2 2 dimethylcyclopropane carboxylate (zeta-cypermethrin CAS RN 52315-07-8) (s)-alpha-cyano-3-phenoxybenzyl (1R 3R)-3-(2 2-dibromovinyl)-2 2-dimethylcyclopropanecarboxylate (deltamethrin CAS RN 52918-63-5) alpha-cyano-3-phenoxybenzyl 2 2 3 3 -tetramethyl cyclopropoanecarboxylate (fenpropathrin CAS RN 64257-84-7) (RS)-alpha-cyano 3-phenoxybenzyl(R)-2-[2-chloro-4-(trifluoromethyl)anilino]-3-methylbutanoate (tau-fluvalinate CAS RN 102851-06-9) (2 3 5 6-tetrafluoro-4-methylphenyl)methyl-(1-alpha 3-alpha)-(Z)-(±)-3-(2-chloro-3 3 3-trifluoro-1-propenyl)-2 2-dimethylcyclopropanecarboxylate (tefluthrin CAS RN 79538-32-2) (±)-cyano (3-phenoxyphenyl)methyl (±)-4-(difluoromethoxy)-alpha-(1-methyl ethyl)benzeneacetate (flucythrinate CAS RN 70124-77-5) cyano(4-fluoro-3-phenoxyphenyl)methyl 3-[2-chloro-2-(4-chlorophenyl)ethenyl]-2 2-dimethylcyclopropanecarboxylate (flumethrin CAS RN 69770-45-2) cyano(4-fluoro-3-phenoxyphenyl)

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methyl 3-(2 2-dichloroethenyl)-2 2-dimethyl-cyclopropanedarboxylate (cyfluthrin CAS RN 68359-37-5) (beta cyfluthrin CAS RN 68359-37-5) (transfluthrin CAS RN 118712-89-3) (S)-alpha-cyano-3-phenoxybenzyl(Z)-(1R-cis)-2 2-dimethyl 3-[2-(2 2 2-trifluoro-trifluoromethyl-ethoxycarbonyl)vinyl]cyclopropane carboxylate (acrinathrin CAS RN 101007-06-1) (1R cis) S and (1S cis) R enantiomer isomer pair of alpha-cyano-3-phenoxybenzyl-3-(2 2-dichlorovinyl)-2 2-dimethylcyclopropane carboxylate (alpha-cypermethrin CAS RN 67375-30-8) [1R 3S)3(1 RS)(1 2 2 2-tetrabromoethyl)]-2 2-dimethylcyclopropanecarboxylic acid (s)-alpha-cyano-3-phenoxybenzyl ester (tralomethrin CAS RN 66841-25-6) cyano-(3-phenoxyphenyl)methyl 2 2-dichloro-1-(4-ethoxyphenyl)cyclopropane carboxylate (cycloprothrin CAS RN 63935-38-6) [1α 3α(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl 3-(2-chloro-3 3 3-trifluoro-1 propenyl)-2 2-dimethylcyclopropanecarboxylate (cyhalothrin CAS RN 68085-85-8) [1-alpha (s) 3-alpha(z)]-cyano(3-phenoxyphenyl)methyl-3-(2-chloro-3 3 3-trifluoro-1-propenyl)-2 2-dimethylcyclopropanecarboxylate (lambda cyhalothrin CAS RN 91465-08-6) (2-methyl-[1 1'-biphenyl]-3-yl)methyl-3-(2-chloro-3 3 3-trifluoro-1-propenyl)-2 2-dimethyl-cyclopropanecarboxylate (bifenthrin CAS RN 82657-04-3) 5-1-benzyl-3-furylmethyl-d-cis(1R 3S E)2 2-dimethyl-3-(2-oxo -2 2 4 5 tetrahydro thiophenylidenemethyl)cyclopropanecarboxylate (kadethrin RU15525 CAS RN 58769-20-3) [5-(phenylmethyl)-3-furanyl]-3-furanyl-2 2-dimethyl-3-(2-methyl-1-propenyl)cyclopropane carboxylate (resmethrin CAS RN 10453-86-8) (1R-trans)-[5-(phenylmethyl)-3-furanyl]methyl 2 2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate (bioresmethrin CAS RN 28434 01-7) 3 4 5 6-tetrahydro-phthalimidomethyl-(1RS)-cis-trans-chrysanthemate (tetramethrin CAS RN 7696-12-0) 3-phenoxybenzyl-d l-cis trans 2 2-dimethyl-3-(2-methylpropenyl)cyclopropane carboxylate (phenothrin CAS RN 26002-80-2) (empenthrin CAS RN 54406-48-3) (cyphenothrin CAS RN 39515-40-7) (prallethrin CAS RN 23031-36-9) (imiprothrin CAS RN 72963-72-5) (RS)-3 allyl-2-methyl-4-oxcyclopent-2-enyl-(1S 3R 1R 3S)-

