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(54) Title: PROCESS OF GROWING MYCORRHIZA

(57) Abstract: The invention relates to a process of growing mycorrhiza by: (a) contacting mycorrhiza with an insecticide and/or nematicide; and (b) growing the mycorrhiza in the presence of the insecticide and/or nematicide such that the amount of mycorrhiza is increased.



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Process of growing mycorrhiza

The invention relates to a process of growing mycorrhiza. The invention further relates to a composition comprising mycorrhiza.

- 5 The production of mycorrhiza requires special conditions not only to allow the fungus to grow but also to stabilize and keep it alive. Various chemicals are reported to enhance the growth of mycorrhizal fungi as is reported in the article by Ishii and Kuramoto (Acta Hort. 638, ISHS 2004, pp.289-292). There are also various chemicals that deteriorate the growth of mycorrhiza such as pesticides like certain fungicides. For commercial use there is still a need
10 for improving the growth of the mycorrhiza.

Accordingly, an object of the invention is a process of growing mycorrhiza by:

- (a) contacting mycorrhiza with an insecticide and/or nematicide; and
(b) growing the mycorrhiza in the presence of the insecticide and/or nematicide such that the
15 amount of mycorrhiza is increased.

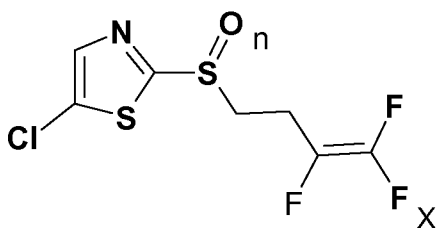
The presence of the insecticide in the process of the invention generally enables an improved growth rate of mycorrhiza, in particular of arbuscular mycorrhiza. The hyphae formation of the mycorrhiza is generally enhanced and its growth rate increased, which leads to an increased
20 yield, a commercially more attractive production process, and may enhance the efficacy of mycorrhiza under field conditions.

The mycorrhiza of the invention can be any mycorrhiza known in the art. Generally, the mycorrhizal fungus includes endomycorrhiza, ectomycorrhiza, ericaceous mycorrhiza and
25 orchidaceous mycorrhiza. Examples of endomycorrhiza are Zygomycetes in particular those in the order of the Glomales which are also referred to as arbuscular mycorrhiza (AM) or vesicular-arbuscular mycorrhiza (VAM). Examples of endomycorrhiza include Basidiomycota and Ascomycota. Of the mycorrhiza fungi the endomycorrhiza is preferred. In a particular embodiment the mycorrhiza fungus is a fungus of the genus Glomus of which Glomus
30 intraradices is a particular example. The ectomycorrhiza generally are preferred due to their beneficial effect in agriculture, horticulture or forestry.

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The insecticide suitable in the process of the invention can be any insecticide known in the art. The insecticide may be an insecticide which is selected from the group consisting of neonicotinoids, carbamates, diamides, spinosyns, phenylpyrazoles, pyrethroids and sulfoxaflor. Examples of neonicotinoids are thiamethoxam, clothianidin, imidacloprid, acetamiprid, dinotefuran, nitenpyram and thiacloprid. Preferred neonicotinoids are thiamethoxam, imidacloprid and clothianidin. Examples of carbamates include thiodicarb, aldicarb, carbofuran, furadan, fenoxycarb, carbaryl, sevin, ethienocarb, and fenobucarb. Examples of diamides include chlorantraniliprole, cyantraniliprole, and flubendiamide. Examples of spinosyns include spinosad and spinetoram. Examples of pyrethroids include lambda-cyhalothrin, gamma-cyhalothrin, and tefluthrin. An example of phenylpyrazole is fipronil. Of these insecticides neonicotinoids, and in particular thiamethoxam, are preferred.

The nematicide suitable for use in the invention can be any nematicide known in the art. Examples include an avermectin (e.g., abamectin), carbamate nematicides (e.g., aldicarb, thiadiazin, carbofuran, carbosulfan, oxamyl, aldoxycarb, ethoprop, methomyl, benomyl, alanycarb), organophosphorus nematicides (e.g., phenamiphos (fenamiphos), fensulfothion, terbufos, fosthiazate, dimethoate, phosphocarb, dichlofenthion, isamidofos, fosthietan, isazofos ethoprophos, cadusafos, terbufos, chlorpyrifos, dichlofenthion, heterophos, isamidofos, mecarphon, phorate, thionazin, triazophos, diamidafos, fosthietan, phosphamidon), and certain fungicides, such as captan, thiophanate-methyl and thiabendazole. Also included as a nematicide is a compound of formula X,



wherein n is 0, 1 or 2 and the thiazole ring may be optionally substituted. Abamectin, aldicarb, thiadiazin, dimethoate, methomyl, a compound of formula X and oxamyl are preferred nematicides for use in this invention.

Mycorrhiza and the insecticide and/or nematicide can be used in any ratio deemed suitable be the person skilled in the art. Generally, the composition comprising the insecticide and/or nematicide that is used in the process of the invention generally comprises at least 1 ppb

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(parts per billion), preferably at least 50 ppb, more preferably at least 100 ppb, and most preferably at least 500 ppb, and generally at most 10,000 ppm (parts per million), preferably at most 5,000 ppm, more preferably at most 2,000 ppm, and most preferably at most 1,000 ppm. The composition can be in any form known in the art. Preferably, the composition is
5 liquid and comprises a solvent or dispersing medium.

The process of the invention can be conducted in-vivo or in-vitro.

In one embodiment of the inventive process, the mycorrhiza and/or insecticide and/or
10 nematocide are isolated from the mixture obtained after step (b) of the process.

A further aspect of the present invention are the products obtained from the above processes. This product comprises both (I) mycorrhiza and (II) insecticide and/or nematocide. Such a product can be suitably used in agriculture, horticulture or forestry where they will
15 positively influence the growth potential of plant propagation material.

In yet another aspect, the invention pertains to a composition comprising (i) mycorrhiza and (ii) insecticide and/or nematocide. The mycorrhiza is preferably and at least partially originating from the process in accordance with the invention, i.e. the mycorrhiza contains insecticide
20 and/or nematocide present during the process. The composition of the invention may originate from a product of the process of the invention where additionally insecticide and/or nematocide is added, or where additionally mycorrhiza from a different source (i.e. without insecticide and/or nematocide) is added.

In a further aspect, the present invention provides a method of controlling or preventing pest damage in a plant propagation material, a plant, part of a plant and/or plant organ that grow at a later point in time, which comprises applying on the pest, plant, part of the plant, plant organ, plant propagation material or a surrounding area thereof, the ingredients of the combination as defined in the first aspect, in any desired sequence or simultaneously. In a
25 particular embodiment, the invention relates to a method of treating a plant propagation material comprising applying the plant propagation material with applying an insecticide suitable for use as seed treatment insecticide to the plant propagation material, and applying
30 a nematocidally active biological agent to the plant propagation material.

