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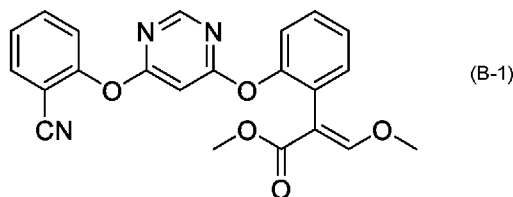
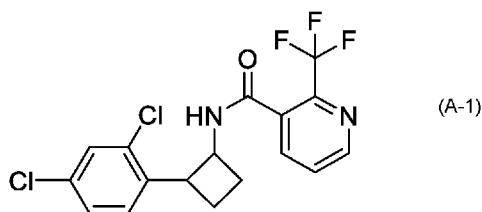
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(54) Title: COMPOSITIONS AND METHODS FOR CONTROLLING INFESTATION OF PLANTS BY PHYTOPATHOGENIC
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(57) Abstract: The invention relates to a method of infestation of a plant by phytopathogenic microorganisms of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus, which comprises applying, in any desired sequence or simultaneously, on the plant, the locus thereof or its propagation material, a combination or composition comprising as component (A), a compound of formula (A-1) and, as component (B), a compound of formula (B-1). Also disclosed are compositions suitable for use in the invention.



COMPOSITIONS AND METHODS FOR CONTROLLING INFESTATION OF PLANTS BY PHYTOPATHOGENIC FUNGI

The present invention relates to compositions and methods for controlling or preventing infestation of plants by phytopathogenic microorganisms, especially phytopathogenic fungi of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus, especially *Fusarium graminearum*.

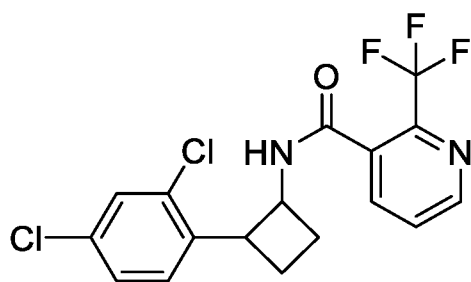
Certain active ingredients and combinations of active ingredients for controlling pest attack are described in the literature.

There is a continuing need to provide pesticidal combinations, which provide improved, for example, biological properties, for example, synergistic properties, especially for controlling phytopathogenic fungal pests. The benefits may also be an increased safety profile, improved physico-chemical properties, or increased biodegradability.

For example, *Fusarium graminearum* (*Gibberella zeae*) is one of the most important phytopathogens with economic impact in small-grain cereals and corn. It is a soil-, seed- and air-borne phytopathogen able to infect crops at various stages. As soil-borne phytopathogen, it can infect crops and cause several disease symptoms such as seed decay, root rot, foot rot and damping-off resulting in reduced crop yields.

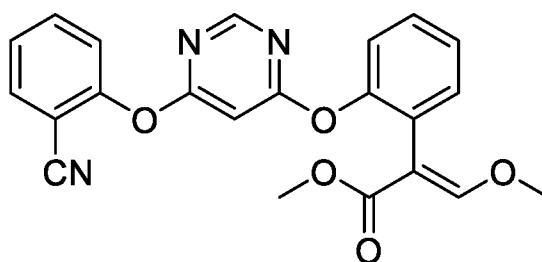
It has been found that particular combinations of active ingredients provide unexpected control or prevention of infestation of plants, when the particular combination is applied on the plant, the locus thereof or its propagation material. More specifically, it has now been found that particular combinations are highly effective at controlling or preventing the infestation of plants by various phytopathogenic microorganisms of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus, in particular *Fusarium graminearum*.

Accordingly, in an aspect, the present invention provides a composition comprising as component (A), a compound of formula A-1:



(A-1; cyclobutrifluram)

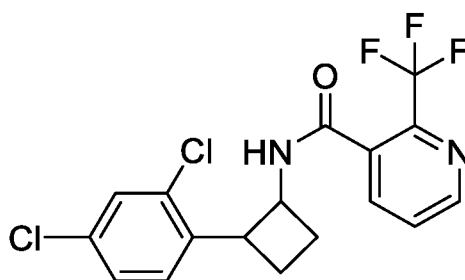
and, as component (B), a compound of formula B-1:



(B-1; azoxystrobin),

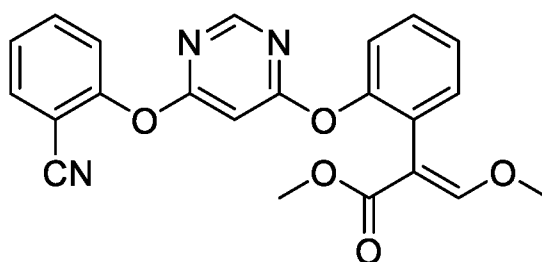
wherein the ratio by weight of (A) to (B) is from 500:1 to 1:500, 100:1 to 1:100, 50:1 to 1:50 or 20:1 to 1:20, or preferably 10:1 to 1:10 or 5:1 to 1:5; more preferably 3:1 to 1:3, or 2:1 to 1:2 or about 1:1..

In another aspect, the present invention provides a method of controlling or preventing infestation of a plant by phytopathogenic microorganisms of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus, which comprises applying, in any desired sequence or simultaneously, on the plant, the locus thereof or its propagation material, a combination or composition comprising as component (A), a compound of formula A-1:



(A-1)

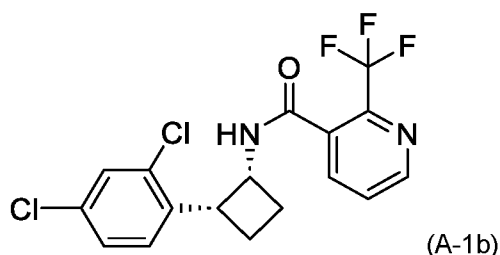
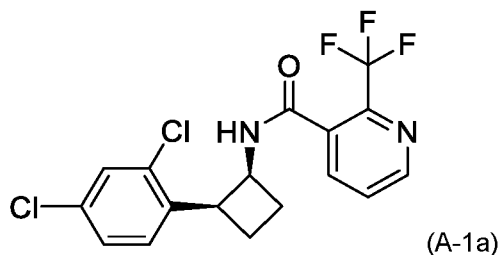
and, as component (B), a compound of formula B-1:



(B-1).

A reference to compounds of formula A-1, cyclobutrifluram, and formula B-1, azoxystrobin, also includes agrochemically acceptable ionic forms, salts, solvates, isomers, including geometric and stereochemical isomers, tautomers, N-oxides, esters, prodrugs, isotopes and protected forms thereof. Preferably, a reference to compounds of formula A-1 and formula B-1 also includes the salts or tautomers or isomers or N-oxides or solvates thereof; and more preferably, the salts or tautomers or N-oxides or solvates thereof, even more preferably the salts or tautomers or solvates thereof.

Cyclobutrifluram comprises 80–100% N-[(1S,2S)-2-(2,4-dichlorophenyl)cyclobutyl]-2-(trifluoromethyl)pyridine-3-carboxamide as illustrated below as compound of formula A-1a (hereinafter “the (1S,2S) enantiomer”), and 20–0% of the corresponding (1R,2R)-enantiomer as illustrated below as compound of formula A-1b (hereinafter “the (1R,2R) enantiomer”). These enantiomers arise because the phenyl ring on the left-hand side and the pyridyl-C(=O)-NH group on the right-hand side are cis to each other on the cyclobutyl ring. According to the present application, the compound of formula A-1 may comprise at least 85%, preferably at least 90%, and more preferably at least 95% of N-[(1S,2S)-2-(2,4-dichlorophenyl)cyclobutyl]-2-(trifluoromethyl)pyridine-3-carboxamide.



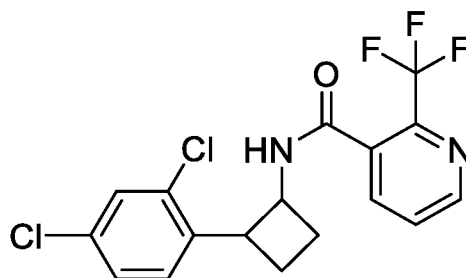
In an embodiment, the compositions and combinations of the invention comprise the compound of formula A-1 in enantiomerically enriched form. In other words, the compositions and combinations of the present invention may contain enantiomerically enriched mixtures of the two enantiomers of this compound (i.e., the (1S,2S) enantiomer (A-1a) and the (1R,2R)-enantiomer (A-1b)), wherein the fraction of the (1S,2S) enantiomer (A-1a) as defined herein is larger.

In an embodiment, the compositions and combinations of the invention comprise the compound of formula A-1 in enantiomerically pure or substantially enantiomerically pure form. For the purposes of the present invention, “substantially enantiomerically pure compounds of the formula A-1” is understood to be in an enantiomeric purity of at least 85% enantiomeric excess (ee), preferably at least 90% ee, more preferably at least 95% ee at least 96% ee, even more preferably at least 97% ee and especially at least 98% ee, e.g. at least 99% or 99.9% ee, wherein the fraction of the (1S,2S) enantiomer is larger.

In an embodiment, compound A-1 is present in the compositions and combinations of the present invention in the form of an enantiomerically enriched mixture containing between 80-100% by weight of compound (A-1a), N-((1S,2S)-2-(2,4-dichlorophenyl)cyclobutyl)-2-(trifluoromethyl)nicotinamide.

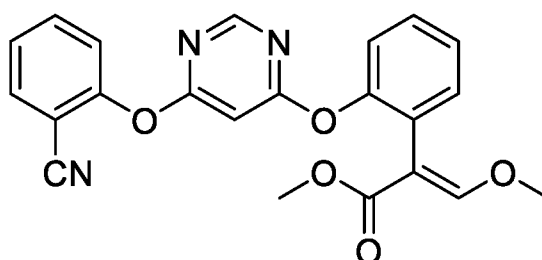
Optionally, the combinations and compositions of the present invention further comprise one or more auxiliaries and/or diluents.

In a further aspect, the present invention provides the use of a combination or composition comprising as component (A), a compound of formula (A-1):



(A-1)

and, as component (B), a compound of formula B-1:



(B-1)

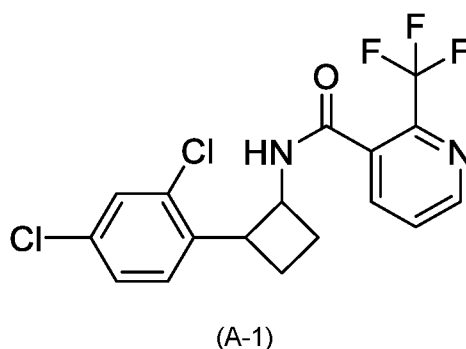
in controlling or preventing infestation of a plant by phytopathogenic microorganisms of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus.