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2 2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (allethrin CAS RN 584-79-2) (bioallethrin CAS RN 584-79 2) and (ZXI8901 CAS RN 160791-64-0)

28 The method of claim 25 wherein the pyrethroid comprises a member selected from the group consisting of tefluthrin lambda cyhalothrin bifenthrin permethrin and cyfluthrin

29 The method of claim 23 wherein the pesticide comprises an oxidiazine insecticide that is selected from the group consisting of 5-(2-chloropyrid-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1 3 5-oxadiazine 5-(2-chlorothiazol-5-ylmethyl)-3-methyl-4-nitroiminoperhydro-1 3 5-oxadiazine 3-methyl-4-nitroimino-5-(1-oxido-3-pyridinomethyl)perhydro-1 3 5-oxadiazine 5-(2-chloro-1-oxido-5-pyridiniomethyl)-3-methyl-4-nitroiminoperhydro-1 3 5-oxidiazine and 3-methyl-5-(2-methylpyrid-5-ylmethyl)-4-nitroiminoperhydro-1 3 5-oxadiazine

30 The method of claim 23 wherein the pesticide comprises a neonicotinoid insecticide that is selected from the group consisting of acetamiprid imidaclopnd thiamethoxam clothianidin dinotefuran flonicamid nithiazine and thiaclopnd

31 The method of claim 23 wherein the pesticide comprises a neonicotinoid that is selected from the group consisting of thiamethoxam (CAS RN 153719-23-4) acetamipnd ((E)-N-[(6-chloro-3-pyridinyl)methyl]-N -cyano-N-methyleneimidamide CAS RN 135410-20-7) imidaclopnd (1-[(6-chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimime CAS RN 138261-41-3) nitenpyram (N-[(6-chloro-3-pyridinyl)methyl]-N-ethyl-N -methyl-2-nitro-1 1-ethenediamine CAS RN 120738-89-8) clothianidin (TI-435 (N-[(2-chloro-5-thiazoyl)methyl]-N -methyl-N -nitro [C(E)]-(9Cl)-guanidine CAS RN 210880-92-5)

32 The method of claim 23 wherein the pesticide comprises a pyrrol pyrazole or phenyl pyrazole that is selected from the group consisting ofchlorfenapyr (4-bromo-2-(4-chlorophenyl)-1-ethoxymethyl-5-trifluoromethylpyrrole-3-carbonitnle CAS RN 122453-73-0) fenpyroximate ((E)-1 1-dimethylethyl-4[[[[(1 3-dimethyl-5-phenoxy-1H-pyrazole-4-

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yl)methylene]amino]oxy]methyl]benzoate CAS RN 111812-58-9) tebufenpyrad (4-chloro-N[[4-1 1-dimethylethyl)phenyl]methyl]-3-ethyl-1-methyl-1H-pyrazole-5-carboxamide CAS RN 119168-77-3) and fipronil (5-amino-[2 6-dichloro-4-(trifluoromethyl)phenyl]-4-[(1R S)-(trifluoromethyl)sulfinyl]-1H-pyrazole-3-carbonitrile CAS RN 120068-37-3)

33 The method of claim 23 wherein the pesticide comprises a diacylhydrazine that is selected from the group consisting of halofenozide (4-chlorobenzoate-2-benzoyl-2 (1 1-dimethylethyl)-hydrazide CAS RN 112226-61-6) methoxyfenozide (RH-2485 N-tert-butyl-N -(3-methoxy-o-toluoyl)-3 5-xylohydrazide CAS RN 161050-58-4) and tebufenozide (3 5-dimethylbenzoic acid 1-(1 1-dimethylethyl)-2-(4-ethylbenzoyl)hydrazide CAS RN 112410-23-8)

34 The method of claim 23 wherein the pesticide comprises a triazole selected from the group consisting of amitrole (CAS RN 61-82-5) and triazamate (ethyl-[[1-[(dimethylamino)carbonyl]-3-(1 1-dimethylethyl)-1H-1 2 4-triazol-5-yl]thio]acetate CAS RN 112143-82-5)