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In a yet further aspect, the present invention provides a method of protecting a plant propagation material, a plant, part of a plant and/or plant organ that grow at a later point in time against pest damage by applying to the pest, plant, part of plant, plant organ, plant propagation material or a surrounding area thereof the ingredients of the combination of the invention in any desired sequence or simultaneously.

The invention also relates to a plant propagation material treated with each of the combination of the invention.

Further, in an embodiment the present invention relates to a method which comprises (i) treating a plant propagation material, such as a seed, with a combination as defined in the first aspect, and (ii) planting or sowing the treated propagation material, wherein the combination protects against pest damage of the treated plant propagation material, or part of plant, plant organ and/or plant grown from the treated propagation material, while simultaneously stimulating and enhancing the growth of the plant propagation material. The presence of the insecticide and/or nematicide in the vicinity of the mycorrhizal fungi, and in particular the arbuscular mycorrhiza, enables a more efficient nutrient and water uptake by the plant propagation material compared to a situation where the insecticide and/or nematicide is absent.

Also, in an embodiment the present invention relates to a method which comprises (i) treating a plant propagation material, such as a seed, with a composition as defined above, and (ii) planting or sowing the treated propagation material, and (iii) achieving protection against pest damage of the treated plant propagation material, or part of plant, plant organ and/or plant grown from the treated propagation material, while simultaneously stimulating and enhancing the growth of the plant propagation material.

In all of the above methods the insecticide and biological agent may also be applied as a mixture. Preferably, the plant propagation material is a seed.

In an embodiment of any aspects of the invention, the combination is a composition comprising, preferably of, (I) mycorrhiza, preferably arbuscular mycorrhiza, and (II) insecticide, and optionally (III) one or more customary formulation auxiliaries.

In an embodiment of any aspects of the invention, the combination is a composition comprising, preferably of, (I) mycorrhiza, preferably arbuscular mycorrhiza, and (II)

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neonicotinoid, preferably thiamethoxam, and optionally (III) one or more customary formulation auxiliaries.

5 In an embodiment of any aspects of the invention, the combination is a composition comprising, preferably of, (I) mycorrhiza, preferably arbuscular mycorrhiza, and (II) nematicide, and optionally (III) one or more customary formulation auxiliaries.

10 In an embodiment of any aspects of the invention, the combination is a composition comprising, preferably of, (I) mycorrhiza, preferably arbuscular mycorrhiza, and (II) avermectin, preferably abamectin, and optionally (III) one or more customary formulation auxiliaries.

15 In one embodiment of the invention the combination may be any of the above combinations except that thiamethoxam is replaced by either imidacloprid or clothianidin.

In a preferred embodiment the combination is in the form of a composition, which composition further comprises (III) one or more customary formulation auxiliaries. In a preferred embodiment, each combination is a composition that is in the form of a pre-mix formulated composition.

20 Each combination can demonstrate synergistic activity compared to the activity of the individual ingredients in the combination. There may be more than one agent, independently of each combination, from (II).

25 In an embodiment, the invention pertains to a product used in agriculture, horticulture or forestry comprising a capsule wherein the combination or composition of the invention, optionally with a seed, is located. The seed may be untreated or treated with at least one pesticide. The capsule may further contain other ingredients such as further pesticides, fertilizers, and nutrients. The capsule useful for carrying out the invention may be a
30 conventional capsule dissolving or disintegrating in the presence of humidity. Such capsules are, for example, used in medicinal arts to administer medicines. Such capsules may therefore be obtained using conventional techniques known in the art. As an indication, such capsules measure from 10 to 30 mm in length and have a diameter ranging from 10 to 25 mm, a preferred dimension being from 15 mm to 25 mm in length and 15 mm to 20 mm in
35 diameter. The ratio of length to diameter is usually from 1:1 to 3:1. The material of the capsule is chosen so that it dissolves or disintegrates in the presence of humidity. It is

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preferred that such dissolution or disintegration occurs rather rapidly. In case a seed is present in the capsule, it is preferred that the capsule is gas and water permeable so that germination of the said seed is not hindered. Suitable materials for such capsules are, for example, gelatin, starch, hydroxypropylmethylcellulose and other cellulose derivatives.

5 Preferred materials are starch and hydroxypropyl methylcellulose.

Controlling, preventing or protecting and its inflections, within the context of the present invention, mean reducing any undesired effect, such as

- infestation or attack, and

10 - damage ,

by a pest on a plant, part of the plant or plant propagation material to such a level that an improvement is demonstrated.

Each combination according to the invention has very advantageous properties for protecting
15 plants against, for example, (i) pathogenic, such as phytopathogenic attack or infestation, which result in disease and damage to the plant, (ii) insect or nematode attack or damage; particularly in the instance of plants, the present invention can control or prevent the pest damage on a seed, or parts of plant, plant organs and/or plants, and/or (iii) the development
20 of a crop under various agronomic and agro-climatic conditions. Further, a combination according to the invention, in the absence of pathogenic or insect and/or nematode pressure, improves the development and growth of a plant as well as the grain and biomass yields of the plant.

These properties are for example the synergistically enhanced actions of combinations
25 compared to the individual ingredients of the combination (e.g. (I), and (II)), resulting in, for example, lower pathogenic pest damage, lower rates of application, or a longer duration of action. In the instance of agriculture, the enhanced actions are found to show an improvement in the growing characteristics of a plant by, for example, higher than expected control of the pest damage, or higher than expected yield, stand establishment, germination,
30 stress resistance (both biotic and abiotic), etc.

The improvement in the growing (or growth) characteristics of a plant can manifest in a number of different ways, but ultimately it results in a better product of the plant. It can, for example, manifest in improving the yield and/or vigour of the plant or quality of the
35 harvested product from the plant, which improvement may not be connected to the control of pests, such as fungi, insects and nematodes.

As used herein the phrase "improving the yield" of a plant relates to an increase in the yield of a product of the plant by a measurable amount over the yield of the same product of the plant produced under the same conditions, but without the application of the subject method. It is preferred that the yield be increased by at least about 0.5%, more preferred that the increase be at least about 1%, even more preferred is about 2%, and yet more preferred is about 4%, or more. Yield can be expressed in terms of an amount by weight or volume of a product of the plant on some basis. The basis can be expressed in terms of time, growing area, weight of plants produced, amount of a raw material used, or the like.

As used herein the phrase "improving the vigour" of a plant relates to an increase or improvement of the vigour rating, or the stand (the number of plants per unit of area), or the plant height, or the plant canopy, or the visual appearance (such as greener leaf colour), or the root rating, or emergence, or protein content, or increased tillering, or bigger leaf blade, or less dead basal leaves, or stronger tillers, or less fertilizer needed, or less seeds needed, or more productive tillers, or earlier flowering, or early grain maturity, or less plant verse (lodging), or increased shoot growth, or earlier germination, or any combination of these factors, or any other advantages familiar to a person skilled in the art, by a measurable or noticeable amount over the same factor of the plant produced under the same conditions, but without the application of the subject method.