Certain weight ratios of component (A) to component (B) may give rise to synergistic activity. Therefore, according to a further aspect of the invention there is provided a composition, wherein component (A) and component (B) are present in the composition in amounts producing a synergistic effect. This synergistic activity is apparent from the fact that the activity of the composition comprising component (A) and component (B) is greater than the sum of the corresponding activities of component (A) and of component (B) alone. This synergistic activity extends the range of action of component (A) and component (B) in two ways. Firstly, the rates of application of component (A) and component (B) are lowered whilst the action remains equally good, meaning that the active ingredient mixture still achieves a high degree of pest control even where the two individual components have become totally ineffective in such a low application rate range. Secondly, there is a substantial broadening of the spectrum of pests that can be controlled.

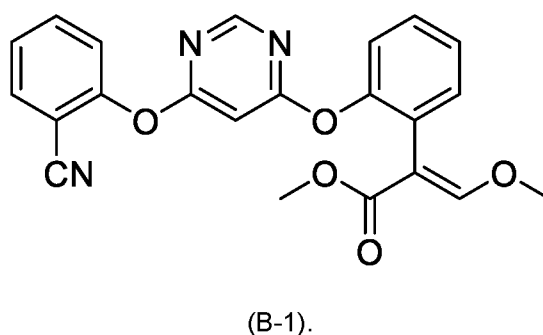
The combinations or compositions of the present invention may comprise a compound of formula (A-1) of component (A) and the compound of formula (B-1) of component (B) in a suitable ratio by weight, examples of which are between 2000:1 to 1:2000, between 1500:1 to 1:1500, between 1000:1 to 1:1000, between 750:1 to 1:750, between 500:1 to 1:500, between 400:1 to 1:400, between 300:1 to 1:300, between 250:1 to 1:250, between 200:1 to 1:200, between 150:1 to 1:150, between 125:1 to 1:125, between 100:1 to 1:100, between 80:1 to 1:80, between 75:1 to 1:75, between 70:1 to 1:70, between 125:2 to 2:125, between 60:1 to 1:60, between 50:1 to 1:50, between 40:1 to 1:40, between

30:1 to 1:30, between 25:1 to 1:25, between 20:1 to 1:20, between 16:1 to 1:16, between 15:1 to 1:15, between 12:1 to 1:12, between 10:1 to 1:10, between 9:1 to 1:9, between 8:1 to 1:8, between 7.5:1 to 1:7.5, between 7:1 to 1:7, between 6:1 to 1:6, between 5:1 to 1:5, between 4:1 to 1:4, between 10:3 to 3:10, between 3:1 to 1:3, between 2.5:1 to 1:2.5, between 2:1 to 1:2, between 5:3 to 3:5, between 8:5 to 5:8, between 1.5:1 to 1:1.5, between 4:3 to 3:4, between 5:4 to 4:5, or about 1:1 by weight; preferably the combinations or compositions of the present invention comprise the compound of formula (A-1) of component (A) and the compound of formula (B-1) of component (B) in a ratio of 10:1 to 1:10 or 5:1 to 1:5, more preferably 3:1 to 1:3 by weight. In certain examples, the ratio is within the range of 2:1 to 1:2, advantageously 1:1, by weight.

In yet another aspect, the present invention provides a method of controlling or preventing infestation of a plant by phytopathogenic microorganisms of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus, which comprises applying to a seed, in any desired sequence or simultaneously, as component (A), a compound of formula A-1:



and, as component (B), a compound of formula B-1:



In an embodiment, the above uses and methods exclude treatment of the human or animal body by surgery or therapy and diagnostic methods practised on the human or animal body. In an embodiment, the use is a non-therapeutic use. In an embodiment, the method is a non-therapeutic method.

Besides any synergistic action, the combinations and compositions according to the aspects of the invention can also have further surprising advantageous properties. Examples of such advantageous properties that may be mentioned are: more advantageous degradability, improved toxicological and/or

ecotoxicological behaviour, or improved characteristics of the useful plants including: emergence, crop yields, more developed root system, tillering increase, increase in plant height, bigger leaf blade, less dead basal leaves, stronger tillers, greener leaf colour, less fertilizers needed, less seeds needed, more productive tillers, earlier flowering, early grain maturity, less plant verse (lodging), increased shoot growth, improved plant vigour, and early germination.

The active ingredients in the combinations of the present invention may be applied to a pest, plant, plant propagation material or plant growing locus either simultaneously (for example as a pre-formulated mixture or a tank mix), or sequentially in a suitable timescale.

The compounds of the combination (i.e. components (A), and (B)), and any other pesticides, may be used either in pure form, i.e., as a solid active ingredient, for example, in a specific particle size, or preferably together with at least one of the auxiliaries (also known as adjuvants) customary in formulation technology, such as extenders, e.g., solvents or solid carriers, or surface-active compounds (surfactants), in the form of a formulation, in the present invention. Generally, the compounds (A), and (B) are each in the form of a formulation composition with one or more of customary formulation auxiliaries.

Therefore, compounds (A) and (B) can be used in the form of separate formulations. The compounds can be applied to the locus where control is desired either simultaneously or in succession at short interval, for example on the same day, if desired together with further carriers, surfactants or other application-promoting adjuvants customarily employed in formulation technology. In a preferred embodiment, (A) and (B) are applied simultaneously. Co-application or simultaneous application of components (A) and (B) has the added benefit of minimising farmer time spent applying products to crops. The combination may also encompass specific plant traits incorporated into the plant using any means, for example conventional breeding or genetic modification.

When compounds of the combination (i.e. (A), and (B)) are applied simultaneously in the present invention, they may be applied as a composition containing the combination, in which case each of (A), and (B) can be obtained from a separate formulation source and mixed together (known as a tank-mix, ready-to-apply, spray broth, or slurry), optionally with other pesticides, or (A), and (B) can be obtained as single formulation mixture source (known as a pre-mix, concentrate, formulated product), and optionally mixed together with other pesticides.

In one embodiment, the composition comprises an agriculturally acceptable formulation adjuvant. In a further embodiment, there is provided a composition consisting essentially of component (A), component (B) and an agriculturally acceptable adjuvant.

In a further embodiment, there is provided a composition consisting of component (A), component (B) and an agriculturally acceptable adjuvant. The compositions of the present invention are generally formulated using formulation adjuvants, such as carriers, solvents and surface-active agents (SFAs).

The combinations and compositions of the present invention may be useful for the control of pests, especially fungi, in improving the tolerance of crop plants to abiotic stress conditions, and/or in improving the yield of crop plants. The present invention provides a method for controlling fungal pests

in or on crop plants, improving the tolerance of crop plants to abiotic stress conditions, and/or improving the yield of crop plants, comprising treating the pests, plants, plant part, plant propagation material, or plant growing locus with combinations or compositions as described herein.

The combinations and compositions of the present invention may be useful for extending the duration of protection afforded to the plant material. In one embodiment, the combinations and compositions of the present invention may show both a fast-acting curative action and a preventative or protective action.

The combinations and compositions of the present invention may be useful for extending the range of crops with which the combinations and compositions are useful and/or the range of pests against which the combinations and compositions provide effective control.

Accordingly, the combinations and compositions of the present invention provide an enhanced biological profile which may include a more complete activity spectrum and/or complementary modes of activity. Advantageously, the component (A) compounds and the component (B) compounds may provide complementary mobilities in the plant. In certain combinations, the component (A) compound has a greater acropetal movement in the plant compared with the component (B) compound, such that the component (B) compound provides more localised protection.

In other combinations, the component (A) compound has a lower acropetal movement in the plant compared with the component (B) compound, such that the component (A) compound provides more localised protection.

Where used herein, the indication 'CAS' followed by a sequence of numbers refers to the Chemical Abstracts Registry number of the active ingredient. Where available or known, active ingredients are also referred to by their common name allocated in accordance with 'ISO 1750:1981 - Pesticides and other agrochemicals — Common names'.

The compounds of formula (A-1) (CAS 1460292-16-3) and B-1 (CAS 131860-33-8) are described in The Pesticide Manual 19th Edition, BCPC 2021.

Examples of the above-mentioned pests are:

from the genus *Fusarium*, for example,

Fusarium virguliforme, *Fusarium fujikuroi*, *Fusarium solani*, *Fusarium oxysporum*, *Fusarium acuminatum*, *Fusarium chlamydosporum*, *Fusarium compactum*, *Fusarium culmorum*, *Fusarium equiseti*, *Fusarium graminearum*, *Fusarium merismoides*, *Fusarium proliferatum*, *Fusarium pseudograminearum*, *Fusarium semitectum*, *Fusarium subglutinans*, *Fusarium verticillioides*, *Fusarium avenaceum*, *Fusarium moniliforme*, and *Fusarium tricinctum*;

from the genus *Rhizoctonia*, for example,

Rhizoctonia solani, *Rhizoctonia cerealis*, *Rhizoctonia zeae*, *Rhizoctonia oryzae*, *Rhizoctonia oryzae-sativae*, *Rhizoctonia leguminicola*, *Rhizoctonia crocorum*, *Rhizoctonia ramicola*, *Rhizoctonia carotae*, and *Rhizoctonia tuliparum*

from the genus *Alternaria*, for example, *Alternaria alternata*, *Alternaria solani*, *Alternaria tenuissima*, *Alternaria brassicicola*, *Alternaria dauci*, *Alternaria radicina*, *Alternaria citri*, *Alternaria sesami*, *Alternaria brassicae*, and *Alternaria raphani*.

The combinations and compositions of the invention are particularly suitable for control of *Fusarium*, particularly *Fusarium graminearum*.

The methods and uses according to the present invention are preferably for controlling or preventing infestation of the crop by phytopathogenic microorganisms of the genera *Fusarium*, *Rhizoctonia* and *Alternaria*, including phytopathogenic fungi that are resistant to other fungicides. Fungi that are "resistant" to particular fungicides refer e.g. to strains of e.g. *Fusarium* that are less sensitive to that fungicide compared to the expected sensitivity of the same species of *Fusarium*. The expected sensitivity can be measured using e.g. a strain that has not previously been exposed to the fungicide.

The combinations and compositions according to the invention can be used for preventing or controlling, i.e. containing or destroying, pests of the abovementioned type which occur in particular on plants, especially on useful plants and ornamentals in agriculture, in horticulture and in forests, or on organs, such as fruits, flowers, foliage, stalks, tubers or roots, of such plants, and in some cases even plant organs which are formed at a later point in time remain protected against these pests.

Suitable target crops are, for example, cereals such as wheat, barley, rye, oats, rice, maize, sorghum, millet, and triticale; beet crops such as sugar beet and fodder beet; fruit trees such as apple, pear, plum, peach, almond, cherry, strawberry, raspberry, blackberry, blueberry, cranberry, nectarine, banana, apricot, avocado, citrus (orange, lemon, grapefruit, tangerine), or grape; leguminous crops like beans, lentils, peas, and soybean; oil crops such as oilseed rape (canola), mustard, poppies, olives, sunflowers, coconut, castor, cocoa, ground nuts, and peanuts; cucurbits like pumpkins, cucumbers, and melons; fibre plants including cotton, flax, hemp, jute, and sisal; *Lauraceae* species such as avocado, cinnamon, and camphor; tobacco; nuts such as almonds, cashews, ground nuts, hazelnuts, pecans, pistachios, and walnuts; coffee; eggplants; sugarcane; tea; pepper; hops; the Plantain family (Banana family); latex plants; grasses such as Bermuda grass, bluegrass, bentgrass, centipede grass, fescue, ryegrass, St. Augustine grass, and Zoysia grass; herbs such as basil, borage, chives, coriander, lavender, lovage, mint, oregano, parsley, rosemary, sage, and thyme; palms, for example oil palm; ornamentals including flowers, shrubs, and trees; other trees like cacao, coconut, olive, and rubber; and a variety of vegetables such as spinach, lettuce, asparagus, cabbage, carrots, onions, tomatoes, potatoes, bell peppers, broccoli, garlic, marrow, okra, pumpkin, and rhubarb. Additionally, vines such as grapes are also suitable target crops.

