(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
9 September 2011 (09.09.2011)

PCT

(10) International Publication Number
WO 2011/108125 A2

(51) **International Patent Classification**:
A01N 51/00 (2006.01)

(21) **International Application Number**:
PCT/JP2010/056284

(22) **International Filing Date**:
31 March 2010 (31.03.2010)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
2010-047745 4 March 2010 (04.03.2010) JP

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

WO 2011/108125 A2

(54) **Title**: PEST CONTROLLING COMPOSITION AND METHOD FOR CONTROLLING PESTS

(57) **Abstract**: An object of the present invention is to provide a pest controlling composition having an excellent control effect against pests. A pest controlling composition containing clothianidin, metconazole, metalaxyl and tolclophos-methyl has an excellent control effect against pests.

DESCRIPTION

PEST CONTROLLING COMPOSITION AND METHOD FOR CONTROLLING PESTS

TECHNICAL FIELD

The present invention relates to a pest controlling composition and a method for controlling pests.

BACKGROUND ART

Various compounds have hitherto been known as active ingredients of pest controlling compositions (for example, refer to The Pesticide Manual - 15th edition (published by BCPC) ISBN 1901396188).

DISCLOSURE OF THE INVENTION

An object of the present invention is to provide a pest controlling composition having an excellent control effect against pests.

The present inventors have studied so as to find a pest controlling composition having an excellent control effect against pests and found that a pest controlling composition containing clothianidin, metconazole, metalaxyl and tolclophos-methyl has an excellent control effect against pests, thus leading to the present invention.

The present invention provides [1] to [9] shown below:

[1] A pest controlling composition containing clothianidin, metconazole, metalaxyl and tolclophos-methyl;

[2] The pest controlling composition according to [1], wherein the total content of metconazole, metalaxyl and

tolclophos-methyl is from 2 to 10,000,000 parts by weight based on 1,000 parts by weight of clothianidin;

[3] The pest controlling composition according to [1] or [2], further containing compound(s) selected from the following Group (A):

Group (A) consisting of:

azoxystrobin, fluoxastrobin, trifloxystrobin, pyraclostrobin, orysastrobin, carboxin, oxycarboxin, fludioxonil, thiuram, captan, thiophanate-methyl and thiabendazole;

[4] The pest controlling composition according to [3], wherein the content of compound(s) selected from Group (A) is from 2 to 10,000,000 parts by weight based on 1,000 parts by weight of clothianidin;

[5] A method for controlling pests, which includes the step of applying an effective amount of the pest controlling composition according to any one of [1] to [4] to pests or habitats of the pests;

[6] A method for controlling pests, which includes the step of applying an effective amount of the pest controlling composition according to any one of [1] to [4] to plant seeds;

[7] The method for controlling pests according to [6], wherein the plant seeds are seeds of corn, cotton, soybean, sugar beet, rapeseed or rice;

[8] The method for controlling pests according to [6], wherein the plant seeds are transgenic plant seeds; and

[9] The method for controlling pests according to [6], wherein the plant seeds are seeds of herbicide-resistant transgenic soybean or herbicide-resistant transgenic

cotton.

Effects of the Invention

Pests can be controlled by the present invention.

MODE FOR CARRYING OUT THE INVENTION

The pest controlling composition of the present invention contains clothianidin, metconazole, metalaxyl and tolclophos-methyl.

Any of clothianidin, metconazole, metalaxyl and tolclophos-methyl used in the present invention are known compounds and are described, for example, in "THE PESTICIDE MANUAL - 15th EDITION (published by BCPC) ISBN 1901396188", page 229, page 749, page 737 and page 1135. These compounds are obtained from commercially available formulations or obtained by production using a known method.

Although there is no particular limitation on the contents of clothianidin, metconazole, metalaxyl and tolclophos-methyl in the pest controlling composition of the present invention, the total content of metconazole, metalaxyl and tolclophos-methyl is usually from 2 to 10,000,000 parts by weight, and preferably from 5 to 50,000 parts by weight, based on 1,000 parts by weight of clothianidin. Although there is no particular limitation on the contents of metconazole, metalaxyl and tolclophos-methyl in the pest controlling composition of the present invention, each content of metconazole, metalaxyl and tolclophos-methyl is usually from 5 to 20,000 parts by weight based on 1,000 parts by weight of metconazole.