35 The method of claim 23 wherein the pesticide comprises a biological/fermentation products selected from the group consisting of avermectin (abamectin CAS RN 71751-41-2) and spinosad (XDE-105 CAS RN 131929-60-7)

36 The method of claim 23 wherein the pesticide comprises an organophosphate insecticide selected from the group consisting of acephate (CAS RN 30560-19-1) chlorpyrifos (CAS RN 2921-88-2) chlorpyrifos-methyl (CAS RN 5598-13-0) diazinon (CAS RN 333-41-5) fenamiphos (CAS RN 22224-92-6) and malathion (CAS RN 121-75-5)

37 The method of claim 23 wherein the pesticide comprises a carbamate insecticide selected from the group consisting of aldicarb (CAS RN 116-06-3) carbaryl (CAS RN 63-25 2) carbofuran (CAS RN 1563-66-2) oxamyl (CAS RN 23135-22-0) and thiodicarb (CAS RN 59669-26-0)

38 The method of claim 22 wherein the pesticide comprises a fungicide

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39 The method of claim 38 wherein the fungicide comprises a triazole fungicide selected from the group consisting of amitrol azaconazole bitertanol bromuconazole climbazole clotrimazole cyproconazole diclobutrazol difenoconazole diniconazole diniconazole-M epoxiconazole etaconazole fenbuconazole fluquinconazole fluotrimazole flusilazole flutriafol furconazole furconazole-cis hexaconazole imibenconazole ipconazole metconazole myclobutanil paclobutrazol penconazole propiconazole quinconazole simeconazole tebuconazole tetraconazole triadimefon triadimenol triazbutil triticonazole 1 (4-fluorophenyl)-2-(1H 1 2 4-triazole-1-yl)ethanone and mixtures thereof

40 The method according to claim 39 wherein the fungicide comprises fluquinconazole simeconazole tebuconazole tetraconazole triticonazole 1-(4-fluorophenyl)-2-(1H-1 2 4-triazole-1-yl)ethanone or mixtures thereof

41 The method according to claim 40 wherein the fungicide comprises fluquinconazole

42 The method according to claim 40 wherein the fungicide comprises simeconazole

43 The method according to claim 40 wherein the fungicide comprises tebuconazole

44 The method according to claim 40 wherein the fungicide comprises tetraconazole

45 The method according to claim 40 wherein the fungicide comprises triticonazole

46 The method according to claim 40 wherein the fungicide comprises 1-(4-fluorophenyl) 2-(1H-1 2 4-triazole-1 yl)ethanone

47 The method according to claim 38 wherein the fungicide omprises a diazole selected from the group consisting of imazalil oxpoconazole pefurazoate prochloraz trifulmizole and mixtures thereof

48 The method according to claim 38 wherein the fungicide comprises a strobilurin type fungicide selected from the group consisting of

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azoxystrobin, dimoxystrobin, famoxadone, kresoxim-methyl, metominostrobin, picoxystrobin, pyraclostrobin, trifloxystrobin, and mixtures thereof.

49. The method according to claim 38, wherein the fungicide comprises a member selected from the group consisting of tebuconazole, simeconazole, fludioxonil, fluquinconazole, difenoconazole, 4,5-dimethyl-N-(2-propenyl)-2-(trimethylsilyl)-3-thiophenecarboxamide (silthiofam), hexaconazole, etaconazole, propiconazole, triticonazole, flutriafol, epoxiconazole, fenbuconazole, bromuconazole, penconazole, imazalil, tetraconazole, flusilazole, metconazole, diniconazole, myclobutanil, triadimenol, bitertanol, pyremethanil, cyprodinil, tridemorph, fenpropimorph, kresoxim-methyl, azoxystrobin, ZEN90160, fenpiclonil, benalaxyl, furalaxyl, metalaxyl, R-metalaxyl, orfurace, oxadixyl, carboxin, prochloraz, triflumizole, pyrifenox, acibenzolar-S-methyl, chlorothalonil, cymoaxnil, dimethomorph, famoxadone, quinoxyfen, fenpropidine, spiroxamine, triazoxide, BAS50001F, hymexazole, pencycuron, fenamidone, guazatine, and cyproconazole.

50. The method according to claim 49, wherein the fungicide comprises silthiofam.

51. The method according to claim 50, wherein the pesticide comprises silthiofam and the polymer comprises polyvinylacetate.