When it is said that the present method is capable of "improving the yield and/or vigour" of a plant, the present method results in an increase in either the yield, as described above, or the vigor of the plant, as described above, or both the yield and the vigor of the plant.

Accordingly, the present invention also provides a method of improving the growing characteristics of a plant, which comprises applying to the plant, part of plant, and/or plant propagation material, the ingredients of the combination, as defined in the first aspect, in any desired sequence or simultaneously, especially in the absence of pathogenic or pests pressure.

Each of the combinations of the invention can be used in the agricultural sector and related fields of use for controlling or preventing damage by pests, such as insect, nematode and pathogen, especially in the agricultural field.

Each of the combinations according to the present invention is effective against pest control, such as control of pests selected from Nematoda, Insecta and Arachnida. In that instance, the combination can also be applied on the pest to control or prevent pest damage and
5 protect the desired material (e.g. plant and part of plant) from pest damage. Examples of pests include:

from the order Lepidoptera, for example, *Acleris* spp., *Adoxophyes* spp., *Aegeria* spp., *Agrotis* spp., *Alabama argillaceae*, *Amylois* spp., *Anticarsia gemmatilis*, *Archips* spp., *Argyrotaenia* spp., *Autographa* spp., *Busseola fusca*, *Cadra cautella*, *Carposina nipponensis*, *Chilo* spp.,
10 *Choristoneura* spp., *Clysia ambiguella*, *Cnaphalocrocis* spp., *Cnephasia* spp., *Cochylis* spp., *Coleophora* spp., *Crocidolomia* spp., *Cryptophlebia leucotreta*, *Crysodeixis includens*, *Cydia* spp., *Diatraea* spp., *Diparopsis castanea*, *Earias* spp., *Elasmopalpus* spp., *Ephestia* spp., *Eucosma* spp., *Eupoecilia ambiguella*, *Euproctis* spp., *Euxoa* spp., *Grapholita* spp., *Hedya nubiferana*, *Heliothis* spp., *Hellula undalis*, *Hyphantria cunea*, *Keiferia lycopersicella*,

15 *Leucoptera scitella*, *Lithocolletis* spp., *Lobesia botrana*, *Lymantria* spp., *Lyonetia* spp., *Malacosoma* spp., *Mamestra brassicae*, *Manduca sexta*, *Operophtera* spp., *Ostrinia nubilalis*, *Pammene* spp., *Pandemis* spp., *Panolis flammea*, *Pectinophora gossypiella*, *Phthorimaea operculella*, *Pieris rapae*, *Pieris* spp., *Plutella xylostella*, *Prays* spp., *Scirpophaga* spp., *Sesamia* spp., *Sparganothis* spp., *Spodoptera* spp., *Synanthedon* spp., *Thaumatopoea* spp.,
20 *Tortrix* spp., *Trichoplusia ni* and *Yponomeuta* spp.;

from the order Coleoptera, for example, *Agriotes* spp., *Anthonomus* spp., *Atomaria linearis*, *Chrysomelidae*, *Ceutorhynchus* spp., *Chaetocnema tibialis*, *Cosmopolites* spp., *Curculio* spp., *Dermestes* spp., *Diabrotica* spp., *Epilachna* spp., *Eremnus* spp., *Gonocephalum* spp., *Heteronychus* spp., *Leptinotarsa decemlineata*, *Lissorhoptrus* spp., *Melolontha* spp.,

25 *Orycaephilus* spp., *Otiorhynchus* spp., *Phlyctinus* spp., *Phyllotreta* spp., *Popillia* spp., *Protostrophus* spp., *Psylliodes* spp., *Rhizopertha* spp., *Scarabeidae*, *Sitophilus* spp., *Sitotroga* spp., *Sternechus* spp., *Tenebrio* spp., *Tribolium* spp. and *Trogoderma* spp.;

from the order Orthoptera, for example, *Blatta* spp., *Blattella* spp., *Gryllotalpa* spp., *Leucophaea maderae*, *Locusta* spp., *Periplaneta* spp. and *Schistocerca* spp.;

30 from the order Isoptera, for example, *Reticulitermes* spp.;

from the order Psocoptera, for example, *Liposcelis* spp.;

from the order Anoplura, for example, *Haematopinus* spp., *Linognathus* spp., *Pediculus* spp., *Pemphigus* spp. and *Phylloxera* spp.;

from the order Mallophaga, for example, *Damalinea* spp. and *Trichodectes* spp.;

from the order Thysanoptera, for example, *Frankliniella* spp., *Hercinothrips* spp., *Megalurothrips* spp., *Taeniothrips* spp., *Thrips* spp., *Thrips palmi*, *Thrips tabaci* and *Scirtothrips aurantii*;

from the order Heteroptera, for example, *Dichelops melacanthus*, *Distantiella theobroma*,
 5 *Dysdercus* spp., *Euchistus* spp., *Eurygaster* spp., *Leptocoris* spp., *Nezara* spp., *Piesma* spp., *Rhodnius* spp., *Sahlbergella singularis*, *Scotinophara* spp. and *Triatoma* spp.;

from the order Homoptera, for example, *Aleurothrixus floccosus*, *Aleyrodes brassicae*,
Aonidiella spp., *Aphididae*, *Aphis* spp., *Aspidiotus* spp., *Bemisia tabaci*, *Ceroplaster* spp.,
Chrysomphalus aonidium, *Chrysomphalus dictyospermi*, *Coccus hesperidum*, *Empoasca*
 10 spp., *Eriosoma larigerum*, *Erythroneura* spp., *Gascardia* spp., *Laodelphax* spp., *Lecanium corni*, *Lepidosaphes* spp., *Macrosiphus* spp., *Myzus* spp., *Nasonovia* spp., *Nephotettix* spp.,
Nilaparvata spp., *Paratoria* spp., *Pemphigus* spp., *Planococcus* spp., *Pseudaulacaspis* spp.,
Pseudococcus spp., *Psylla* spp., *Pulvinaria aethiopica*, *Quadraspidotus* spp., *Rhopalosiphum*
 spp., *Saissetia* spp., *Scaphoideus* spp., *Schizaphis* spp., *Sitobion* spp., *Trialeurodes*