The pest controlling composition of the present

invention can contain, in addition to clothianidin, metconazole, metalaxyl and tolclophos-methyl, compound(s) selected from the following Group (A):

Group (A) consisting of:

azoxystrobin, fluoxastrobin, trifloxystrobin, pyraclostrobin, orysastrobin, carboxin, oxycarboxin, fludioxonil, thiuram, captan, thiophanate-methyl and thiabendazole.

Any of azoxystrobin, fluoxastrobin, trifloxystrobin, pyraclostrobin, orysastrobin, carboxin, oxycarboxin, fludioxonil, thiuram, captan, thiophanate-methyl and thiabendazole are known compounds and are described, for example, in "THE PESTICIDE MANUAL - 15th EDITION (published by BCPC) ISBN 1901396188", page 62, page 538, page 1167, page 971, page 840, page 164, page 855, page 520, page 1132, page 154, page 1128 and page 1109. These compounds are obtained from commercially available formulations, or obtained by production using a known method.

When the pest control agent of the present invention contains compound(s) selected from Group (A), the content thereof is not particularly limited and is usually from 2 to 10,000,000 parts by weight, and preferably from 5 to 50,000 parts by weight, based on 1,000 parts by weight of clothianidin.

The pest controlling composition of the present invention may be produced by merely mixing clothianidin, metconazole, metalaxyl and tolclophos-methyl, and optional compound(s) selected from Group (A), but is usually produced by mixing these compounds with an inert carrier, optionally adding surfactants and other adjuvants for

formulation, and formulating the resultant mixture into oil solutions, emulsifiable concentrates, flowable formulations, wettable powders, granular wettable powders, dust formulations and granules. The pest controlling composition can be used as a pest control agent as it is, or after adding other inert ingredients.

The total content of clothianidin, metconazole, metalaxyl and tolclophos-methyl, and optional compound(s) selected from Group (A) in the pest controlling composition of the present invention is usually within a range from 0.1 to 99% by weight, preferably from 0.2 to 90% by weight, and more preferably from 1 to 80% by weight.

To the pest controlling composition of the present invention, insecticides or fungicides other than those described above may be optionally added. Although there is no particular limitation on the kind of insecticides or fungicides, ethaboxam is preferably exemplified.

Examples of the solid carrier used in the formulation include fine powers and granules of minerals such as kaolin clay, attapulgite clay, bentonite, montmorillonite, acid clay, pyrophyllite, talc, diatomite, and calcite; natural organic substances such as corncob powder and walnut shell powder; synthetic organic substances such as urea; salts such as calcium carbonate and ammonium sulfate; and synthetic inorganic substances such as synthetic hydrous silicon oxide. Examples of the liquid carrier include aromatic hydrocarbons such as xylene, alkylbenzene, and methylnaphthalene; alcohols such as 2-propanol, ethylene glycol, propylene glycol, and ethylene glycol monoethyl ether; ketones such as acetone, cyclohexanone, and

isophorone; vegetable oils such as soybean oil and cottonseed oil; petroleum-based aliphatic hydrocarbons; esters; dimethylsulfoxide; acetonitrile and water.

Examples of the surfactant include anionic surfactants such as alkylsulfuric acid ester salt, alkylarylsulfonic acid salt, dialkylsulfosuccinic acid salt, polyoxyethylenealkylaryletherphosphoric acid ester salt, lignin sulfonic acid salt, and naphthalenesulfonate polycondensed with formaldehyde; nonionic surfactants such as polyoxyethylene alkyl aryl ether, polyoxyethylene-alkylpolyoxypropylene block copolymer, and sorbitan fatty acid ester; and cationic surfactants such as alkyltrimethylammonium salt.

Examples of the other adjuvants for formulation include water-soluble polymers such as polyvinyl alcohol and polyvinyl pyrrolidone; gum arabic; alginic acid and salts thereof; polysaccharides such as CMC (carboxymethyl cellulose) and xanthan gum; inorganic substances such as aluminum magnesium silicate and alumina sol; preservatives; colorants; and stabilizing agents such as PAP (isopropyl acidic phosphate) and BHT.