52. The method according to claim 50, wherein the pesticide comprises silthiofam and the polymer comprises methocel.

53. The method according to claim 1, wherein the amount of the pesticide is between about 0.5 gm of the pesticide active ingredient / 100 kg of seed and about 2,000 gm / 100 kg of seed.

54. The method according to claim 1, wherein the amount of the pesticide is between about 25 gm and about 1,000 gm / 100 kg of seed.

55. The method according to claim 1, wherein the amount of the pesticide is between about 100 gm and about 800 gm / 100 kg of seed.

56. The method according to claim 1, wherein the treatment comprises the steps:

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a. providing a seed;

b. contacting the seed with a latex comprising the polymer;

c. forming a polymer coating on the seed before treating the seed with a phytotoxic agent, wherein the coating is free of the phytotoxic agent and wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination; and

d. contacting the polymer coated seed with the phytotoxic agent.

57. The method according to claim 54, wherein the polymer coating is applied so that it directly contacts the seed without intervening material between the coating and the seed.

58. Phytotoxic agent-treated plant seed having an improved germination rate, each seed comprising a plant seed having a phytotoxic agent deposited thereupon, and having a polymer coating which is free of the phytotoxic agent located between the seed and the phytotoxic agent, wherein the type of polymer and the coating thickness are designed to block phytotoxic contact of the phytotoxic agent with the seed while allowing sufficient transfer of oxygen and moisture under environmental conditions normally encountered by the seed after planting to maintain the seed's viability and enable its germination.

59. A plant that is grown from a seed that is treated by the method according to claim 1.

60. A method of producing an agronomic crop, the method comprising the steps:

a. providing plant seeds of the agronomic crop that have been treated by the method according to claim 1;

b. planting the seeds; and

c. cultivating the planted seeds and plants that sprout from the seeds.

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17396/09058
51-21(52837)

ABSTRACT

A method of improving germination rate in pesticide-treated plant seeds involves forming a pesticide-free polymer coating on a plant seed before treating the seed with a pesticide where the type of polymer and the coating thickness are designed to block phytotoxic contact of the pesticide with the seed while allowing sufficient transfer of oxygen to maintain the seed s viability and sufficient transfer of moisture under environmental conditions normally encountered by the seed after planting to enable its germination and then treating the coated plant seed with a pesticide Seeds that have been treated by this method and plants that are grown from the treated seeds are also described

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Practitioner's Docket No. 17396/09058 ***PATENT***

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT SUPPLEMENTAL, DIVISIONAL, CONTINUATION, OR C-I-P)

As a below named inventor I hereby declare that

TYPE OF DECLARATION

This declaration is for an original application

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name. I believe that I am an original and first inventor of the subject matter that is claimed, and for which a patent is sought on the invention entitled

TITLE OF INVENTION

METHOD OF PROTECTING SEEDS TREATED WITH A PHYTOTOXIC AGENT

SPECIFICATION IDENTIFICATION

The specification of which is being filed herewith as a provisional application that is identified as practitioner s Docket No 17396/09058

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above

I acknowledge the duty to disclose information which is material to patentability as defined in 37 Code of Federal Regulations, Section 1 56

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(35 U S.C Section 119(e))

I hereby claim the benefit under Title 35 United States Code, Section 119(e) of any United States provisional application(s) listed below

PROVISIONAL APPLICATION NUMBER **FILING DATE**

Not applicable

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith

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Martha J Yates	47 194
Jian Zhou	41 422
Mark C Dukes	32,343
Neil C Jones	35,561
Craig N Killen	35 218
Lloyd G Harr	38 446
Charles E. Dunlap	35 124
Wesley D Few	47 560
Luis E. Arri	47 393
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314