Crops are to be understood as being those which are naturally occurring, obtained by conventional methods of breeding, or obtained by genetic engineering. They include crops which contain so-called output traits (e.g. improved storage stability, higher nutritional value and improved flavour).

Crops are to be understood as also including those crops which have been rendered tolerant to herbicides like bromoxynil or classes of herbicides such as ALS-, EPSPS-, GS-, HPPD- and PPO-inhibitors. An example of a crop that has been rendered tolerant to imidazolinones, e.g. imazamox, by

conventional methods of breeding is Clearfield® summer canola. Examples of crops that have been rendered tolerant to herbicides by genetic engineering methods include e.g. glyphosate- and glufosinate-resistant maize varieties commercially available under the trade names RoundupReady®, Herculex I® and LibertyLink®.

Crops are also to be understood as being those which naturally are or have been rendered resistant to harmful microorganisms or insects. This includes plants transformed by the use of recombinant DNA techniques, for example, to be capable of synthesising one or more selectively acting toxins, such as are known, for example, from toxin-producing bacteria. Examples of toxins which can be expressed include d-endotoxins, vegetative insecticidal proteins (Vip), insecticidal proteins of bacteria colonising nematodes, and toxins produced by scorpions, arachnids, wasps and fungi.

An example of a crop that has been modified to express the *Bacillus thuringiensis* toxin is the Bt maize KnockOut (Syngenta Seeds). An example of a crop comprising more than one gene that codes for insecticidal resistance and thus expresses more than one toxin is VipCot® (Syngenta Seeds). Crops or seed material thereof can also be resistant to multiple types of pests (so-called stacked transgenic events when created by genetic modification). For example, a plant can have the ability to express an insecticidal protein while at the same time being herbicide tolerant, for example Herculex I® (Dow AgroSciences, Pioneer Hi-Bred International).

Normally, in the management of a crop a grower would use one or more other agronomic chemicals or biologicals in addition to the composition of the present invention.

The term "crops" is to be understood as including also crop plants which have been so transformed by the use of recombinant DNA techniques that they are capable of synthesising one or more selectively acting toxins, such as are known, for example, from toxin-producing bacteria, especially those of the genus *Bacillus*.

Toxins that can be expressed by such transgenic plants include, for example, insecticidal proteins, for example insecticidal proteins from *Bacillus cereus* or *Bacillus popilliae*; or insecticidal proteins from *Bacillus thuringiensis*, such as δ -endotoxins, e.g. Cry1Ab, Cry1Ac, Cry1F, Cry1Fa2, Cry2Ab, Cry3A, Cry3Bb1 or Cry9C, or vegetative insecticidal proteins (Vip), e.g. Vip1, Vip2, Vip3 or Vip3A; or insecticidal proteins of bacteria colonising nematodes, for example *Photorhabdus* spp. or *Xenorhabdus* spp., such as *Photorhabdus luminescens*, *Xenorhabdus nematophilus*; toxins produced by animals, such as scorpion toxins, arachnid toxins, wasp toxins and other insect-specific neurotoxins; toxins produced by fungi, such as *Streptomyces* toxins, plant lectins, such as pea lectins, barley lectins or snowdrop lectins; agglutinins; proteinase inhibitors, such as trypsin inhibitors, serine protease inhibitors, patatin, cystatin, papain inhibitors; ribosome-inactivating proteins (RIP), such as ricin, maize-RIP, abrin, luffin, saporin or bryodin; steroid metabolism enzymes, such as 3-hydroxysteroidoxidase, ecdysteroid-UDP-glycosyl-transferase, cholesterol oxidases, ecdysone inhibitors, HMG-COA-reductase, ion channel blockers, such as blockers of sodium or calcium channels, juvenile hormone esterase, diuretic hormone receptors, stilbene synthase, bibenzyl synthase, chitinases and glucanases.

In the context of the present invention there are to be understood by δ -endotoxins, for example Cry1Ab, Cry1Ac, Cry1F, Cry1Fa2, Cry2Ab, Cry3A, Cry3Bb1 or Cry9C, or vegetative insecticidal proteins (Vip), for example Vip1, Vip2, Vip3 or Vip3A, expressly also hybrid toxins, truncated toxins and modified toxins. Hybrid toxins are produced recombinantly by a new combination of different domains of those proteins (see, for example, WO 02/15701). Truncated toxins, for example a truncated Cry1Ab, are known. In the case of modified toxins, one or more amino acids of the naturally occurring toxin are replaced. In such amino acid replacements, preferably non-naturally present protease recognition sequences are inserted into the toxin, such as, for example, in the case of Cry3A055, a cathepsin-G-recognition sequence is inserted into a Cry3A toxin (see WO 03/018810).

Examples of such toxins or transgenic plants capable of synthesising such toxins are disclosed, for example, in EP-A-0 374 753, WO 93/07278, WO 95/34656, EP-A-0 427 529, EP-A-451 878 and WO 03/052073.

The processes for the preparation of such transgenic plants are generally known to the person skilled in the art and are described, for example, in the publications mentioned above. CryI-type deoxyribonucleic acids and their preparation are known, for example, from WO 95/34656, EP-A-0 367 474, EP-A-0 401 979 and WO 90/13651.

The toxin contained in the transgenic plants imparts to the plants tolerance to harmful insects. Such insects can occur in any taxonomic group of insects, but are especially commonly found in the beetles (Coleoptera), two-winged insects (Diptera) and moths (Lepidoptera).

Transgenic plants containing one or more genes that code for an insecticidal resistance and express one or more toxins are known and some of them are commercially available. Examples of such plants are: YieldGard® (maize variety that expresses a Cry1Ab toxin); YieldGard Rootworm® (maize variety that expresses a Cry3Bb1 toxin); YieldGard Plus® (maize variety that expresses a Cry1Ab and a Cry3Bb1 toxin); Starlink® (maize variety that expresses a Cry9C toxin); Herculex I® (maize variety that expresses a Cry1Fa2 toxin and the enzyme phosphinothricine N-acetyltransferase (PAT) to achieve tolerance to the herbicide glufosinate ammonium); NuCOTN 33B® (cotton variety that expresses a Cry1Ac toxin); Bollgard I® (cotton variety that expresses a Cry1Ac toxin); Bollgard II® (cotton variety that expresses a Cry1Ac and a Cry2Ab toxin); VipCot® (cotton variety that expresses a Vip3A and a Cry1Ab toxin); NewLeaf® (potato variety that expresses a Cry3A toxin); NatureGard®, Agrisure® GT Advantage (GA21 glyphosate-tolerant trait), Agrisure® CB Advantage (Bt11 corn borer (CB) trait) and Protecta®.

Further examples of such transgenic crops are:

1. **Bt11 Maize** from Syngenta Seeds SAS, Chemin de l'Hobit 27, F-31 790 St. Sauveur, France, registration number C/FR/96/05/10. Genetically modified *Zea mays* which has been rendered resistant to attack by the European corn borer (*Ostrinia nubilalis* and *Sesamia nonagrioides*) by transgenic expression of a truncated Cry1Ab toxin. Bt11 maize also transgenically expresses the enzyme PAT to achieve tolerance to the herbicide glufosinate ammonium.

2. **Bt176 Maize** from Syngenta Seeds SAS, Chemin de l'Hobit 27, F-31 790 St. Sauveur, France, registration number C/FR/96/05/10. Genetically modified *Zea mays* which has been rendered resistant to attack by the European corn borer (*Ostrinia nubilalis* and *Sesamia nonagrioides*) by transgenic expression of a Cry1Ab toxin. Bt176 maize also transgenically expresses the enzyme PAT to achieve tolerance to the herbicide glufosinate ammonium.
3. **MIR604 Maize** from Syngenta Seeds SAS, Chemin de l'Hobit 27, F-31 790 St. Sauveur, France, registration number C/FR/96/05/10. Maize which has been rendered insect-resistant by transgenic expression of a modified Cry3A toxin. This toxin is Cry3A055 modified by insertion of a cathepsin-G-protease recognition sequence. The preparation of such transgenic maize plants is described in WO 03/018810.
4. **MON 863 Maize** from Monsanto Europe S.A. 270-272 Avenue de Tervuren, B-1150 Brussels, Belgium, registration number C/DE/02/9. MON 863 expresses a Cry3Bb1 toxin and has resistance to certain Coleoptera insects.
5. **IPC 531 Cotton** from Monsanto Europe S.A. 270-272 Avenue de Tervuren, B-1150 Brussels, Belgium, registration number C/ES/96/02.
6. **1507 Maize** from Pioneer Overseas Corporation, Avenue Tedesco, 7 B-1160 Brussels, Belgium, registration number C/NL/00/10. Genetically modified maize for the expression of the protein Cry1F for achieving resistance to certain Lepidoptera insects and of the PAT protein for achieving tolerance to the herbicide glufosinate ammonium.
7. **NK603 × MON 810 Maize** from Monsanto Europe S.A. 270-272 Avenue de Tervuren, B-1150 Brussels, Belgium, registration number C/GB/02/M3/03. Consists of conventionally bred hybrid maize varieties by crossing the genetically modified varieties NK603 and MON 810. NK603 × MON 810 Maize transgenically expresses the protein CP4 EPSPS, obtained from *Agrobacterium sp.* strain CP4, which imparts tolerance to the herbicide Roundup® (contains glyphosate), and also a Cry1Ab toxin obtained from *Bacillus thuringiensis subsp. kurstaki* which brings about tolerance to certain Lepidoptera, include the European corn borer.

Transgenic crops of insect-resistant plants are also described in BATS (Zentrum für Biosicherheit und Nachhaltigkeit, Zentrum BATS, Clarastrasse 13, 4058 Basel, Switzerland) Report 2003, (<http://bats.ch>).

The term "crops" is to be understood as including also crop plants which have been so transformed by the use of recombinant DNA techniques that they are capable of synthesising antipathogenic substances having a selective action, such as, for example, the so-called "pathogenesis-related proteins" (PRPs, see e.g. EP-A-0 392 225). Examples of such antipathogenic substances and transgenic plants capable of synthesising such antipathogenic substances are known, for example, from EP-A-0 392 225, WO 95/33818 and EP-A-0 353 191. The methods of producing such transgenic plants are generally known to the person skilled in the art and are described, for example, in the publications mentioned above.