The pest controlling composition of the present invention can be used so as to protect plants from infestation due to pests (for example, noxious arthropods such as noxious insects and noxious mites, and plant diseases) which cause infestation such as feeding or sapping to plants.

Examples of noxious arthropods on which the pest controlling composition of the present invention exert a control effect include:

Hemiptera pests: planthoppers such as Laodelphax striatellus, Nilaparvata lugens, and Sogatella furcifera, leafhoppers such as Nephotettix cincticeps and Nephotettix virescens, aphids such as Aphis gossypii, Myzus persicae, Brevicoryne brassicae, Macrosiphum euphorbiae, Aulacorthum solani, Rhopalosiphum padi, and Toxoptera citricidus, plant bugs such as Nezara antennata, Riptortus clavetus, Leptocorisa chinensis, Eysarcoris parvus, Halyomorpha mista, and Lyus lineolaris, whiteflies such as Trialeurodes vaporariorum, Bemisia tabaci, and Bemisia argentifolii, scales such as Aonidiella aurantii, Comstockaspis perniciosa, Unaspis citri, Ceroplastes rubens, and Icerya purchasi, lace bugs, and jumping plantlices;

Lepidoptera pests: Pyralidae such as Chilo suppressalis, Tryporyza incertulas, Cnaphalocrocis medinalis, Notarcha derogata, Plodia interpunctella, Ostrinia furnacalis, Ostrinia nubilaris, Hellula undalis, and Pediasia teterrellus, Noctuidae such as Spodoptera litura, Spodoptera exigua, Pseudaletia separata, Mamestra brassicae, Agrotis ipsilon, Plusia nigrisigna, Trichoplusia spp., Heliothis spp., and Helicoverpa spp., Pieridae such as Pieris rapae, Tortricidae such as Adoxophyes spp., Grapholita molesta, Leguminivora glycinivorella, Matsumuraeses azukivora, Adoxophyes orana fasciata, Adoxophyes sp., Homona magnanima, Archips fuscocupreanus, and Cydia pomonella, Gracillariidae such as Caloptilia theivora, and Phyllonorycter ringoneella, Carposinidae such as Carposina niponensis, Lyonetiidae such as Lyonetia spp., Lymantriidae such as Lymantria spp. and Euproctis spp., Yponameutidae such as Plutella xylostella, Gelechiidae such

as Pectinophora gossypiella and Phthorimaea operculella, Arctiidae such as Hyphantria cunea, and Tineidae such as Tinea translucens;

Thysanoptera pests: Thripidae such as Frankliniella occidentalis, Thrips parmi, Scirtothrips dorsalis, Thrips tabaci, Frankliniella intonsa, and Frankliniella fusca;

Diptera pests: Agromyzidae such as Hylemya antiqua, Hylemya platura, Agromyza oryzae, Hydrellia griseola, Chlorops oryzae, and Liriomyza trifolii, Dacus cucurbitae, and Ceratitis capitata;

Coleoptera pests: Epilachna vigintioctopunctata, Aulacophora femoralis, Phyllotreta striolata, Oulema oryzae, Echinocnemus squameus, Lissorhoptrus oryzophilus, Anthonomus grandis, Callosobruchus chinensis, Sphenophorus venatus, Popillia japonica, Anomala cuprea, Diabrotica spp., Leptinotarsa decemlineata, Agriotes spp., and Lasioderma serricorne;

Orthoptera pests: Gryllotalpa africana, Oxya yezoensis, and Oxya japonica;

Hymenoptera pests: Athalia rosae, Acromyrmex spp., and Solenopsis spp.

Of the noxious arthropods, preferred examples are aphids; Thripidae; Agromyzidae; Agriotes spp., Leptinotarsa decemlineata, Popillia japonica, Anomala cuprea, Anthonomus grandis, Lissorhoptrus oryzophilus, Frankliniella fusca and Diabrotica spp.; Plutella xylostella; the larvae of Lepidoptera pests; Leguminivora glycinivorella and the like.

Examples of plant disease on which the pest controlling composition of the present invention exert a

control effect include the following diseases.

Rice diseases: Magnaporthe grisea, Cochliobolus miyabeanus, Rhizoctonia solani, and Gibberella fujikuroi.