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DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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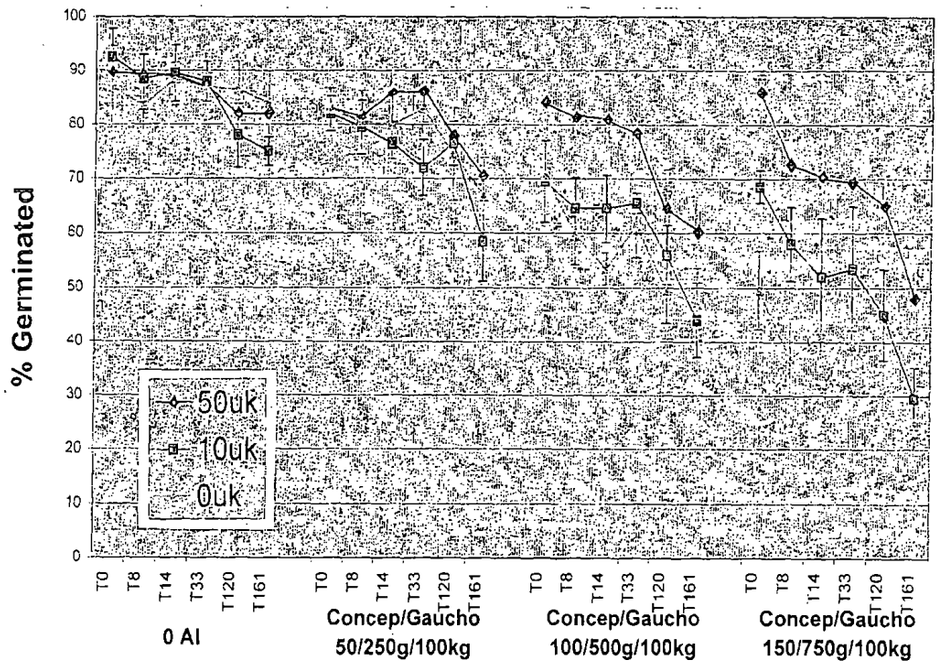


FIGURE 1.

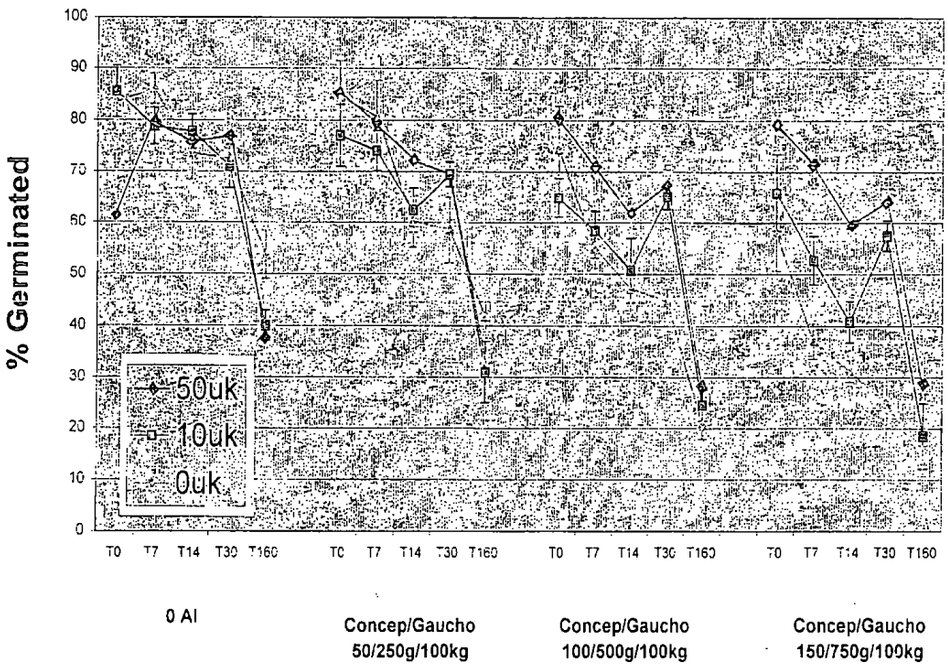


FIGURE 2.

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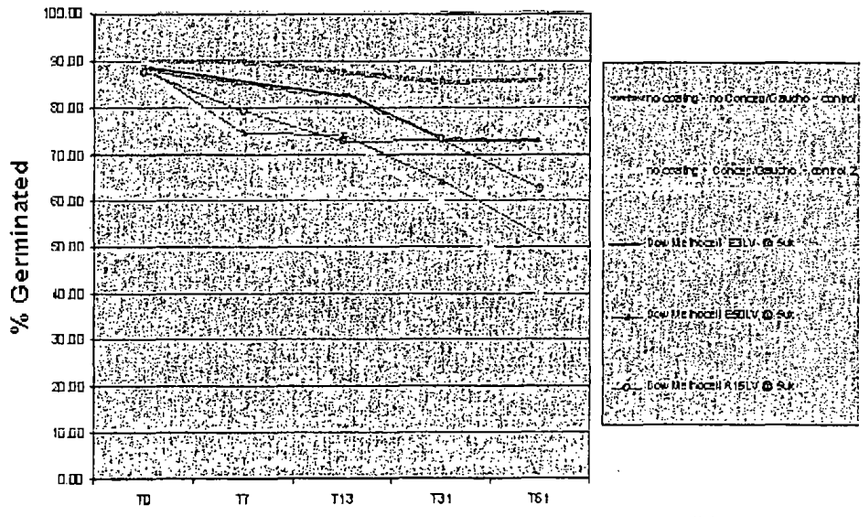


FIGURE 3.