Crops may also be modified for enhanced resistance to fungal (for example *Fusarium*, Anthracnose, or Phytophthora), bacterial (for example *Pseudomonas*) or viral (for example potato leafroll virus, tomato spotted wilt virus, cucumber mosaic virus) pathogens.

Crops also include those that have enhanced resistance to nematodes, such as the soybean cyst nematode.

Crops that are tolerant to abiotic stress include those that have enhanced tolerance to drought, high salt, high temperature, chill, frost, or light radiation, for example through expression of NF-YB or other proteins known in the art.

Antipathogenic substances which can be expressed by such transgenic plants include, for example, ion channel blockers, such as blockers for sodium and calcium channels, for example the viral KP1, KP4 or KP6 toxins; stilbene synthases; bibenzyl synthases; chitinases; glucanases; the so-called "pathogenesis-related proteins" (PRPs; see e.g. EP-A-0 392 225); antipathogenic substances produced by microorganisms, for example peptide antibiotics or heterocyclic antibiotics (see e.g. WO 95/33818) or protein or polypeptide factors involved in plant pathogen defence (so-called "plant disease resistance genes", as described in WO 03/000906).

The term "plants" refers to all physical parts of a plant, including seeds, seedlings, saplings, roots, tubers, stems, stalks, foliage, and fruits.

The term "locus" as used herein means fields in or on which plants are growing, or where seeds of cultivated plants are sown, or where seed will be placed into the soil. It includes soil, seeds, and seedlings, as well as established vegetation.

The term "plant propagation material" denotes all generative parts of a plant, for example seeds or vegetative parts of plants such as cuttings and tubers. It includes seeds in the strict sense, as well as roots, fruits, tubers, bulbs, rhizomes, and parts of plants. Germinated plants and young plants which are to be transplanted after germination or after emergence from the soil, may also be mentioned. These young plants may be protected before transplantation by a total or partial treatment by immersion. Preferably "plant propagation material" is understood to denote seeds.

The term "regulating or improving the growth of a crop" means an improvement in plant vigour, an improvement in plant quality, improved tolerance to stress factors, and/or improved input use efficiency.

In an embodiment, the phytopathogenic fungus is *Fusarium graminearum* (*Gibberella zeae*).

In an embodiment, the plant is selected from cereals, soybean, maize, cotton, rice, vegetables, pome fruits, stone fruits, citrus, and potato.

In an embodiment, the plant is a cereal plant, in particular wheat or barley.

Further areas of use of the compositions according to the invention are the protection of stored goods and store rooms and the protection of raw materials, such as wood, textiles, floor coverings or buildings, and also in the hygiene sector, especially the protection of humans, domestic animals and productive livestock against pests of the mentioned type.

The present invention provides a method of improving the tolerance of a plant to abiotic stress, wherein the method comprises applying to the plant, plant part, plant propagation material, or plant growing locus a composition as described herein.

The present invention provides a method for regulating or improving the growth of a plant, wherein the method comprises applying to the plant, plant part, plant propagation material, or plant growing locus a composition as described herein. In one embodiment, plant growth is regulated or improved when the plant is subject to abiotic stress conditions.

Where a range of numbers is disclosed herein (for example, 1 to 10), this is intended to include all numbers and intervening values within that range (for example, 1, 1.1, 2, 3, 3.9, 4, 5, 6, 6.5, 7, 8, 9 and 10) and also any sub-range of numbers and intervening values within that range (for example, 2 to 8, 1.5 to 5.5 and 3.1 to 4.7). Additionally, it is intended that the both the upper and lower limits specified are included within the range.

Where ranges or values used herein are preceded by the term "about", this term is intended to provide support for both the exact number that it precedes, and also a number that is near to or approximately the number that it precedes. In determining whether a number is near to or approximately a specifically recited number, the near or approximating number may be a number, which would be rounded to or be substantially equivalent to the specifically recited number. For example, the term "about 5" includes 5.0, 4.5, 5.4, 4.92, 5.01, and so on.

The composition can be in the form of concentrates which are diluted prior to use, although ready-to-use compositions can also be made. The final dilution is usually made with water, but can be made instead of, or in addition to, water, with, for example, liquid fertilisers, micronutrients, biological organisms, oil or solvents.

The compositions according to the invention are generally formulated in various ways using formulation adjuvants, such as carriers, solvents and surface-active substances. The formulations can be in various physical forms, e.g. in the form of dusting powders, gels, wettable powders, water-dispersible granules, water-dispersible tablets, effervescent pellets, emulsifiable concentrates, micro-emulsifiable concentrates, oil-in-water emulsions, oil-flowables, aqueous dispersions, oily dispersions, suspo-emulsions, capsule suspensions, emulsifiable granules, soluble liquids, water-soluble concentrates (with water or a water-miscible organic solvent as carrier), impregnated polymer films or in other forms known e.g. from the Manual on Development and Use of FAO and WHO Specifications for Pesticides, United Nations, First Edition, Second Revision (2010). Such formulations can either be used directly or diluted prior to use. The dilutions can be made, for example, with water, liquid fertilisers, micronutrients, biological organisms, oil or solvents.

The formulations can be prepared e.g. by mixing the active ingredient with the formulation adjuvants in order to obtain compositions in the form of finely divided solids, granules, solutions, dispersions or emulsions. The active ingredients can also be formulated with other adjuvants, such as finely divided solids, mineral oils, oils of vegetable or animal origin, modified oils of vegetable or animal origin, organic solvents, water, surface-active substances or combinations thereof.

The active ingredients can also be contained in very fine microcapsules. Microcapsules contain the active ingredients in a porous carrier. This enables the active ingredients to be released into the environment in controlled amounts (e.g. slow-release). Microcapsules usually have a diameter of from 0.1 to 500 microns. They contain active ingredients in an amount of about from 25 to 95 % by weight of the capsule weight. The active ingredients can be in the form of a monolithic solid, in the form of fine particles in solid or liquid dispersion or in the form of a suitable solution. The encapsulating membranes can comprise, for example, natural or synthetic rubbers, cellulose, styrene/butadiene copolymers, polyacrylonitrile, polyacrylate, polyesters, polyamides, polyureas, polyurethane or chemically modified polymers and starch xanthates or other polymers that are known to the person skilled in the art. Alternatively, very fine microcapsules can be formed in which the active ingredient is contained in the form of finely divided particles in a solid matrix of base substance, but the microcapsules are not themselves encapsulated.

The formulation adjuvants that are suitable for the preparation of the compositions according to the invention are known per se. As liquid carriers there may be used: water, toluene, xylene, petroleum ether, vegetable oils, acetone, methyl ethyl ketone, cyclohexanone, acid anhydrides, acetonitrile, acetophenone, amyl acetate, 2-butanone, butylene carbonate, chlorobenzene, cyclohexane, cyclohexanol, alkyl esters of acetic acid, diacetone alcohol, 1,2-dichloropropane, diethanolamine, p-diethylbenzene, diethylene glycol, diethylene glycol abietate, diethylene glycol butyl ether, diethylene glycol ethyl ether, diethylene glycol methyl ether, N,N-dimethylformamide, dimethyl sulfoxide, 1,4-dioxane, dipropylene glycol, dipropylene glycol methyl ether, dipropylene glycol dibenzoate, diproxitol, alkylpyrrolidone, ethyl acetate, 2-ethylhexanol, ethylene carbonate, 1,1,1-trichloroethane, 2-heptanone, alpha-pinene, d-limonene, ethyl lactate, ethylene glycol, ethylene glycol butyl ether, ethylene glycol methyl ether, gamma-butyrolactone, glycerol, glycerol acetate, glycerol diacetate, glycerol triacetate, hexadecane, hexylene glycol, isoamyl acetate, isobornyl acetate, isooctane, isophorone, isopropylbenzene, isopropyl myristate, lactic acid, laurylamine, mesityl oxide, methoxypropanol, methyl isoamyl ketone, methyl isobutyl ketone, methyl laurate, methyl octanoate, methyl oleate, methylene chloride, m-xylene, n-hexane, n-octylamine, octadecanoic acid, octylamine acetate, oleic acid, oleylamine, o-xylene, phenol, polyethylene glycol, propionic acid, propyl lactate, propylene carbonate, propylene glycol, propylene glycol methyl ether, p-xylene, toluene, triethyl phosphate, triethylene glycol, xylenesulfonic acid, paraffin, mineral oil, trichloroethylene, perchloroethylene, ethyl acetate, amyl acetate, butyl acetate, propylene glycol methyl ether, diethylene glycol methyl ether, methanol, ethanol, isopropanol, and alcohols of higher molecular weight, such as amyl alcohol, tetrahydro-furfuryl alcohol, hexanol, octanol, ethylene glycol, propylene glycol, glycerol, N-methyl-2-pyrrolidone and the like.

Suitable solid carriers are, for example, talc, titanium dioxide, pyrophyllite clay, silica, attapulgite clay, kieselguhr, limestone, calcium carbonate, bentonite, calcium montmorillonite, cottonseed husks, wheat flour, soybean flour, pumice, wood flour, ground walnut shells, lignin and similar substances.

A large number of surface-active substances can advantageously be used in both solid and liquid formulations, especially in those formulations which can be diluted with a carrier prior to use. Surface-active substances may be anionic, cationic, non-ionic or polymeric and they can be used as emulsifiers,

wetting agents or suspending agents or for other purposes. Typical surface-active substances include, for example, salts of alkyl sulfates, such as diethanolammonium lauryl sulfate

salts of alkylarylsulfonates, such as calcium dodecylbenzenesulfonate

alkylphenol/alkylene oxide addition products, such as nonylphenol ethoxylate

alcohol/alkylene oxide addition products, such as tridecylalcohol ethoxylate

soaps, such as sodium stearate

salts of alkylnaphthalenesulfonates, such as sodium dibutylnaphthalenesulfonate

dialkyl esters of sulfosuccinate salts, such as sodium di(2-ethylhexyl)sulfosuccinate

sorbitol esters, such as sorbitol oleate

quaternary amines, such as lauryltrimethylammonium chloride, polyethylene glycol esters of fatty acids, such as polyethylene glycol stearate

block copolymers of ethylene oxide and propylene oxide

and salts of mono and di-alkylphosphate esters

and also further substances described e.g. in McCutcheon's Detergents and Emulsifiers Annual, MC Publishing Corp., Ridgewood New Jersey (1981).

Further adjuvants that can be used in pesticidal formulations include crystallisation inhibitors, viscosity modifiers, suspending agents, dyes, anti-oxidants, foaming agents, light absorbers, mixing auxiliaries, antifoams, complexing agents, neutralising or pH-modifying substances and buffers, corrosion inhibitors, fragrances, wetting agents, take-up enhancers, micro-nutrients, plasticisers, glidants, lubricants, dispersants, thickeners, antifreezes, microbicides, and liquid and solid fertilisers.