Wheat diseases: Erysiphe graminis, Fusarium graminearum, F. avenacerum, F. culmorum, Microdochium nivale, Puccinia striiformis, P. graminis, P. recondita, Micronectriella nivale, Typhula sp., Ustilago tritici, Tilletia caries, Pseudocercosporella herpotrichoides, Mycosphaerella graminicola, Stagonospora nodorum, and Pyrenophora tritici-repentis.

Barley diseases: Erysiphe graminis, Fusarium graminearum, F. avenacerum, F. culmorum, Microdochium nivale, Puccinia striiformis, P. graminis, P. hordei, Ustilago nuda, Rhynchosporium secalis, Pyrenophora teres, Cochliobolus sativus, Pyrenophora graminea, and Rhizoctonia solani.

Corn diseases: Ustilago maydis, Cochliobolus heterostrophus, Gloeocercospora sorghi, Puccinia polysora, Cercospora zeae-maydis, and Rhizoctonia solani.

Citrus plant diseases: Diaporthe citri, Elsinoe fawcetti, Penicillium digitatum, P. italicum, Phytophthora parasitica, and Phytophthora citrophthora.

Apple diseases: Monilinia mali, Valsa ceratosperma, Podosphaera leucotricha, Alternaria alternata apple pathotype, Venturia inaequalis, Colletotrichum acutatum, Phytophtora cactorum, Diplocarpon mali, and Botryosphaeria berengeriana.

Pear diseases: Venturia nashicola, V. pirina, Alternaria alternata Japanese pear pathotype, Gymnosporangium haraeanum, and Phytophtora cactorum.

Peach diseases: Monilinia fructicola, Cladosporium carpophilum, and Phomopsis sp.

Grape diseases: Elsinoe ampelina, Glomerella cingulata, Uncinula necator, Phakopsora ampelopsidis, Guignardia bidwellii, and Plasmopara viticola.

Persimmon diseases: Gloeosporium kaki, Cercospora kaki, and Mycosphaerella nawae.

Pepo diseases: Colletotrichum lagenarium, Sphaerotheca fuliginea, Mycosphaerella melonis, Fusarium oxysporum, Pseudoperonospora cubensis, Phytophthora sp., and Pythium sp.

Tomato diseases: Alternaria solani, Cladosporium fulvum, and Phytophthora infestans.

Eggplant diseases: Phomopsis vexans and Erysiphe cichoracearum.

Brassica diseases: Alternaria japonica, Cercosporella brassicae, Plasmodiophora brassicae, and Peronospora parasitica.

Welsh onion diseases: Puccinia allii, Peronospora destructor.

Soybean diseases: Cercospora kikuchii, Elsinoe glycines, Diaporthe phaseolorum var. sojae, Septoria glycines, Cercospora sojina, Phakopsora pachyrhizi, Phytophthora sojae, and Rhizoctonia solani.

Kidney bean diseases: Colletotrichum lindemthianum.

Peanut diseases: Cercospora personata, Cercospora arachidicola, and Sclerotium rolfsii.

Pea diseases: Erysiphe pisi and Fusarium solani f. sp. pisi.

Potato diseases: Alternaria solani, Phytophthora

infestans, Phytophthora erythroseptica, and Spongospora subterranean f. sp. subterranea.

Strawberry diseases: Sphaerotheca humuli and Glomerella cingulata.

Tea diseases: Exobasidium reticulatum, Elsinoe leucospila, Pestalotiopsis sp., and Colletotrichum theae-sinensis.

Tobacco diseases: Alternaria longipes, Erysiphe cichoracearum, Colletotrichum tabacum, Peronospora tabacina, and Phytophthora nicotianae.

Rapeseed diseases: Sclerotinia sclerotiorum and Rhizoctonia solani.

Cotton diseases: Rhizoctonia solani and Fusarium oxysporum.

Sugar beet diseases: Cercospora beticola, Thanatephorus cucumeris, Thanatephorus cucumeris, and Aphanomyces cochlioides.

Rose diseases: Diplocarpon rosae, Sphaerotheca pannosa, and Peronospora sparsa.