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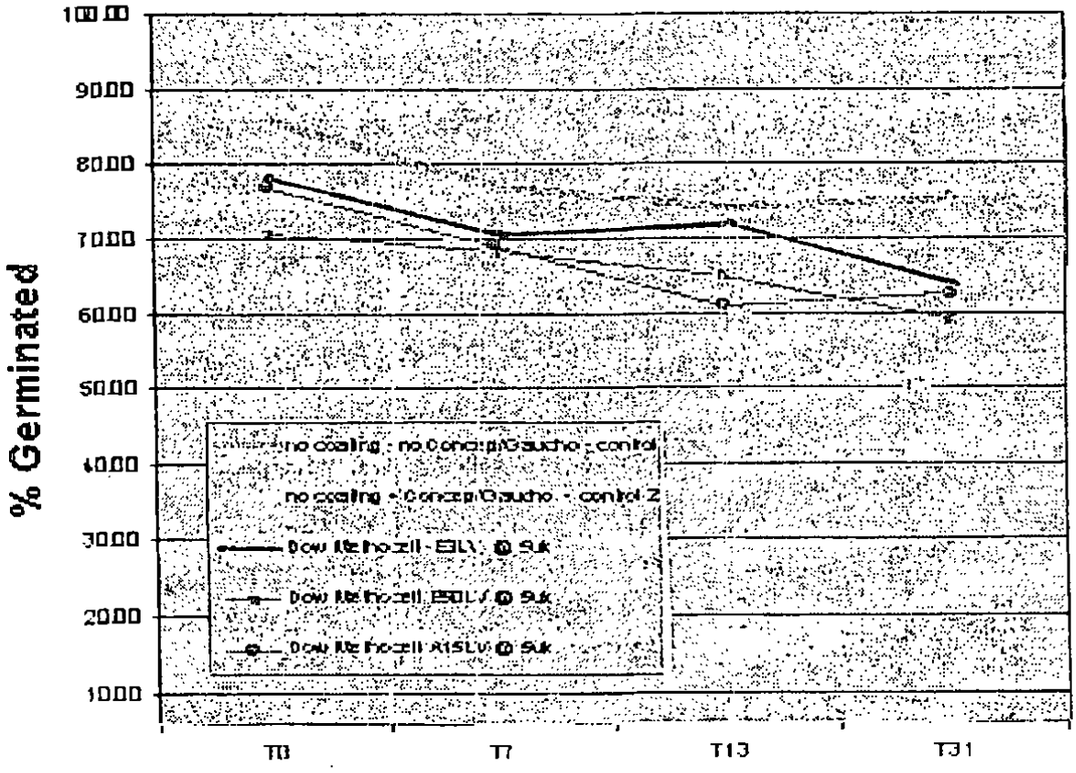


FIGURE 4.