15 *vaporariorum*, *Trioza erytrae* and *Unaspis citri*;

from the order Hymenoptera, for example, *Acromyrmex*, *Athalia rosae*, *Atta* spp., *Cephus* spp.,
Diprion spp., *Diprionidae*, *Gilpinia polytoma*, *Hoplocampa* spp., *Lasius* spp.,
Monomorium pharaonis, *Neodiprion* spp., *Solenopsis* spp. and *Vespa* spp.;

from the order Diptera, for example, *Antherigona soccata*, *Bibio hortulanus*, , *Ceratitis* spp.,
 20 *Chrysomyia* spp., *Culex* spp., *Cuterebra* spp., *Dacus* spp., *Delia* spp., *Drosophila melanogaster*,
Liriomyza spp., *Melanagromyza* spp., *Orseolia* spp., *Oscinella frit*, *Pegomyia hyoscyami*,
Phorbia spp., *Rhagoletis pomonella*, *Sciara* spp.;

from the order Acarina, for example, *Acarus siro*, *Aceria sheldoni*, *Aculus schlechtendali*,
Amblyomma spp., *Argas* spp., *Brevipalpus* spp., *Bryobia praetiosa*, *Calipitimerus* spp.,
 25 *Chorioptes* spp., *Dermanyssus gallinae*, *Eotetranychus carpini*, *Eriophyes* spp., *Hyalomma* spp.,
Olygonychus pratensis, *Ornithodoros* spp., *Panonychus* spp., *Phyllocoptruta oleivora*,
Polyphagotarsonemus latus, *Psoroptes* spp., *Rhipicephalus* spp., *Rhizoglyphus* spp.,
Sarcoptes spp., *Tarsonemus* spp. and *Tetranychus* spp.; and

from the class Nematoda, for example, the species of *Tylenchus* spp., *Atylenchus* spp.,
 30 *Anguina* spp., *Rotylenchus* spp., *Criconema* spp., *Tylenchulus* spp., *Paratylenchus* spp.,
Aphenlenchus spp., *Bursaphelenchus* spp., *Paralongidorus* spp., *Trichodorus* spp.,
Meloidogyne spp. (for example, *Meloidogyne incognita* and *Meloidogyne javanica*),
Heterodera spp. (for example, *Heterodera glycines*, *Heterodera schachtii*, *Heterodora avenae*
 and *Heterodora trifolii*), *Globodera* spp. (for example, *Globodera rostochiensis*), *Radopholus*
 35 spp. (for example, *Radopholus similis*), *Rotylenchulus* spp., *Pratylenchus* spp. (for example,
Pratylenchus neglectans and *Pratylenchus penetrans*), *Aphelenchoides* spp., *Helicotylenchus*

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spp., *Hoplolaimus* spp., *Paratrichodorus* spp., *Longidorus* spp., *Nacobbus* spp., *Subanguina* spp., *Belonolaimus* spp., *Criconemella* spp., *Criconemoides* spp., *Ditylenchus* spp., *Dolichodorus* spp., *Hemicriconemoides* spp., *Hemicycliophora* spp., *Hirschmaniella* spp., *Hypsoperine* spp., *Macroposthonia* spp., *Melinius* spp., *Punctodera* spp., *Quinisulcius* spp.,
5 *Scutellonema* spp., *Xiphinema* spp., and *Tylenchorhynchus* spp.

In an embodiment, further agent(s), such as active ingredient(s), can be used with each combination according to the present invention. Therefore, each of the combinations of the present invention may be mixed with, for example, one or more other known pesticides, such
10 as other fungicides, insecticides, nematicides, etc. The use of additional agents, such as other active ingredients, can be for reasons, for example, broader spectrum control (e.g. wider variety of pests, diseases, etc), lower rates, synergy and economy. A skilled person would understand that a single pesticidal active ingredient may have activity in more than one area of pest control, for example, a pesticide may have fungicide, insecticide and nematicide
15 activity. Specifically, aldicarb is known for insecticide, acaricide and nematicide activity, while metam is known for insecticide, herbicide, fungicide and nematicide activity, and thiabendazole and captan can provide nematicide and fungicide activity. It is further noted that the insecticide and/or nematicide may allow a fungicide – that would usually as sole product have a detrimental effect on the mycorrhizal fungus – to be present without or with
20 hardly a detrimental effect on the growth of the mycorrhiza.

Each of the compositions of the invention can be formulated for a particular use. Preferably, each combination is formulated for protecting cultivated plants or their propagation materials, in particular the compositions are suitable for treatment of seeds. Accordingly, each
25 combination of the invention can be applied to the plant in a conventional manner, such as foliar spray. Advantageously, each of the combinations are formulated for plant propagation material, such as seed, treatment applications for improving the growth of a plant derived from the treated material (or seed), for example, by controlling or preventing damage by pests and/or pathogens, which are found in agriculture and forestry, and can particularly damage
30 the plant in the early stages of its development.

Further, the present invention also envisages soil application of the combinations of the invention to control the soil-dwelling pests and/or soil-borne pathogens. Methods of applying to the soil can be via any suitable method, which ensures that the combination penetrates the
35 soil, for example, nursery tray application, in furrow application, soil drenching, soil injection,

drip irrigation, application through sprinklers or central pivot, incorporation into soil (broad cast or in band) are such methods.

The benefits from the invention can also be achieved either by (i) treating plant
5 propagation material with a combination or (ii) applying to the locus where control, growth stimulation or more efficient use of nutrients and water is desired, generally the planting site, the combination, or both (i) and (ii). Indeed, the benefits from the invention can also be achieved by treating plant propagation material with one or more of the ingredients of the combination, and then applying to the locus where control is desired with the other
10 ingredient(s) of the combination.

The term "plant propagation material" is understood to denote all the generative parts of the plant, such as seeds, which can be used for the multiplication of the latter and vegetative plant materials such as cuttings and tubers (for example, potatoes). Accordingly, as used
15 herein, part of a plant includes propagation material. There may be mentioned, *e.g.*, the seeds (in the strict sense), roots, fruits, tubers, bulbs, rhizomes, 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.

20 Parts of plant and plant organs that grow at later point in time are any sections of a plant that develop from a plant propagation material, such as a seed. Parts of plant, plant organs, and plants can also benefit from the pest damage protection achieved by the application of each combination on to the plant propagation material. In an embodiment, certain parts of a plant
25 and certain plant organs that grow at later point in time can also be considered as plant propagation material, which can themselves be applied (or treated) with the combination; and consequently, the plant, further parts of the plant and further plant organs that develop from the treated parts of plant and treated plant organs can also benefit from the pest damage protection achieved by the application of each combinations on to the certain parts of plant
30 and certain plant organs.

Methods for applying or treating pesticidal active ingredients and mixtures thereof on to plant propagation material, especially seeds, are known in the art, and include dressing, coating, pelleting and soaking application methods of the propagation material. Such
35 methods are also applicable to the combinations according to the invention. In a preferred embodiment, the combination is applied or treated on to the plant propagation material by

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a method such that the germination is not induced; generally seed soaking induces germination because the moisture content of the resulting seed is too high. Accordingly, examples of suitable methods for applying (or treating) a plant propagation material, such as a seed, is seed dressing, seed coating or seed pelleting and alike.

5

It is preferred that the plant propagation material is a seed.