Chrysanthemum and Compositae vegetable diseases: Bremia lactucae, Septoria chrysanthemi-indici, and Puccinia horiana.

Diseases of various plants: diseases caused by Pythium spp. (Pythium aphanidermatum, Pythium debarianum, Pythium graminicola, Pythium irregulare, Pythium ultimum), Botrytis cinerea, and Sclerotinia sclerotiorum.

Japanese radish diseases: Alternaria brassicicola.

Wheat grass diseases: Sclerotinia homeocarpa and Rhizoctonia solani.

Banana diseases: Mycosphaerella fijiensis and

Mycosphaerella musicola.

Sunflower diseases: Plasmopara halstedii.

Seed diseases and diseases at early growth stage of various plants, caused by fungi which belong to the genus Aspergillus, the genus Penicillium, the genus Fusarium, the genus Gibberella, the genus Tricoderma, the genus Thielaviopsis, the genus Rhizopus, the genus Mucor, the genus Corticium, the genus Phoma, the genus Rhizoctonia, the genus Diplodia and the like.

The pest controlling composition of the present invention can be used so as to control pests by application to pests or the place where pests inhabit or the place where pests might inhabit.

Examples of the place where pests inhabit or the place where pests might inhabit include foliage of plants, seeds of plants and bulbs of plants. Specifically, scaly bulb, solid bulb, root stock, stem tuber and rhizophore are exemplified as the bulb.

The pest controlling method of the present invention is conducted by treatment with the pest controlling composition of the present invention, and specific examples thereof include a treatment to foliage of plants, such as foliage application; a treatment to seeds, such as seed disinfection or seed coating; and a treatment to bulbs, such as seed tuber.

Specific examples of the method for a treatment to foliage of plants in the pest controlling method of the present invention include a treating method of application to surfaces of plants, such as foliage application.

The method for a treatment to seeds and the method

for a treatment to bulbs in the controlling method of the present invention is, for example, a method of treating seeds and bulbs of plants to be protected from pests with the pest controlling composition of the present invention. Specific examples of the method include a spray treatment in which a suspension of the pest controlling composition of the present invention is sprayed over seed surfaces or bulb surfaces in mist form; a smearing treatment in which a wettable powder, an emulsifiable concentrate or a flowable formulation of the pest controlling composition of the present invention is applied to seeds or bulbs after adding a small amount of water or as it is; an immersion treatment in which seeds are immersed in a solution of the pest controlling composition of the present invention for a given time; a film coating treatment; and a pellet coating treatment.

When plants are treated with the pest controlling composition of the present invention, the amount of the composition can vary depending upon the kind of plants to be treated, kind and degree of incidence of pests to be controlled, formulation form, treatment time and meteorological conditions. The total content of clothianidin, metconazole, metalaxyl and tolclophos-methyl, and optional compound(s) selected from Group (A) is usually from 1 to 5,000 g, and preferably from 2 to 400 g, per 10,000 m^2 of the place where the plants are cultivated.

In the case of an emulsifiable concentrate, a wettable powder and a flowable formulation, the treatment is usually conducted by spraying the composition after dilution with water. In this case, the total concentration

of clothianidin, metconazole, metalaxyl and tolclophos-methyl, and optional compound(s) selected from Group (A) is usually from 0.0001 to 3% by weight, and preferably from 0.0005 to 1% by weight. In the case of a dust formulation and a granule, the treatment is usually conducted without dilution.

In the treatment to seeds, the application is usually conducted in the total amount of clothianidin, metconazole, metalaxyl and tolclophos-methyl, and optional compound(s) selected from Group (A) within a range from 0.001 to 20 g, and preferably from 0.01 to 5 g, based on 1 kg of seeds.

In the treatment to bulbs, the application is usually conducted in the total amount of clothianidin, metconazole, metalaxyl and tolclophos-methyl, and optional compound(s) selected from Group (A) within a range from 0.001 to 20 g, and preferably from 0.01 to 5 g, based on 1 kg of bulbs.

The pest controlling method of the present invention can be used in crop lands such as upland field, paddy field, and orchard.