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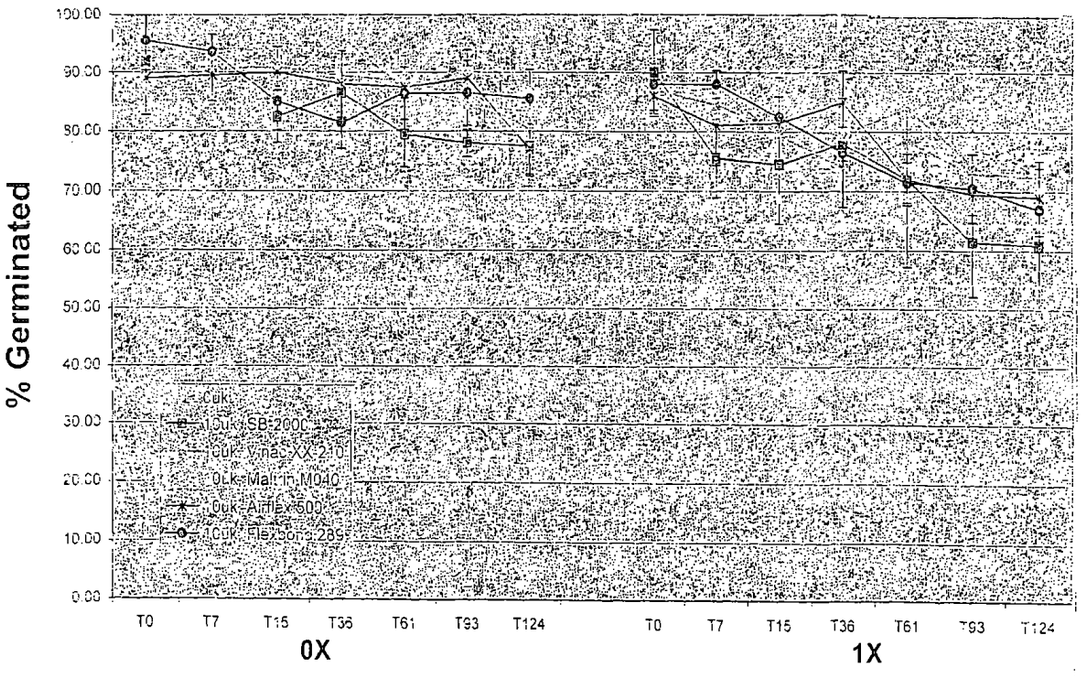


FIGURE 5.

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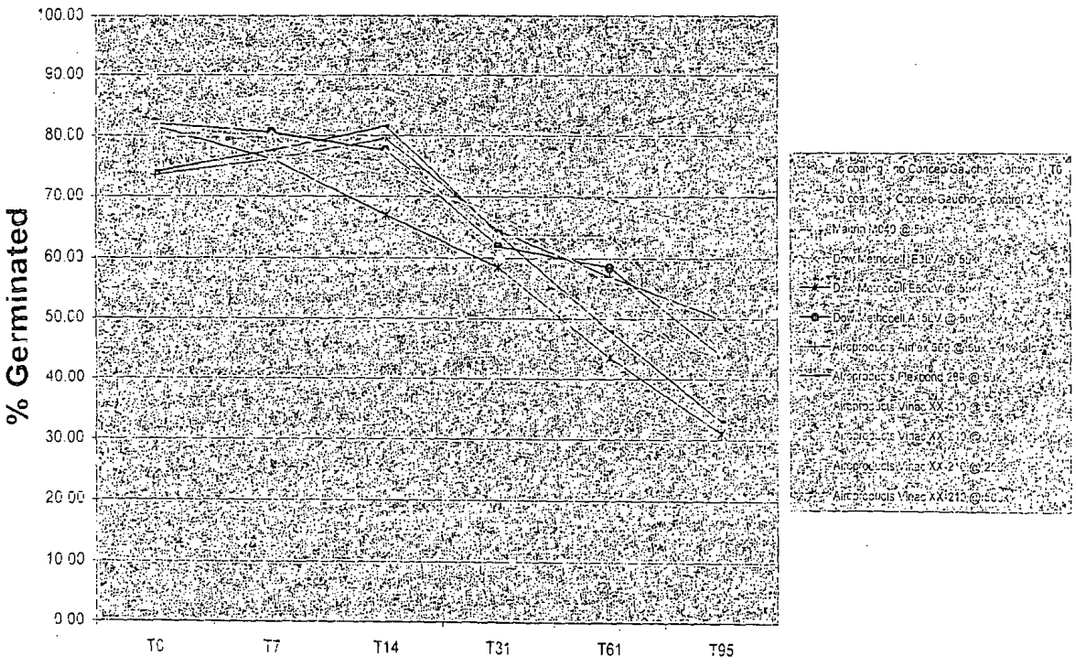


FIGURE 6.