Although it is believed that the present method can be applied to a seed in any physiological state, it is preferred that the seed be in a sufficiently durable state that it
10 incurs no damage during the treatment process. Typically, the seed would be a seed that had 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. The seed would preferably also be biologically stable to the extent that the treatment would cause no biological damage to the seed. It is believed that the treatment can be applied to the seed
15 at any time between harvest of the seed and sowing of the seed or during the sowing process (seed directed applications). The seed may also be primed either before or after the treatment.

Even distribution of the ingredients in the combination and adherence thereof to the seeds is
20 desired during propagation material treatment. Treatment could vary from a thin film (dressing) of the formulation containing the combination, for example, a mixture of active ingredient(s), on a plant propagation material, such as a seed, where the original size and/or shape are recognizable to an intermediary state (such as a coating) and then to a thicker film (such as pelleting with many layers of different materials (such as carriers, for example, clays;
25 different formulations, such as of other active ingredients; polymers; and colourants) where the original shape and/or size of the seed is no longer recognisable.

An aspect of the present invention includes application of the combinations onto the plant propagation material in a targeted fashion, including positioning the ingredients in the
30 combination onto the entire plant propagation material or on only parts thereof, including on only a single side or a portion of a single side. One of ordinary skill in the art would understand these application methods from the description provided in EP954213B1 and WO06112700.

35 The combinations described herein can also be used to enhance the growth of a plant through treating, or applying, a combination according to the present on to a "pill" or a

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suitable substrate and placing, or sowing, the treated pill, or substrate, next to a plant propagation material . Such techniques are known in the art, particularly in EP1124414, WO07067042, and WO07067044.

- 5 Application of the combinations described herein onto plant propagation material also includes protecting the plant propagation material treated with the combination of the present invention by placing one or more pesticide-containing particles next to a pesticide-treated seed, wherein the amount of pesticide is such that the pesticide-treated seed and the pesticide-containing particles together contain an Effective Dose of the pesticide and the
10 pesticide dose contained in the pesticide-treated seed is less than or equal to the Maximal Non-Phytotoxic Dose of the pesticide. Such techniques are known in the art, particularly in WO2005/120226.

15 Application of the combinations onto the seed also includes controlled release coatings on the seeds, wherein the ingredients of the combinations are incorporated into materials that release the ingredients over time. Examples of controlled release seed treatment technologies are generally known in the art and include polymer films, waxes, or other seed coatings, wherein the ingredients may be incorporated into the controlled release material or applied between layers of materials, or both.

20 Seed can be treated by applying thereto the mycorrhiza (I) and at least one insecticide and/or nematicide (II) in any desired sequence or simultaneously.

25 The seed treatment occurs to an unsown seed, and the term "unsown seed" is meant to include seed at any period between the harvest of the seed and the sowing of the seed in the ground for the purpose of germination and growth of the plant.

30 Treatment to an unsown seed is not meant to include those practices in which the active ingredient is applied to the soil but would include any application practice that would target the seed during the planting process.

Preferably, the treatment occurs before sowing of the seed so that the sown seed has been pre-treated with the combination. In particular, seed coating or seed pelleting are preferred in the treatment of the combinations according to the invention. As a result of
35 the treatment, the ingredients in each combination are adhered on to the seed and therefore available for pest control.

The treated seeds can be stored, handled, sowed and tilled in the same manner as any other active ingredient treated seed.

- 5 Each combination according to the present invention is suitable for plants of the crops: cereals, such as wheat, barley, rye, oats, rice, maize (silage maize, sweet corn and field corn) or sorghum; beet, such as sugar or fodder beet; fruit, for example pomaceous fruit, stone fruit, tree nut or soft fruit, such as apples, pears, plums, peaches, bananas, almonds, walnuts, pistachios, cherries or berries, for example strawberries, raspberries or blackberries;
- 10 leguminous crops, such as beans, lentils, peas or soya; oil crops, such as oilseed rape, mustard, poppies, olives, sunflowers, coconut, castor, cocoa or ground nuts; cucurbits, such as pumpkins, marrow, cucumbers or melons; fibre plants, such as cotton, flax, hemp or jute; citrus fruit, such as oranges, lemons, grapefruit or tangerines; vegetables, such as spinach, lettuce, asparagus, cabbages, iceberg, carrots, onions, tomatoes, paprika, potatoes or bell
- 15 peppers; Lauraceae, such as avocado, Cinnamomum or camphor; and also tobacco, nuts, coffee, eggplants, sugarcane, tea, pepper, grapevines, hops, the plantain family, latex plants, lawn, turf, fodder grass, and ornamentals, such as petunias, geranium/pelargoniums, pansies and impatiens; and shrubs, broad-leaved trees and evergreens, such as conifers, and fast growing groves such as poplars or willows. In particular, the combination is suitable for
- 20 coffee, citrus, stone fruits (especially apple, pears, plums, peaches), tree nuts (especially almonds and pistachios), vegetable crops, and forestry crops. In particular, cotton, soya, maize, and cereals.

- Each of the combinations according to the present invention are particularly suitable for use
- 25 in Corn, Cereals (including Rice), Soybean, Cotton, Sugar Beet, Sunflower, Potato, Beans, Sorghum, Peas, Peanuts, as well as Vegetables such as Cole Crops, and Fruiting Vegetables.

- Suitable target crops also include modified crop plants of the foregoing crop types. The
- 30 wording "modified crop plants" refers to both genetically modified or transgenic crop plant as well crop plants modified through natural selection or conventional breeding. The modified crop plants used according to the invention are plants, or propagation material thereof, which are transformed by means of recombinant DNA technology in such a way that they are - for instance - capable of synthesizing selectively acting toxins as are known, for example, from
- 35 toxin-producing invertebrates, especially of the phylum Arthropoda, as can be obtained from *Bacillus thuringiensis* strains; or as are known from plants, such as lectins; or in the

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alternative capable of expressing a herbicidal or fungicidal resistance. Examples of such toxins, or modified plants which are capable of synthesizing such toxins, have been disclosed, for example, in EP-A-0 374 753, WO 93/07278, WO 95/34656, EP-A-0 427 529 and EP-A-451 878 and are incorporated by reference in the present application.