The compositions according to the invention can include an additive comprising an oil of vegetable or animal origin, a mineral oil, alkyl esters of such oils or mixtures of such oils and oil derivatives. The amount of oil additive in the composition according to the invention is generally from 0.01 to 10 %, based on the mixture to be applied. For example, the oil additive can be added to a spray tank in the desired concentration after a spray mixture has been prepared. Preferred oil additives comprise mineral oils or an oil of vegetable origin, for example rapeseed oil, olive oil or sunflower oil, emulsified vegetable oil, alkyl esters of oils of vegetable origin, for example the methyl derivatives, or an oil of animal origin, such as fish oil or beef tallow. Preferred oil additives comprise alkyl esters of C₈-C₂₂ fatty acids, especially the methyl derivatives of C₁₂-C₁₈ fatty acids, for example the methyl esters of lauric acid, palmitic acid and oleic acid (methyl laurate, methyl palmitate and methyl oleate, respectively). Many oil derivatives are known from the Compendium of Herbicide Adjuvants, 10th Edition, Southern Illinois University, 2010.

The inventive compositions generally comprise from 0.1 to 99 % by weight, especially from 0.1 to 95 % by weight, of active ingredients and from 1 to 99.9 % by weight of a formulation adjuvant which preferably includes from 0 to 25 % by weight of a surface-active substance. Whereas commercial

products may preferably be formulated as concentrates, the end user will normally employ dilute formulations.

Examples of foliar formulation types for pre-mix compositions are:

GR: Granules

WP: wettable powders

WG: water-dispersible granules (powders)

SG: water soluble granules

SL: soluble concentrates

EC: emulsifiable concentrate

EW: emulsions, oil-in-water

ME: micro-emulsions

SC: aqueous suspension concentrates

CS: aqueous capsule suspensions

OD: oil-based suspension concentrate, and

SE: aqueous suspo-emulsions.

Examples of seed treatment formulation types for pre-mix compositions are:

WS wettable powders for seed treatment slurry

LS: solution for seed treatment

ES emulsions for seed treatment

FS suspension concentrate for seed treatment

WG: water dispersible granules, and

CS: aqueous capsule suspension.

Examples of formulation types suitable for tank-mix compositions are solutions, dilute emulsions, suspensions, or a mixture thereof, and dusts. As with the nature of the formulations, the methods of application, such as foliar, drench, spraying, atomizing, dusting, scattering, coating or pouring, are chosen in accordance with the intended objectives and the prevailing circumstances.

The tank-mix compositions are generally prepared by diluting with a solvent (for example, water) the one or more pre-mix compositions containing different pesticides, and optionally further auxiliaries. Suitable carriers and adjuvants can be solid or liquid and are the substances ordinarily employed in formulation technology, e.g. natural or regenerated mineral substances, solvents, dispersants, wetting

agents, tackifiers, thickeners, binders or fertilizers. Generally, a tank-mix formulation for foliar or soil application comprises 0.1 to 20 %, especially 0.1 to 1 %, of the desired ingredients, and 99.9 to 80 %, especially 99.9 to 85 %, of a solid or liquid auxiliaries (including, for example, a solvent such as water), where the auxiliaries can be a surfactant in an amount of 0 to 20 %, especially 0.1 to 15 %, based on the tank-mix formulation.

Typically, a pre-mix formulation for foliar application comprises 0.1 to 99.9 %, especially 1 to 95 %, of the desired ingredients, and 99.9 to 0.1 %, especially 99 to 5 %, of a solid or liquid adjuvant (including, for example, a solvent such as water), where the auxiliaries can be a surfactant in an amount of 0 to 50 %, especially 0.5 to 40 %, based on the pre-mix formulation.

Normally, a tank-mix formulation for seed treatment application comprises 0.25 to 80%, especially 1 to 75 %, of the desired ingredients, and 99.75 to 20 %, especially 99 to 25 %, of a solid or liquid auxiliaries (including, for example, a solvent such as water), where the auxiliaries can be a surfactant in an amount of 0 to 40 %, especially 0.5 to 30 %, based on the tank-mix formulation.

Typically, a pre-mix formulation for seed treatment application comprises 0.5 to 99.9 %, especially 1 to 95 %, of the desired ingredients, and 99.5 to 0.1 %, especially 99 to 5 %, of a solid or liquid adjuvant (including, for example, a solvent such as water), where the auxiliaries can be a surfactant in an amount of 0 to 50 %, especially 0.5 to 40 %, based on the pre-mix formulation.

Whereas commercial products will preferably be formulated as concentrates (e.g, pre-mix composition (formulation)), the end user will normally employ dilute formulations (e.g., tank mix composition). Preferred seed treatment pre-mix formulations are aqueous suspension concentrates. The formulation can be applied to the seeds using conventional treating techniques and machines, such as fluidized bed techniques, the roller mill method, rotostatic seed treaters, and drum coaters. Other methods, such as spouted beds may also be useful. The seeds may be presized before coating. After coating, the seeds are typically dried and then transferred to a sizing machine for sizing. Such procedures are known in the art. The compounds of the present invention are particularly suited for use in soil and seed treatment applications.

In general, the pre-mix compositions of the invention contain 0.5 to 99.9 especially 1 to 95, advantageously 1 to 50, % by mass of the desired ingredients, and 99.5 to 0.1, especially 99 to 5, % by mass of a solid or liquid adjuvant (including, for example, a solvent such as water), where the auxiliaries (or adjuvant) can be a surfactant in an amount of 0 to 50, especially 0.5 to 40, % by mass based on the mass of the pre-mix formulation.

The rates of application vary within wide limits and depend on the nature of the soil, the method of application, the crop plant, the pest to be controlled, the prevailing climatic conditions, and other factors governed by the method of application, the time of application and the target crop.

The rates of application of combinations and compositions of the present invention may vary within wide limits and depend on the nature of the soil, the method of application (pre- or post-emergence, seed dressing, application to the seed furrow, no tillage application etc.), the crop plant, the prevailing climatic

conditions, and other factors governed by the method of application, the time of application and the target crop.

For foliar or drench application, the combinations and compositions of the present invention are generally applied at a rate of from 1 to 2000 g/ha, especially from 10 to 1000 g/ha.

In certain examples, the rate of application of component (A) is from 20 to 200 g/ha. In some examples, the rate of application of component (A) is from 50 to 100 g/ha, optionally from 60 to 75 g/ha or about 100 g/ha.

In certain examples, the rate of application of component (B) is from 20 to 200 g/ha. In some examples, the rate of application of component (A) is from 50 to 100 g/ha, optionally from 60 to 75 g/ha or about 100 g/ha.

For seed treatment the rate of application is generally between 0.0005 and 150 g of component (A) and between 0.0005 and 150 g of component (B) per kg of seed.

In certain examples, the rate of application is between 0.002 and 0.03 mg of component (A) and between 0.002 and 0.03 mg of component (B) per seed.

In certain examples, the seed treatment comprises applying to the seed 0.001 - 50 g of component (A) per kg of seed; preferably 0.01 - 10 g per kg of seed; more preferably 0.05 - 1.25 g per kg of seed; most preferably 0.25 - 0.6 g per kg of seed.

In certain examples, the seed treatment comprises applying to the seed 0.001 - 50 of component (B) per kg of seed; preferably 0.01 - 10 g per kg of seed; more preferably 0.05 - 1 g per kg of seed; most preferably 0.1 - 0.8 g per kg of seed.

Preferred formulations can have the following compositions (weight %):

Emulsifiable concentrates:

active ingredient:	1 to 95 %, preferably 60 to 90 %
surface-active agent:	1 to 30 %, preferably 5 to 20 %
liquid carrier:	1 to 80 %, preferably 1 to 35 %

Dusts:

active ingredient:	0.1 to 10 %, preferably 0.1 to 5 %
solid carrier:	99.9 to 90 %, preferably 99.9 to 99 %

Suspension concentrates:

active ingredient:	5 to 75 %, preferably 10 to 50 %
water:	94 to 24 %, preferably 88 to 30 %
surface-active agent:	1 to 40 %, preferably 2 to 30 %

Wettable powders:

active ingredient:	0.5 to 90 %, preferably 1 to 80 %
surface-active agent:	0.5 to 20 %, preferably 1 to 15 %
solid carrier:	5 to 95 %, preferably 15 to 90 %

Granules:

active ingredient:	0.1 to 30 %, preferably 0.1 to 15 %
solid carrier:	99.5 to 70 %, preferably 97 to 85 %

The following Examples further illustrate, but do not limit, the invention.

<u>Wettable powders</u>	a)	b)	c)
active ingredients	25 %	50 %	75 %
sodium lignosulfonate	5 %	5 %	-
sodium lauryl sulfate	3 %	-	5 %
sodium diisobutyl naphthalenesulfonate	-	6 %	10 %
phenol polyethylene glycol ether (7-8 mol of ethylene oxide)	-	2 %	-
highly dispersed silicic acid	5 %	10 %	10 %
Kaolin	62 %	27 %	-

The combination is thoroughly mixed with the adjuvants and the mixture is thoroughly ground in a suitable mill, affording wettable powders that can be diluted with water to give suspensions of the desired concentration.

<u>Powders for dry seed treatment</u>	a)	b)	c)
active ingredients	25 %	50 %	75 %
light mineral oil	5 %	5 %	5 %
highly dispersed silicic acid	5 %	5 %	-
Kaolin	65 %	40 %	-
Talcum	-		20

The combination is thoroughly mixed with the adjuvants and the mixture is thoroughly ground in a suitable mill, affording powders that can be used directly for seed treatment.

<u>Emulsifiable concentrate</u>	
active ingredients	10 %
octylphenol polyethylene glycol ether	3 %
(4-5 mol of ethylene oxide)	
calcium dodecylbenzenesulfonate	3 %
castor oil polyglycol ether (35 mol of ethylene oxide)	4 %
Cyclohexanone	30 %
xylene mixture	50 %

Emulsions of any required dilution, which can be used in plant protection, can be obtained from this concentrate by dilution with water.

<u>Dusts</u>	a)	b)	c)
Active ingredients	5 %	6 %	4 %
Talcum	95 %	-	-
Kaolin	-	94 %	-
mineral filler	-	-	96 %

Ready-for-use dusts are obtained by mixing the combination with the carrier and grinding the mixture in a suitable mill. Such powders can also be used for dry dressings for seed.

<u>Extruder granules</u>	
Active ingredients	15 %
sodium lignosulfonate	2 %
carboxymethylcellulose	1 %
Kaolin	82 %

The combination is mixed and ground with the adjuvants, and the mixture is moistened with water. The mixture is extruded and then dried in a stream of air.

<u>Coated granules</u>	
Active ingredients	8 %
polyethylene glycol (mol. wt. 200)	3 %
Kaolin	89 %

The finely ground combination is uniformly applied, in a mixer, to the kaolin moistened with polyethylene glycol. Non-dusty coated granules are obtained in this manner.