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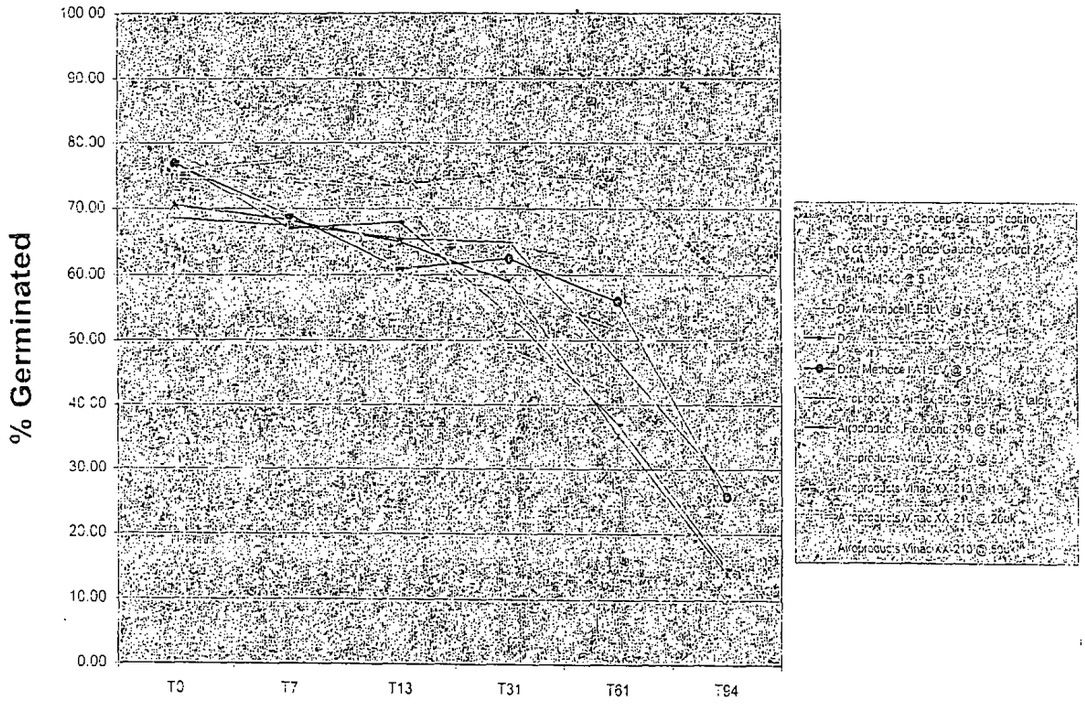


FIGURE 7.

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Dependencia 9999 DIRECCION DE NUEVOS EMPRENDIMIENTOS

REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL TRAMITE

		USUARIO	RADICADOR
PATENTE DE INVENCIÓN	MODELO DE UTILIDAD	( )	( )
Indicacion de que se solicita la concesión de una patente		( )	( )
Datos de identificación del solicitante o de la persona que se presenta la solicitud		( )	( )
Descripción de la invencion		( )	( )
Dibujos de ser estos pertinentes.		( )	( )
Comprobante de Pago de las tasas establecidas			
COMPLETA ( )	INCOMPLETA	( )	( )

DISEÑO INDUSTRIAL ( )

- Indicación de que se solicita el registro de Diseno Industrial	( )	( )
Datos de identificación del solicitante o de la persona que presenta	( )	( )
- la solicitud		
- Representación grafica o fotografica del Diseno Industrial o muestra del Material que incorpora el diseño	( )	( )
Comprobante de pago de las tasas establecidas	( )	( )
COMPLETA ( )	INCOMPLETA ( )	( )

ESQUEMA DE TRAZADO ( )

- Indicación de que solicita el registro de un Esquema de trazado	( )	( )
- Datos de identificación del solicitante o de la persona que presenta La solicitud	( )	( )
Representación grafica del esquema de trazado	( )	( )
Comprobante de pago de las tasas establecidas	( )	( )
COMPLETA ( )	INCOMPLETA ( )	( )

Firma Responsable

Fecha

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Folio_____

2020
Bogotá DC

Doctor
JUAN PABLO CADENA SARMIENTO
Apoderado
MONSANTO TECHNOLOGY LLC

REFERENCIA	Radicación No	05 53780
	Solicitud Internacional	PCT/US2003/036178
	Fecha inicio fase nacional	05 07 2005
	Trámite	011
	Evento	379
	Actuación	416
	Oficio No	585
	Folios	001

Teniendo en cuenta que la solicitud de privilegio de patente que se tramita bajo el expediente indicado en la referencia, reúne los requisitos de forma establecidos en la Decisión 486 de la Comisión de la Comunidad Andina, el Tratado de Cooperación en Materia de Patentes (PCT) el Reglamento y la Circular Unica de la Superintendencia de Industria y Comercio, se envía el extracto de la solicitud a la Oficina de Comunicaciones para efecto de su publicación en la Gaceta de Propiedad Industrial

Cumplase
Dado en Bogotá DC 19 AGO 2005

ALIX CARMENZA CÉSPEDES DE VERGEL
Jefe de la División de Nuevas Creaciones

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