5

The mass ratio of any two ingredients in each combination is selected as to give the desired, for example, synergistic action. In general, the mass ratio would vary depending on the specific ingredient and how many ingredients are present in the combination. Generally, the mass ratio between any two ingredients in any combination of the present invention,

10 independently of one another, is from 100:1 to 1:100, including from 99:1, 98:2, 97:3, 96:4, 95:5, 94:6, 93:7, 92:8, 91:9, 90:10, 89:11, 88:12, 87:13, 86:14, 85:15, 84:16, 83:17, 82:18, 81:19, 80:20, 79:21, 78:22, 77:23, 76:24, 75:25, 74:26, 73:27, 72:28, 71:29, 70:30, 69:31, 68:32, 67:33, 66:34, 65:45, 64:46, 63:47, 62:48, 61:49, 60:40, 59:41, 58:42, 57:43, 56:44, 55:45, 54:46, 53:47, 52:48, 51:49, 50:50, 49:51, 48:52, 47:53, 46:54, 45:55, 44:56, 43:57, 15 42:58, 41:59, 40:60, 39:61, 38:62, 37:63, 36:64, 35:65, 34:66, 33:67, 32:68, 31:69, 30:70, 29:71, 28:72, 27:73, 26:74, 25:75, 24:76, 23:77, 22:78, 21:79, 20:80, 19:81, 18:82, 17:83, 16:84, 15:85, 14:86, 13:87, 12:88, 11:89, 10:90, 9:91, 8:92, 7:93, 6:94, 5:95, 4:96, 3:97, 2:98, to 1:99. Preferred mass ratios between any two components of present invention are from 75:1 to 1:75, more preferably, 50:1 to 1.50, especially 25:1 to 1:25, advantageously 10:1 to 20 1:10, such as 5:1 to 1:5. It is noted that the above ratios apply to the combinations or compositions used to treat the plant propagation materials.

In an embodiment, the ratio of (I) to (II), wherein (I) is mycorrhiza in particular arbuscular mycorrhiza, and (II) is a neonicotinoid in particular thiamethoxam, is 1:10 to 500:1, such as 25 1:7 to 400:1, preferably 10:1 to 300:1, such as 15:1 to 80:1, preferably 20:1 to 50:1.

In an embodiment, the ratio of (I) to (II), wherein (I) is mycorrhiza in particular arbuscular mycorrhiza, and (II) is an avermectin in particular abamectin, is 1:10 to 500:1, such as 1:7 to 400:1, preferably 10:1 to 300:1, such as 15:1 to 80:1, preferably 20:1 to 50:1.

30

The rates of application (use) of a combination vary, for example, according to type of use, type of crop, the specific agent (II) in the combination, type of plant propagation material (if appropriate), but is such that the active ingredients in the combination is an effective amount to provide the desired enhanced action (such as disease or pest control) and can be 35 determined by trials and routine experimentation known to one of ordinary skill in the art.

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Generally for foliar or soil treatments, application rates can vary from 0.05 to 3 kg per hectare (g/ha) of ingredients.

Generally for seed treatments, application rates can vary from 0.5 to 1000g / 100kg of seeds of ingredients. In an embodiment, compound (I) is applied at a rate of 0.01 to 2, preferably 0.03 to 1.5, mg ai /seed, depending on the crop. Whereas the rates of application of the biological agents can vary depending on the specific agent and type of crop. Such rates would be readily available to a skilled person.

10 The plant propagation material treated by each combination of the present invention can be, therefore, resistant to pest damage; accordingly, the present invention also provides a pest resistant plant propagation material which is treated with each combination and consequently at least the ingredients thereof are adhered on the propagation material, such as seed.

15 The seed treatment combinations and compositions can also comprise or may be applied together and/or sequentially with further active compounds. These further useful active compounds can be fertilizers or micronutrient donors (such as Mo, Zn and / or Co) or other preparations that influence plant growth, such as inoculants (e.g. a strain of nitrogen-fixing bacteria), plant inducers (e.g. nod factors – see US2005187107, which hereby is
20 incorporated).

In a preferred embodiment of the invention, soybean seeds and modified soybean seeds are treated with a combination of the present invention. In addition, the soybean seeds may be inoculated with an appropriate strain of nitrogen-fixing bacteria for the purpose of promoting
25 plant growth. Preferably, seeds may be inoculated with an effective bacterial strain such as *Rhizobium* spp. or *Azospirillum* spp. before sowing. The primary effect of such bacteria is in the fixation of atmospheric nitrogen into a useable form for the plant. *Rhizobia* bacteria, for example, is especially preferred in order to form nodules on the plant roots that are sustained by the plant and in turn provide nitrogen for the plant as mentioned above.

30 In a further embodiment, a soybean plant propagation material is treated with a plant inducer, e.g. a nod factor derived from *Bradyrhizobium japonicum*, *Sinorhizobium fredii*, *Sinorhizobium meliloti*, *Bradyrhizobium* sp. (*Arachis*), or *Rhizobium leguminosarum* biovar *phaseoli*, *viciae*, or *trifolii*.

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In an aspect, the present invention also envisages use of the combinations of the present invention with glyphosate tolerant plants, especially glyphosate tolerant soybean plants, in particular for the control of asian soybean rust. Accordingly, the present invention provides a method comprising (α) applying a combination or composition according to the invention, especially those containing (II) one or more insecticides and/or nematicides of the invention, to a glyphosate tolerant plant propagation material, preferably soybean propagation material, and (β) applying a product of the inventive process to the resulting plant, part of plant and/or the locus thereof one or more times (i) before emergence, (ii) after emergence, or (iii) both (i) and (ii), provided that pesticide composition (B) comprises glyphosate is applied at any desired time during the process.

Generally, glyphosate-containing composition can be applied, if applied only once, at a rate of 960 g ae/ha; if applied twice the rate can vary from 1200 to 1680 g ae/ha. The rates and number of applications vary according to the particular conditions. Preferably, the composition (B) is applied three times with an application rate of 960, 720 and 400 g ae/ha respectively. In such an embodiment, the present invention controls, prevents or treats *Phakopsora pachyrhizi* and/or *P. meibomia*, especially *Phakopsora pachyrhizi*.

Each of the combinations of the present invention may also comprise alkali metal, alkaline earth metal, metal, or ammonium salts. Zinc chloride and alkali metal, alkaline earth metal, or ammonium salts of mineral acids, especially nitrates, phosphates, sulfates, chlorides, and carbonates of sodium, potassium, ammonium, magnesium, and calcium are preferred.

Depending upon the particular plant propagation material to be treated, the conditions under which it is to be stored, and the soil and weather conditions under which it is expected to germinate and grow, the combinations of the present invention may include a wide spectrum of one or more additives. Such additives include, but are not limited to, uv-protectants, pigments, dyes, extenders such as flour, dispersing agents, excipients, anti-freezing agents, preservatives, herbicidal safeners, seed safeners, seed conditioners, micronutrients, fertilizers, biocontrol agents, surfactants, sequestering agents, plasticizers, colorants, brighteners, emulsifiers, flow agents such as calcium stearate, talc and vermiculite, coalescing agents, defoaming agents, humectants, thickeners, waxes, bactericides, insecticides, pesticides, and fillers such as cellulose, glass fibers, clay, kaolin, talc, pulverized tree bark (e.g., Douglas fir bark or alderbark), calcium carbonate and wood meal, and odor-modifying agents. Typical excipients include finely divided mineral substances such as pumice, attapulgite, bentonite, kaoline zeolite, diatomite, and other clays, modified diatomaceous adsorbents, charcoal,

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vermiculite, finely divided organic substances such as peat moss, wood powder, and the like. Such additives are commercially available and known in the art.