Suspension concentrate

active ingredients	40 %
propylene glycol	10 %
nonylphenol polyethylene glycol ether (15 mol of ethylene oxide)	6 %
Sodium lignosulfonate	10 %
carboxymethylcellulose	1 %
silicone oil (in the form of a 75 % emulsion in water)	1 %
Water	32 %

The finely ground combination is intimately mixed with the adjuvants, giving a suspension concentrate from which suspensions of any desired dilution can be obtained by dilution with water. Using such dilutions, living plants as well as plant propagation material can be treated and protected against infestation by microorganisms, by spraying, pouring or immersion.

Flowable concentrate for seed treatment

active ingredients	40 %
propylene glycol	5 %
copolymer butanol PO/EO	2 %
Tristyrenephenole with 10-20 moles EO	2 %
1,2-benzisothiazolin-3-one (in the form of a 20% solution in water)	0.5 %
monoazo-pigment calcium salt	5 %
Silicone oil (in the form of a 75 % emulsion in water)	0.2 %
Water	45.3 %

The finely ground combination is intimately mixed with the adjuvants, giving a suspension concentrate from which suspensions of any desired dilution can be obtained by dilution with water. Using such dilutions, living plants as well as plant propagation material can be treated and protected against infestation by microorganisms, by spraying, pouring or immersion.

Slow Release Capsule Suspension

28 parts of the combination are mixed with 2 parts of an aromatic solvent and 7 parts of toluene diisocyanate/polymethylene-polyphenylisocyanate-mixture (8:1). This mixture is emulsified in a mixture of 1.2 parts of polyvinylalcohol, 0.05 parts of a defoamer and 51.6 parts of water until the desired particle size is achieved. To this emulsion a mixture of 2.8 parts 1,6-diaminohexane in 5.3 parts of water is added. The mixture is agitated until the polymerization reaction is completed. The obtained capsule suspension is stabilized by adding 0.25 parts of a thickener and 3 parts of a dispersing agent. The capsule suspension formulation contains 28% of the active ingredients. The medium capsule diameter is 8-15 microns. The resulting formulation is applied to seeds as an aqueous suspension in an apparatus suitable for that purpose.

The combination or composition of the present invention may be applied to a plant, part of the plant, plant organ, plant propagation material or a plant growing locus.

The application is generally made by spraying (A) and (B) separately (i.e. the combination) or (A) and (B) together (i.e. the composition), typically by tractor mounted sprayer for large areas, but other methods such as dusting (for powders), drip or drench can also be used. Alternatively the combination or composition may be applied in furrow or directly to a seed before or at the time of planting.

The combination or composition of the present invention may be applied pre-emergence or post-emergence. Where the combination or composition is used to regulate the growth of crop plants or

enhance the tolerance to abiotic stress, it may be applied post-emergence of the crop. Where the combination or composition is used to inhibit or delay the germination of seeds, it may be applied pre-emergence. Where the combination or composition is used to control pests, it may be applied as a preventative (before pest establishment) or curative (after pest establishment) treatment.

The present invention envisages application of the combinations and compositions of the invention to plant propagation material prior to, during, or after planting, or any combination of these.

Although active ingredients can be applied to plant propagation material in any physiological state, a common approach is to use seeds in a sufficiently durable state to incur no damage during the treatment process. Typically, seed would have been harvested from the field removed from the plant and separated from any cob, stalk, outer husk, and surrounding pulp or other non-seed plant material. Seed would preferably also be biologically stable to the extent that treatment would not cause biological damage to the seed. It is believed that treatment can be applied to seed at any time between seed harvest and sowing of seed including during the sowing process.

Methods for applying or treating active ingredients on to plant propagation material or to the locus of planting are known in the art and include dressing, coating, pelleting and soaking as well as nursery tray application, in furrow application, soil drenching, soil injection, drip irrigation, application through sprinklers or central pivot, or incorporation into soil (broad cast or in band). Alternatively or in addition active ingredients may be applied on a suitable substrate sown together with the plant propagation material.

The combinations and compositions according to the invention can be used in combination with other pesticides, including other pesticides such as insecticides, acaricides, nematocides, fungicides, or agents that enhance the activity of the composition according to the invention, in for example chemical treatment or pest control programs. The combination may have further surprising advantages, which could be described as synergistic effects.

Suitable other pesticides are, for example, pesticides of the following classes of active ingredients: organophosphates, nitrophenol derivatives, thioureas, juvenile hormones, formamidines, benzophenone derivatives, ureas, pyrrole derivatives, carbamates, pyrethroids, chlorinated hydrocarbons, acylureas, pyridylmethyleamino derivatives, macrolides, benzoylureas, neonicotinoids and biological agents such as *Bacillus thuringiensis* strains or bacterially-derived pesticides such as spinosads, avermectins and Cry proteins.

The term "seed treatment" generally refers to application of a material to a seed prior to or during the time it is planted in soil to improve the handling characteristics of the seed, protect the seed prior to germination, support the germination and/or support the growth of the resulting plant. Some seed treatments are employed solely for the purpose of improving the handling characteristics or other physical characteristics of seeds, and include no agricultural active ingredients. Other seed treatments bind one or more active ingredients to seeds for various beneficial purposes. For example, seed treatments that include one or more active ingredients are commonly used to ensure uniform stand establishment by protecting against soilborne diseases and insects. Typical examples include the

application of pesticides such as fungicides, insecticides and plant growth regulators. Systemic seed treatments may eliminate, or at least reduce the need for, traditional broadcast sprays of foliar fungicides or insecticides for certain early season airborne diseases and insects.

The seed treatment mixture can also comprise or may be applied together and/or sequentially with further active compounds. These further compounds can be fertilizers or micronutrient donors or other preparations that influence plant growth, such as inoculants.

Component (A) is present in a fungicidally-effective amount in the formulation, for example, in an amount of 1% to about 60% by weight, based on the total weight of the seed treatment mixture. The compound of Component (B) is present in a fungicidally-active amount of from about 1 % to about 60% by weight, based on the total weight of the seed treatment mixture.

Components (A) and (B) may be applied to the seed sequentially or simultaneously.

The seed treatment may include further components, such as further fungicidal, insecticidal, acaricidal, and/or nematocidal ingredients. In yet further embodiments, the active component further includes other active ingredients.

The seed treatment mixture may additionally include non-active ingredients in some amount. For example, the active component may include surfactants, solvents (e.g., water and/or other solvents), thickeners, preservatives (including bactericides and other biocides), humectants, antifreeze ingredients, antifoam ingredients and if appropriate colorants, or other additives.

The seed treatment mixture can be applied to a seed in a variety of manners conventional in the seed treating art, including but not limited to mixing in a container (e.g., a bottle, bag or tumbler), mechanical application, tumbling, spraying, and immersion, followed by drying. Examples of seed coating techniques and machines that can be employed include fluidized bed techniques, the roller mill method, rotary seed treaters, drum coaters, side vended pan, tumble mixers and spouted beds. The seeds may be pre-sized before coating. In one embodiment, the seed treatment mixture is applied to seeds in a Hege seed treater, which rotates as the formulation is being added to the seeds. Mixing is preferably continued until the seed treatment mixture is distributed uniformly on the seed (i.e., uniform coatings over all of the seeds to be treated and an even coating on each individual seed). The seed treatment mixture can be applied to seeds in a batch treatment process or in a continuous treatment process. In one representative batch treatment process, the seeds to be treated are introduced to a batch treatment tank and the seed treatment mixture is then added and mixed with the seeds. Alternatively a continuous treatment process can be used to apply the seed treatment mixture to seeds in which a stream of seeds are introduced into a receptacle containing the seed treatment slurry and, after contacting the formulation, recovered from the receptacle for drying. A stream of seed treatment mixture can continuously flow into the receptacle as well to replenish quantities of the mixture that are removed with treated seeds.

After application of the seed treatment mixture (whether in a batch process or a continuous process) the seeds are allowed a period of time to dry. For example, the seeds can be spun in a bowl for a period of time, for example, at least 15 seconds, to allow for drying. Different time periods may be needed to

allow for variability in drying conditions due to weather or different seed sizes. Moreover, heat can be provided, if desired, to increase drying times, for example, in the form of a heated stream of air. After drying, the coated seeds can undergo a size separation or classification process.

As used herein, the term "seed" denotes any resting stage of a plant that is physically detached from the vegetative stage of a plant and/or may be stored for prolonged periods of time and/or can be used to re-grow another plant individual of the same species. Here, the term "resting" refers to a state wherein the plant retains viability, within reasonable limits, in spite of the absence of light, water and/or nutrients essential for the vegetative (i.e. non-seed) state. In particular, the term refers to true seeds but does not embrace plant propagules such as suckers, corms, bulbs, fruit, tubers, grains, cuttings and cut shoots.

In one embodiment, the seeds treated as described herein include seeds of corn (maize), wheat, barley, oat, rye, spelt, canola, rice, sugar beet, cotton, millet varieties such as sorghum, sun flowers, beans, peas, oil plants such as soybeans, cabbages, tomatoes, eggplants (aubergines), pepper and other vegetables and spices as well as ornamental shrubs and flowers. Suitable target crops also include transgenic crop plants of the foregoing. In one embodiment, the seed is from maize, cotton, wheat, barley, soybeans, or canola, preferably maize or cotton.

Although the seed treatment methods described herein can be applied to a seed in any physiological state, it is preferred that the seed be in a sufficiently durable state that it incurs no significant damage during the treatment process. Typically, the seed is a seed that has been harvested from a field; removed from the plant; and/or separated from the fruit and any cob, pod, stalk, outer husk, and surrounding pulp or other non-seed plant material. The seed is preferably also biologically stable to the extent that the treatment would cause no biological damage to the seed. In one embodiment, for example, the treatment can be applied to seed that has been harvested, cleaned and dried to a moisture content below about 15% by weight. In an alternative embodiment, the seed can be one that has been dried and then primed with water and/or another material and then re-dried before or during the treatment with a seed treatment mixture as described herein. In one embodiment, the seed to be treated is thus substantially dry. "Substantially dry" is used herein to refer to a seed that has a moisture content which results if the seed is allowed to equilibrate in an air atmosphere at 20 to 30 °C and 30-90% relative humidity, e.g. at 25 °C and 50% relative humidity.

The seed treatment mixture can be applied to the seed at any time from the harvest of the seed to the sowing of the seed in the ground for the purpose of germination and growth of the plant. For example, the treatment may be carried out several weeks or months, for example up to 12 months, before planting the seed, for example in the form of a seed dressing treatment, without a substantially reduced efficacy being observed. Seeds can be treated, for example, at a central location and then dispersed for planting. This permits the person who plants the seeds to avoid the handling and use of active ingredients and to merely handle and plant the treated seeds in a manner that is conventional for regular untreated seeds, which reduces human exposure.

A seed dressing formulation is applied in a manner known per se to the seeds employing the compositions according to the invention and a diluent in suitable seed dressing formulation form, e.g. as an aqueous suspension or in a dry powder form having good adherence to the seeds. Such seed dressing formulations are known in the art. Seed dressing formulations may contain the single active ingredients or the combination of active ingredients in encapsulated form, e.g. as slow-release capsules, or microcapsules.

In a further aspect, the present application also relates to plant propagation material coated with the composition according to the invention.