The composition of the present invention can be used in crop lands where "plants" listed below are cultivated so as to control pests in the crop lands:

agricultural crops: corn, rice, wheat, barley, rye, oat, sorghum, cotton, soybean, pea, kidney bean, peanut, sarrazin, sugar beet, rapeseed, sunflower, sugar cane, tobacco and the like;

vegetables: Solanaceae vegetables (eggplant, tomato, green pepper, hot pepper, potato, etc.), Cucurbitaceae vegetables (cucumber, pumpkin, zucchini, watermelon, melon, squash, etc.), Cruciferae vegetables (Japanese radish,

turnip, horseradish, kohlrabi, Chinese cabbage, cabbage, brown mustard, broccoli, cauliflower, etc.), Compositae vegetables (burdock, garland chrysanthemum, artichoke, lettuce, etc.), Liliaceae vegetables (Welsh onion, onion, garlic, asparagus, etc.), Umbelliferae vegetables (carrot, parsley, celery, parsnip, etc.), Chenopodiaceae vegetables (spinach, Swiss chard, etc.), Labiatae vegetables (Japanese basil, mint, basil, etc.), strawberry, sweat potato, yam, aroid, etc.;

wheat grass;

fruit trees: pomaceous fruits (apple, common pear, Japanese pear, Chinese quince, quince, etc.), stone fleshy fruits (peach, plum, nectarine, Japanese plum, cherry, apricot, prune, etc.), citrus plants (Satsuma mandarin, orange, lemon, lime, grapefruit, etc.), nuts (chestnut, walnut, hazel nut, almond, pistachio, cashew nut, macadamia nut, etc.), berry fruits (blueberry, cranberry, blackberry, raspberry, etc.), grape, persimmon, olive, loquat, banana, coffee, date, coconut, etc.; and

trees other than fruit trees: tea, mulberry, flowering trees and shrubs, street trees (ash tree, birch, dogwood, eucalyptus, ginkgo, lilac, maple tree, oak, poplar, cercis, Chinese sweet gum, plane tree, zelkova, Japanese arborvitae, fir tree, Japanese hemlock, needle juniper, pine, spruce, and yew).

Of these plants, corn, wheat, soybean, cotton, rapeseed and sugar beet are exemplified as preferred examples.

The above "plants" also include those provided with resistance to herbicides, including HPPD inhibitors such as

isoxaflutole; ALS inhibitors such as imazethapyr and thifen sulfuronmethyl; EPSP synthesis enzyme inhibitors such as glyphosate; glutamine synthesis enzyme inhibitors such as glufosinate; acetyl CoA carboxylase inhibitors such as sethoxydim; bromoxynil, dicamba and 2,4-D, by way of a classical breeding method or a genetic recombination technique.

Examples of the "plants" provided with resistance to an imidazolinone-based ALS inhibitor-type herbicide such as imazethapyr by the classical breeding method include rapeseed, wheat, sunflower, and rice, which have been already on the market under the trade name of Clearfield®. Likewise, there is soybean which has resistance to a sulfonyl urea-based ALS inhibitor-type herbicide such as thifensulfuron—methyl by the classical breeding method, and which has been already on the market under the trade name of STS soybean. Likewise, there is SR corn as an example of a plant which is provided with resistance to an acetyl CoA carboxylase inhibitor, such as trione oxime-based and aryloxy phenoxypropionic acid-based herbicides, by a classical breeding method. Examples of the plant provided with resistance to the acetyl CoA carboxylase inhibitor are described in the proceeding of the National Academy of Sciences of the United States of America (Proc. Natl. Acad. Sci. USA), Vol. 87, pp. 7175-7179 (1990) and the like. Also, mutated acetyl CoA carboxylase, which is resistant to the acetyl CoA carboxylase inhibitor, is reported in the Weed Science, Vol. 53, pp. 728-746 (2005). The plants with resistance to the acetyl CoA carboxylase inhibitor can be made by introducing such a mutated acetyl

CoA carboxylase gene into a plant by means of a genetic recombination technique, or by introducing resistance-providing mutation into acetyl CoA carboxylase of the plant. Further, by introducing base substitution mutation introducing nucleic acid typified by a chimeraplasty technology (Gura T., "Repairing the Genome's Spelling Mistakes", Science, Vol. 285, pp. 316-318 (1999)) into a plant cell and inducing site-specific amino acid substitution mutation to the acetyl CoA carboxylase gene of the plant or the ALS gene, a plant resistant to acetyl CoA carboxylase inhibitors and ALS inhibitors can be made.