The insecticide (I) of the invention and one or more nematocidally active biological agents (II),
5 and optionally 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 auxiliary (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 insecticide (I) and one or more
10 agents (II) are in the form of a formulation composition with one or more of customary formulation auxiliaries.

Therefore, each combination of the insecticide compound (I) and one or more biological agents (II) is normally used in the form of formulations. The ingredients in the combination
15 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, the ingredients in the combination are applied simultaneously.

20 In the event ingredients of the combinations are applied simultaneously in the present invention, they may be applied as a composition containing the combination, in which case each of (I) and (II) 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,
25 or (I) and (II) can be obtained as single formulation mixture source (known as a pre-mix, concentrate, formulated product), and optionally mixed together with other pesticides.

In an embodiment, each combination of the present invention is applied as a composition. Accordingly, the present invention includes a composition comprising (I) and (II), and
30 optionally other pesticides, and optionally one or more customary formulation auxiliaries; which may be in the form of a tank-mix or pre-mix composition.

In an embodiment, each combination of (I) and (II) with one or more customary formulation auxiliaries is provided in the form of a pre-mix composition (or formulated product).

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Alternative to the actual synergistic action with respect to pesticidal activity, the combinations according to the invention also can have surprising advantageous properties which can also be described, in a wider sense, as synergistic activity. Examples of such advantageous properties that may be mentioned are: advantageous behaviour during formulation and/or

5 upon application, for example upon grinding, sieving, emulsifying, dissolving or dispensing; increased storage stability; improved stability to light; more advantageous degradability; improved toxicological and/or ecotoxicological behaviour; or any other advantages familiar to a person skilled in the art.

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

GR: Granules

WP: wettable powders

WG: water dispersable granules (powders)

SG: water soluble granules

15 SL: soluble concentrates

EC: emulsifiable concentrate

EW: emulsions, oil in water

ME: micro-emulsion

SC: aqueous suspension concentrate

20 CS: aqueous capsule suspension

OD: oil-based suspension concentrate, and

SE: aqueous suspo-emulsion.

Whereas, examples of seed treatment formulation types for pre-mix compositions are:

25 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

30 CS: aqueous capsule suspension.

Examples of formulation types suitable for tank-mix compositions are solutions, dilute emulsions, suspensions, or a mixture thereof, and dusts.

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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.

- 5 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.

- 10 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.

- 15 The formulations are prepared in known manner, e.g., by homogeneously mixing and/or grinding the active ingredients with extenders, e.g., solvents, solid carriers and, where appropriate, surface-active compounds (surfactants).

- 20 Suitable solvents are: aromatic hydrocarbons, preferably the fractions containing 8 to 12 carbon atoms, e.g. xylene mixtures or substituted naphthalenes, phthalates, such as dibutyl phthalate or dioctyl phthalate, aliphatic hydrocarbons, such as cyclohexane or paraffins, alcohols and glycols and their ethers and esters, such as ethanol, ethylene glycol, ethylene glycol monomethyl or monoethyl ether, ketones, such as cyclohexanone, strongly polar solvents, such as N-methyl-2-pyrrolidone, dimethyl sulfoxide or dimethylformamide, as well as vegetable oils or epoxidised vegetable oils, such as epoxidised coconut oil or soybean oil; or water.

25

- The solid carriers used, e.g., for dusts and dispersible powders, are normally natural mineral fillers, such as calcite, talcum, kaolin, montmorillonite or attapulgite. In order to improve the physical properties it is also possible to add highly dispersed silicic acid or highly dispersed absorbent polymers. Suitable granulated adsorptive carriers are porous types, for example pumice, broken brick, sepiolite or bentonite, and suitable nonsorbent carriers are, for example, calcite or sand. In addition, a great number of pregranulated materials of inorganic or organic nature can be used, e.g., especially dolomite or pulverized plant residues.

30

- 35 Depending upon the nature of the ingredients to be formulated, suitable surface-active compounds are non-ionic, cationic and/or anionic surfactants having good emulsifying,

dispersing and wetting properties. The term "surfactants" will also be understood as comprising mixtures of surfactants.

Particularly advantageous application-promoting adjuvants are also natural or synthetic phospholipids of the cephalin and lecithin series, e.g., phosphatidylethanolamine, phosphatidylserine, phosphatidylglycerol and lysolecithin.

Generally, a tank-mix formulation for foliar or soil application comprises 0.1 to 20%, especially 0.1 to 15 %, 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).

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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.

- 5 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.

- 10 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.

- 15 A preferred embodiment is a plant propagation material treating (or protecting) composition, wherein said plant propagation material protecting composition comprises additionally a colouring agent. The plant propagation material protecting composition or mixture may also comprise at least one polymer from water-soluble and water-dispersible film-forming polymers that improve the adherence of the active ingredients to the treated plant propagation material,
20 which polymer generally has an average molecular weight of at least 10,000 to about 100,000.

The Examples which follow serve to illustrate the invention.

25 Formulation Examples

<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 %	-

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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

- 5 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 (4-5 mol of ethylene oxide)	3 %
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.

10

<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 %

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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 %

- 5 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 %

- 10 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 %

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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.

5

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.

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Using such formulations, either straight or diluted, plant propagation material can be treated and protected against pest damage, for example, from pathogen(s), by, for example, spraying, pouring or immersing.

The combinations according to the invention are distinguished by the fact that they are especially well tolerated by plants and are environmentally friendly.

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In an embodiment, the combinations according to the invention can also be used to treat stored products, such as grain, for protection against pathogens and/or pests.

Each combination according to the invention is especially advantageous for the treatment of plant propagation material.

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In a preferred embodiment, each of the combinations of the present invention is a plant propagation material, preferably seed, treating composition.

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In each aspect and embodiment of the invention, "consisting essentially" and inflections thereof are a preferred embodiment of "comprising" and its inflections, and "consisting of" and inflections thereof are a preferred embodiment of "consisting essentially of" and its inflections.

Use of a term in a singular form also encompasses that term in plural form and vice a versa.

Certain compounds defined in the first aspect are active ingredients for use in the agrochemical industry (also known as pesticides). A description of their structure as well as the structures of other pesticides (e.g., fungicides, insecticides, nematicides) can be found in the e-Pesticide Manual, version 3.1, 13th Edition, Ed. CDC Tomlin, British Crop Protection Council, 2004-05.

The invention is demonstrated in the following Examples.

Examples

A solution of spores of *Glomus intraradices* (ex Amykor GmbH) was mixed with various commercial insecticide or nematicide products (ex Syngenta Crop Protection AG) in differing rates. The respective products and their relative rates have been indicated in the Table below. The mixtures were subsequently incubated for at least three days at a temperature of 26°C without exposure to light. The resulting mixtures were washed and the spores were analysed using the vitality test, using iodonitro tetrazolium chloride (INT) and in which the number of red colored spores is counted.