A synergistic effect exists whenever the action of an active ingredient combination is greater than the sum of the actions of the individual components. The action to be expected E for a given active ingredient combination obeys the so-called COLBY formula and can be calculated as follows (COLBY, S.R. "Calculating synergistic and antagonistic responses of herbicide combination". Weeds, Vol. 15, pages 20-22 1967):

ppm = milligrams of active ingredient (a.i.) per liter

X = % action by first active ingredient using p ppm of the active ingredient

Y = % action by second active ingredient using q ppm of the active ingredient.

According to Colby, the expected (additive) action of active ingredients A + B using p + q ppm of active

ingredient is $E = X + Y - \frac{X \cdot Y}{100}$

If the action actually observed O is greater than the expected action E, then the action of the combination is super-additive, i.e. there is a synergistic effect. In mathematical terms, synergism corresponds to a positive value for the difference of (O-E). In the case of purely complementary addition of activities (expected activity), said difference (O-E) is zero. A negative value of said difference (O-E) signals a loss of activity compared to the expected activity.

Table 1 sets out certain preferred combinations for controlling or preventing infestation of a plant. Table 1 lists example application ratios, Table 1 also lists key pests against which the combinations are particularly effective and key crops for which the inventive combinations are particularly advantageous.

Table 1A

Weight ratio component A: component B				Pest	Crop
typical	preferred	more preferred	most preferred		
1000:1 - 1:1000	100:1 - 1:100	1:10 - 10:1	1:2 - 2:1	<i>Fusarium graminearum</i> <i>Fusarium pseudograminearum</i> <i>Fusarium culmorum</i> <i>Fusarium avenaceum</i> <i>Fusarium moniliforme</i> <i>Fusarium oxysporum</i> <i>Fusarium proliferatum</i> <i>Fusarium solani</i> <i>Fusarium subglutinans</i> <i>Fusarium tricinctum</i> <i>Fusarium virguliforme</i> , <i>Fusarium fujikuroi</i> <i>Fusarium verticillioides</i> <i>Fusarium merismoides</i> <i>Fusarium acuminatum</i> <i>Fusarium chlamydosporum</i> <i>Fusarium compactum</i> <i>Fusarium equiseti</i> <i>Fusarium semitectum</i>	cereal cotton soybean vegetable pome fruit stone fruit citrus potato

Table 1A

Weight ratio component A: component B				Pest	Crop
typical	preferred	more preferred	most preferred		
1000:1 - 1:1000	100:1 - 1:100	1:10 - 10:1	1:2 - 2:1	<i>Rhizoctonia solani</i> <i>Rhizoctonia cerealis</i> <i>Rhizoctonia zeae</i> <i>Rhizoctonia oryzae</i> <i>Rhizoctonia oryzae-sativae</i> <i>Rhizoctonia leguminicola</i> <i>Rhizoctonia crocorum</i> <i>Rhizoctonia ramicola</i> <i>Rhizoctonia carotae</i> <i>Rhizoctonia tuliparum</i>	cereal cotton soybean vegetable pome fruit stone fruit citrus potato

Table 1C

Weight ratio component A: component B				Pest	Crop
typical	preferred	more preferred	most preferred		
1000:1 - 1:1000	100:1 - 1:100	1:10 - 10:1	1:5 - 5:1	<i>Alternaria alternata</i> <i>Alternaria solani</i> <i>Alternaria tenuissima</i> <i>Alternaria brassicicola</i> <i>Alternaria dauci</i> <i>Alternaria radicina</i> <i>Alternaria citri</i> <i>Alternaria sesami</i> <i>Alternaria brassicae</i> <i>Alternaria raphani</i>	cereal cotton soybean vegetable pome fruit stone fruit citrus potato

Table 1D

Weight ratio component A: component B				Pest	Crop
typical	preferred	more preferred	most preferred		
1000:1 - 1:1000	100:1 - 1:100	10:1 - 1:10	1:5 - 5:1	<i>Fusarium graminearum</i>	cereal

Table 2 sets out certain combinations for seed treatments and lists key pests against which the combinations are particularly effective and key seed species for which the inventive combinations are particularly advantageous as seed treatments.

Table 2

	Typical (g/kg seed)	Preferred (g/kg seed)	More preferred (g/kg seed)	Most preferred (g/kg seed)	Pest	Crop (seed)
component A	0.001 - 50	0.01 - 10	0.05 - 1.25	0.25 - 0.6	<i>Fusarium graminearum</i> <i>Fusarium pseudograminearum</i> <i>Fusarium culmorum</i> <i>Fusarium avenaceum</i> <i>Fusarium moniliforme</i> <i>Fusarium oxysporum</i> <i>Fusarium proliferatum</i> <i>Fusarium solani</i> <i>Fusarium subglutinans</i> <i>Fusarium tricinctum</i> <i>Fusarium virguliforme</i> , <i>Fusarium fujikuroi</i> <i>Fusarium verticillioides</i> <i>Fusarium merismoides</i> <i>Fusarium acuminatum</i>	cereal cotton soybean vegetable pome fruit stone fruit citrus potato
component B	0.001 - 50	0.01 - 10	0.05 - 1	0.1 - 0.8	<i>Fusarium chlamydosporum</i> <i>Fusarium compactum</i> <i>Fusarium equiseti</i> <i>Fusarium semitectum</i> <i>Rhizoctonia solani</i> <i>Rhizoctonia cerealis</i> <i>Rhizoctonia zeae</i> <i>Rhizoctonia oryzae</i> <i>Rhizoctonia oryzae-sativae</i> <i>Rhizoctonia leguminicola</i> <i>Rhizoctonia crocorum</i> <i>Rhizoctonia ramicola</i> <i>Rhizoctonia carotae</i> <i>Rhizoctonia tuliparum</i> <i>Alternaria alternata</i> <i>Alternaria solani</i> <i>Alternaria tenuissima</i> <i>Alternaria brassicicola</i> <i>Alternaria dauci</i> <i>Alternaria radicina</i> <i>Alternaria citri</i> <i>Alternaria sesami</i> <i>Alternaria brassicae</i> <i>Alternaria raphani</i>	

Biological ExamplesMethodology:*Fusarium graminearum* *in vitro* bioassay

The synergistic biological activity of combinations of component (A) and component (B) as disclosed herein was assessed using an *in vitro* bioassay (micro-profiling screen in liquid culture). Fungal strain: *Gibberella zeae* strain K-6102; fungal colonies on PDA; growth medium used for the test: PDB + 0.3% agar. The experiment was conducted in 96-well plates, using application rates of 0.01, 0.1, and 1 mg ai/l; 4 replicates (wells) per treatment. All substances were dissolved in DMSO (2%) and diluted in Tween 20 (0.025%). Conidial spores were added in each well at the same time with the fungicide treatments (3600 spores/well). Incubation was performed during 3 days, at 95%RH and 24°C in the dark. Subsequently, the optical density was measured with a photometer (620 nm) and the efficacy (E, %) was calculated. The expected efficacy (E_{exp}) of a mixture was calculated according to the Abbott method (Levy *et al.* 1986. *The joint action of fungicides in mixtures: comparison of two methods for synergy calculation. Bulletin OEPP/EPPO Bulletin* 16, 651+65): $\% E_{exp} = A + B - (AB/100)$, wherein A and B are the control levels provided by the single fungicides. For synergy calculation, the ratio (SF, synergy factor) between the observed experimental efficacy of the mixture (E_{obs}) and the expected efficacy of the mixture (E_{exp}) is: $SF = E_{obs} / E_{exp}$. An $SF > 1$ indicates synergism.

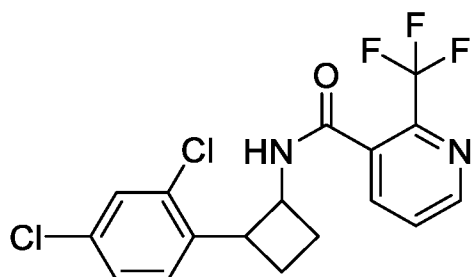
Results

Component (conc, ppm)	Efficacy (% , n=4)	SF
A (1)	40.8	-
A (0.1)	35.8	-
A (0.01)	5.1	-
B (1)	15.9	-
B (0.1)	5.9	-
B (0.01)	1.1	-
A (1) + B (1)	64.7	1.291
A (1) + B (0.1)	51.2	1.157
A (1) + B (0.01)	43.2	1.042
A (0.1) + B (1)	63.8	1.386
A (0.1) + B (0.1)	51.6	1.304
A (0.1) + B (0.01)	37.8	1.035

A (0.01) + B (1)	55.3	2.742
A (0.01) + B (0.1)	26.8	2.500
A (0.01) + B (0.01)	0.0	0.000

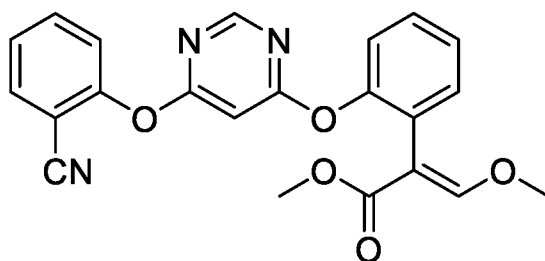
CLAIMS

1. A composition comprising as component (A), a compound of formula A-1:



(A-1; cyclobutrifluram)

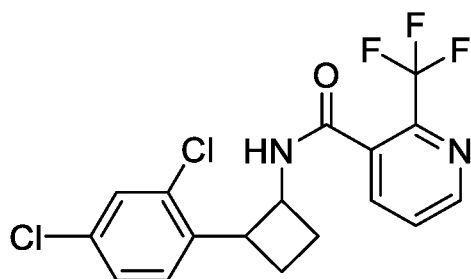
and, as component (B), a compound of formula B-1:



(B-1; azoxystrobin),

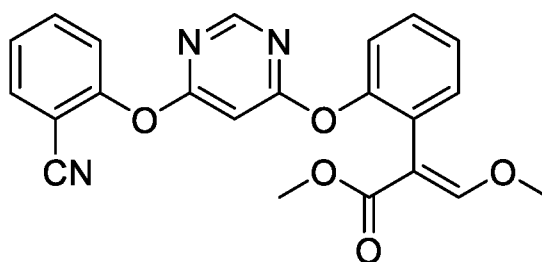
wherein the ratio by weight of (A) to (B) is from 500:1 to 1:500, 100:1 to 1:100, 50:1 to 1:50 or 20:1 to 1:20, or preferably 10:1 to 1:10 or 5:1 to 1:5; more preferably 3:1 to 1:3, or 2:1 to 1:2 or about 1:1.

2. A method of controlling or preventing infestation of a plant by a phytopathogenic microorganism of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus, which comprises applying, in any desired sequence or simultaneously, on the plant, the locus thereof or its propagation material, a combination or composition comprising as component (A), a compound of formula A-1:



(A-1)

and, as component (B), a compound of formula B-1:



(B-1).

3. The method according to claim 2, wherein the phytopathogenic microorganism is selected from *Fusarium virguliforme*, *Fusarium fujikuroi*, *Fusarium solani*, *Fusarium oxysporum*, *Fusarium acuminatum*, *Fusarium chlamydosporum*, *Fusarium compactum*, *Fusarium culmorum*, *Fusarium equiseti*, *Fusarium graminearum*, *Fusarium merismoides*, *Fusarium proliferatum*, *Fusarium pseudograminearum*, *Fusarium semitectum*, *Fusarium subglutinans*, *Fusarium verticillioides*, *Fusarium avenaceum*, *Fusarium moniliforme*, and *Fusarium tricinctum*, preferably *Fusarium graminearum*.

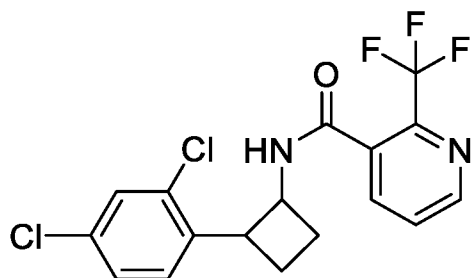
4. The method according to any one of claims 2 to 3, wherein the plant is selected from cereals, soybean, cotton, vegetables, pome fruits, stone fruits, citrus, and potato.

5. The method according to any one of claims 2 to 4, wherein the plant is a cereal plant, preferably a maize, wheat, barley, oats, or rye plant.

6. The method according to any one of claims 2 to 5, wherein the ratio by weight of (A) to (B) is from 2000:1 to 1:2000, between 1500:1 to 1:1500, between 1000:1 to 1:1000, between 750:1 to 1:750, between 500:1 to 1:500, between 400:1 to 1:400, between 300:1 to 1:300, between 250:1 to 1:250, between 200:1 to 1:200, between 150:1 to 1:150, between 125:1 to 1:125, between 100:1 to 1:100, between 80:1 to 1:80, between 75:1 to 1:75, between 70:1 to 1:70, between 125:2 to 2:125, between 60:1 to 1:60, between 50:1 to 1:50, between 40:1 to 1:40, between 30:1 to 1:30, between 25:1 to 1:25, between 20:1 to 1:20, between 16:1 to 1:16, between 15:1 to 1:15, between 12:1 to 1:12, between 10:1 to 1:10, between 9:1 to 1:9, between 8:1 to 1:8, between 7.5:1 to 1:7.5, between 7:1 to 1:7, between 6:1 to 1:6, between 5:1 to 1:5, between 4:1 to 1:4, between 10:3 to 3:10, between 3:1 to 1:3, between 2.5:1 to 1:2.5, between 2:1 to 1:2, between 5:3 to 3:5, between 8:5 to 5:8, between 1.5:1 to 1:1.5, between 4:3 to 3:4, between 5:4 to 4:5, or about 1:1 by weight.

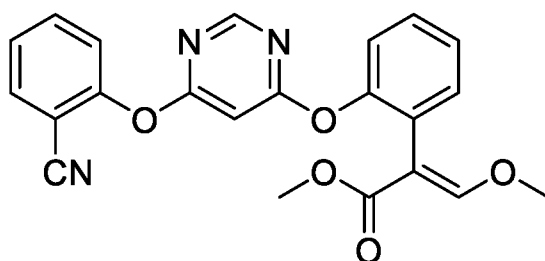
7. The method according to any one of claims 1 to 5, wherein the rate of application of component (A) is from 1 to 2000 g/ha, preferably from 10 to 1000 g/ha, more preferably from 20 to 200 g/ha or from 50 to 100 g/ha, most preferably from 60 to 75 g/ha; and the rate of application of component (B) is from 1 to 2000 g/ha, preferably from 10 to 1000 g/ha, more preferably from 20 to 200 g/ha or from 50 to 100 g/ha, most preferably from 60 to 75 g/ha.

8. A seed treatment composition comprising, as component (A) a compound of formula A-1:



(A-1)

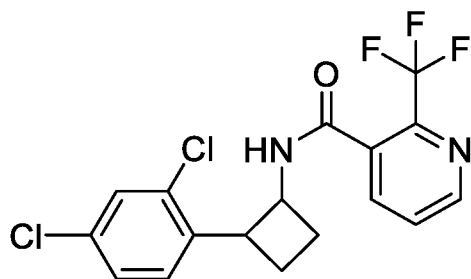
and, as component (B), a compound of formula B-1:



(B-1),

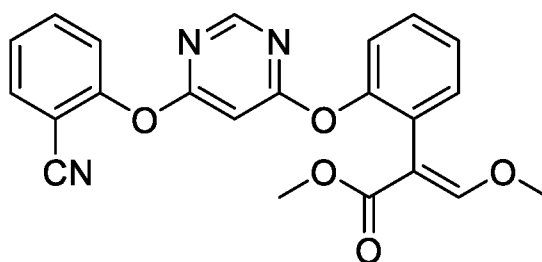
wherein the ratio by weight of (A) to (B) is from 500:1 to 1:500, 100:1 to 1:100, 50:1 to 1:50 or 20:1 to 1:20, or preferably 10:1 to 1:10 or 5:1 to 1:5; more preferably 3:1 to 1:3, or 2:1 to 1:2 or about 1:1.

9. A method of controlling or preventing infestation of a plant by phytopathogenic microorganisms of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus, which comprises applying to a seed, in any desired sequence or simultaneously, as component (A), a compound of formula A-1:



(A-1)

and, as component (B), a compound of formula B-1:

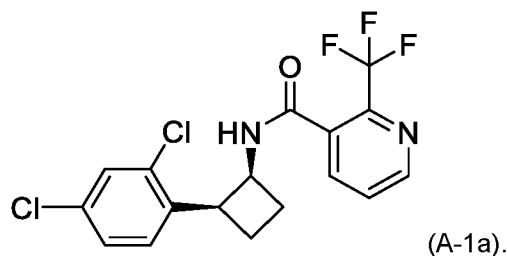


(B-1).

10. The method according to claim 9, comprising applying to the seed 0.001 - 50 g of component (A) per kg of seed; preferably 0.01 - 10 g per kg of seed; more preferably 0.05 - 1.25 g per kg of seed; most preferably 0.25 - 0.6 g per kg of seed and/or 0.001 - 50 of component (B) per kg of seed; preferably 0.01 - 10 g per kg of seed; more preferably 0.05 - 1 g per kg of seed; most preferably 0.1 - 0.8 g per kg of seed.

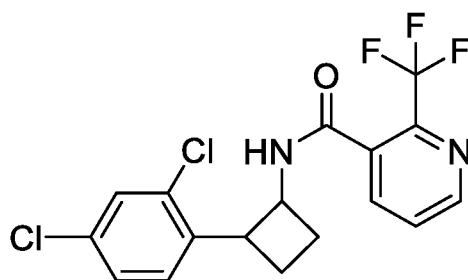
11. The method according to claim 9 or 10, wherein the rate of application is between 0.002 and 0.03 mg of component (A) and between 0.002 and 0.03 mg of component (B) per seed.

12. The composition according to claim 1 or 8, or the method according to any one of claims 2-7 or 9-11, wherein component A comprises at least 85%, and preferably at least 90%, of the S-enantiomer of formula (A-1a):



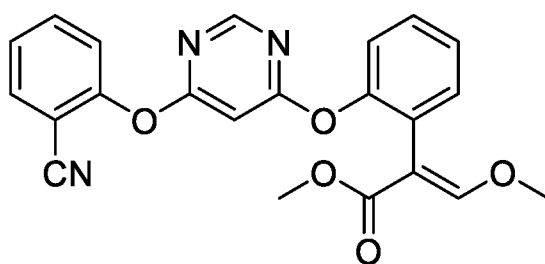
(A-1a).

13. A coated plant propagation material, wherein the coating comprises a composition comprising as component (A), a compound of formula A-1:



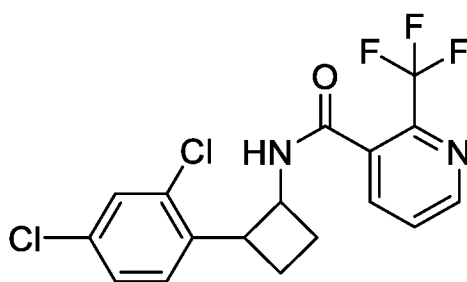
(A-1)

and, as component (B), a compound of formula B-1:



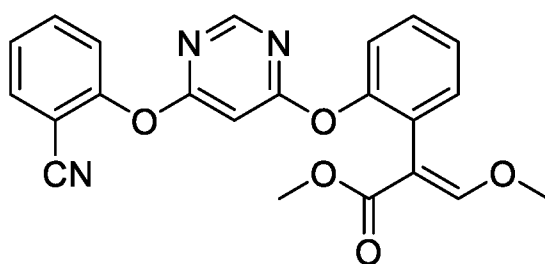
(B-1).

14. Use of a composition comprising as component (A), a compound of formula A-1:



(A-1)

and, as component (B), a compound of formula B-1:



(B-1),

for infestation of a plant by phytopathogenic microorganisms of the *Fusarium* genus, the *Rhizoctonia* genus or the *Alternaria* genus.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/077982

A. CLASSIFICATION OF SUBJECT MATTER INV. A01N43/40 A01N43/54 A01P3/00 A01P5/00 ADD.		
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) A01N A01P 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 practicable, search terms used) EPO-Internal, CHEM ABS Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AU 2021 255 795 A1 (BAYER AG) 10 November 2022 (2022-11-10) claim 1 page 2, line 24 - page 3, line 6 page 6, lines 7-9 page 7, lines 12-13 page 24, lines 26-28 page 26, lines 23-25 page 28, lines 3-5 -----	1 - 14
A	WO 2022/073797 A1 (BASF SE [DE]) 14 April 2022 (2022-04-14) claim 1 complete table; page 2, line 21 - page 4, line 1 ----- - / - -	1 - 14
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search 3 December 2024		Date of mailing of the international search report 19/12/2024
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Größl, Sylvester

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2024/077982

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2023/072785 A1 (SYNGENTA CROP PROTECTION AG [CH]) 4 May 2023 (2023-05-04) biological examples 1-2, including tables 1-2; page 28 - page 30 -----	1 - 14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2024/077982

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AU 2021255795 A1	10-11-2022	AR 121830 A1	13-07-2022
		AU 2021255795 A1	10-11-2022
		BR 112022020792 A2	29-11-2022
		CA 3180165 A1	21-10-2021
		CN 115515426 A	23-12-2022
		EP 4135520 A1	22-02-2023
		US 2023133087 A1	04-05-2023
		UY 39169 A	30-11-2021
		WO 2021209363 A1	21-10-2021

WO 2022073797 A1	14-04-2022	AR 123721 A1	04-01-2023
		EP 4225034 A1	16-08-2023
		US 2023371511 A1	23-11-2023
		WO 2022073797 A1	14-04-2022

WO 2023072785 A1	04-05-2023	CN 118368985 A	19-07-2024
		EP 4422404 A1	04-09-2024
		JP 2024540114 A	31-10-2024
		WO 2023072785 A1	04-05-2023