Table 1

Product	Active ingredient	% vital spores		
		1:1 ¹	1:2 ¹	1:5 ¹
Control ²		87.7	94.2	91.9
Cruiser 350 FS	Thiamethoxam	99.2	99.8	100
Cruiser 350 FS (without pigment)	Thiamethoxam	97.6	95.9	96.0
Cruiser 5 FS (without pigment)	Thiamethoxam	97.6	98.8	96.5
Avicta 400 FS	Abamectin	92.4	95.7	93.2

¹ product to spore ratio

² INT treated spores were kept for 3 days

From Table 1 it can be deduced that *Glomus* spores treated with thiamethoxam or abamectin have an increased vitality over the *Glomus* spores themselves.

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In a further experiment, a solution of spores of *Glomus intraradices* was mixed with a variety of insecticidal or nematicidal products, i.e. Cruiser 5 FS (without pigment), Force 20 CS (tefluthrin product ex Syngenta), and Avicta 500 FS (without pigment and ex Syngenta) in a 1:1 ratio. The growth of the *Glomus* hyphen, and the formation of secondary spores were determined using a light microscope, and compared to the control spores solution. For all these combinations the growth of the *Glomus* hyphens were found to be considerably higher than the control. It was further observed that the secondary spore formation of the mixtures of the invention was at least similar to the control, and significantly higher for the mixture with Cruiser 5 FS. This behavior is advantageous for the production of *Glomus* spores as well as advantageous for its use in agricultural applications, e.g. when applied to a seed or when applied in forestry applications.

CLAIMS

1. Process of growing mycorrhiza by:

- 5 (a) contacting mycorrhiza with an insecticide and/or nematicide; and
(b) growing the mycorrhiza in the presence of the insecticide and/or nematicide such that the amount of mycorrhiza is increased.

10 2. Process according to claim 1 wherein the mycorrhiza is an endomycorrhiza, preferably an arbuscular mycorrhiza.

3. Process according to claims 1 or 2 wherein the insecticide is a neonicotinoid.

15 4. Process according to any one of claims 1 to 3 wherein the insecticide is thiamethoxam.

5. Process according to any one of the preceding claims further comprising the step of:
(c) isolating mycorrhiza and/or the insecticide and/or the nematicide.

20 6. Product obtainable from any one of the processes of claims 1 to 5.

7. Mycorrhiza, preferably arbuscular mycorrhiza, and an insecticide and/or nematicide.

8. Composition comprising mycorrhiza and an insecticide and/or nematicide.

25 9. Capsule enclosing a composition according to claim 8.

10. Use of an insecticide and/or nematicide in the sporulation of mycorrhiza.

30 11. Use of composition of claim 8 in agriculture, horticulture or forestry.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/056368

A. CLASSIFICATION OF SUBJECT MATTER
INV. C12N1/14 C12N3/00 A01N63/04
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)
C12N A01N

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, BIOSIS, COMPENDEX, EMBASE, FSTA, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SREENIVASA M N ET AL: "USE OF PESTICIDES FOR MASS PRODUCTION OF VESICULAR-ARBUSCULAR MYCORRHIZAL INOCULUM" PLANT AND SOIL, vol. 119, no. 1, 1989, pages 127-132, XP8124379 ISSN: 0032-079X the whole document ----- -/--	1-11

☒ Further documents are listed in the continuation of Box C.

☒ See patent family 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

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2010/056368

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	TRAPPE J M ET AL: "REACTIONS OF MYCORRHIZAL FUNGI AND MYCORRHIZA FORMATION TO PESTICIDES" GROGAN, R. G., G. A. ZENTMYER AND E. B. COWLING (ED.). ANNUAL REVIEW OF PHYTOPATHOLOGY, VOL. 22. XII+487P. ANNUAL REVIEWS INC.: PALO ALTO, CALIF., USA. ILLUS SERIES : ANNUAL REVIEW OF PHYTOPATHOLOGY (ISSN 0066-4286), 1984, pages 331-360, XP8124380 page 350 - page 352; table 4	1-11
X	Feldmann F: "Weltweiter Handel mit Inokulum arbuskulärer Mykorrhizapilze - eine Risikoanalyse für die Bundesrepublik Deutschland" Schriftenreihe des BMVEL "Angewandte Wissenschaft"no. 498, May 2003 (2003-05), pages 165-175, XP002594837 Retrieved from the Internet: URL:http://www.feldmann-lifescience.de/downloads/Weltweit1.pdf [retrieved on 2010-08-02] figure 2	1-11
X	Feldmann F: "Nebenwirkungen von Pflanzenschutzmitteln auf arbuskuläre Mykorrhizapilze als Nichtzielorganismen" 28 February 2008 (2008-02-28), XP002594838 Retrieved from the Internet: URL:http://www.feldmann-lifescience.de/downloads/PSM.pdf [retrieved on 2010-08-02] figure 1	1-11
X	JOHNSON NANCY COLLINS ET AL: "Vesicular-arbuscular mycorrhizae and cultural stresses" ASA SPECIAL PUBLICATION; MYCORRHIZAE IN SUSTAINABLE AGRICULTURE SOIL SCIENCE SOCIETY OF AMERICA, INC., AMERICAN SOCIETY OF AGRONOMY, INC., CROP SCIENCE SOCIETY OF AMERICA, INC. {A}, 677 SOUTH SEGOE ROAD, MADISON, WISCONSIN 53711, USA SERIES : ASA SPE, 1992, pages 71-99, XP8124378 & SYMPOSIUM; DENVER, COLORADO, USA; OCTOBER 31, 1991 page 84 - page 85	1-11

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2010/056368

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	TIWARI MANOJ ET AL: "Arbuscular mycorrhizal colonization status and growth of Acacia catechu Wills. seedlings under pesticide application" PROCEEDINGS OF THE INDIAN NATIONAL SCIENCE ACADEMY PART B BIOLOGICAL SCIENCES, vol. 78, no. Part 1, January 2008 (2008-01), pages 61-65, XP8124382 ISSN: 0369-8211 the whole document	1-11
X	----- DATABASE WPI Week 199343 Thomson Scientific, London, GB; AN 1993-338911 XP002594841 & JP 5 244933 A (IDEMITSU KOSAN CO LTD) 24 September 1993 (1993-09-24) * abstract	1,2,5-11
X	----- WO 02/077201 A2 (HILDITCH ANTHONY JOHN [ZA]; STRAKER COLIN JOHN [ZA]) 3 October 2002 (2002-10-03) claims 8-10 -----	7-11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/056368

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 5244933	A	24-09-1993	NONE	
WO 02077201	A2	03-10-2002	AU 2002250627 A1	08-10-2002