Examples of the plant provided with resistance by means of a genetic recombination technique include corn, soybean, cotton, rapeseed and sugar beet cultivars resistant to glyphosate, which have been already on the market under the trade name of RoundupReady® and Agrisure® GT. Similarly, there are corn, soybean, cotton and rapeseed cultivars provided with resistance to glufosinate by means of a genetic recombination technique, which have been already on the market under the trade name of LibertyLink®. Similarly, cotton provided with resistance to bromoxynil by means of a genetic recombination technique has been already on the market under the trade name of BXN.

The above "plants" also include those which have been made capable of synthesizing selective toxins known as genus Bacillus, using a genetic recombination technique.

Examples of the insecticidal toxins expressed in such transgenic plants include insecticidal proteins derived from Bacillus cereus and Bacillus popilliae; δ-endotoxins derived from Bacillus thuringiensis, e.g. Cry1Ab, Cry1Ac,

Cry1F, Cry1Fa2, Cry2Ab, Cry3A, Cry3Bb1 and Cry9C, and insecticidal proteins such as VIP1, VIP2, VIP3 and VIP3A; insecticidal toxins derived from nematodes; insecticidal toxins produced by animals, such as scorpion toxin, spider toxin, bee toxin and insect-specific neurotoxins; filamentous fungi toxins; plant lectins; agglutinin; protease inhibitors such as trypsin inhibitors, serine protease inhibitors, patatin, cystatin and papain inhibitors; ribosome-inactivating proteins (RIP) such as ricin, corn-RIP, abrin, rufin, sapolin and priodin; steroid metabolic enzymes such as 3-hydroxysteroid oxidase, ecdysteroid-UDP-glucosyltransferase and cholesterol oxidase; ecdysone inhibitors; HMG-CoA reductase; ion channel inhibitors such as sodium channel inhibitors and calcium channel inhibitors; juvenile hormone esterase; diuretic hormone receptors; stilbene synthetase; bibenzyl synthetase; chitinase; and glucanase.

The toxins expressed in such transgenic plants include δ-endotoxin proteins such as Cry1Ab, Cry1Ac, Cry1F, Cry1Fa2, Cry2Ab, Cry3A, Cry3Bb1, Cry9C, Cry34Ab and Cry35Ab, hybrid toxins of insecticidal proteins such as VIP1, VIP2, VIP3 and VIP3A, partially deficient toxins, and modified toxins. The hybrid toxins can be made by a novel combination of the different domains of such proteins, using a genetic recombination technique. A known partially deficient toxin is Cry1Ab, in which a part of an amino acid sequence is deficient. In modified toxins, one or more amino acids of a natural toxin are replaced.

Examples of such toxins and transgenic plants capable of synthesizing such toxins are described 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 toxins contained in such transgenic plants impart resistance to insect pests of Coleoptera, insect pests of Hemiptera, insect pests of Diptera, insect pests of Lepidoptera and Nematoda to the plants.

It has already been known that there are transgenic plants containing one or more insecticidal pest-resistant genes and capable of producing one or more toxins. Some of them are commercially available. Examples of such transgenic plants include YieldGard® (a corn cultivar expressing a Cry1Ab toxin), YieldGard Rootworm® (a corn cultivar expressing a Cry3Bb1 toxin), YieldGard Plus® (a corn cultivar expressing Cry1Ab and Cry3Bb1 toxins), Herculex® I (a corn cultivar expressing Cry1Fa2 toxin and phosphinotrysin N-acetyltransferase (PAT) for imparting resistance to Glufosinate), NuCOTN33B® (a cotton cultivar expressing a Cry1Ac toxin), Bollgard® I (a cotton cultivar expressing a Cry1Ac toxin), Bollgard® II (a cotton cultivar expressing Cry1Ac and Cry2Ab toxins), VIPCOT® (a cotton cultivar expressing a VIP toxin), NewLeaf® (a potato cultivar expressing a Cry3A toxin), NatureGard® Agrisure® GT Advantage (GA21 Glyphosate resistant property), Agrisure® CB Advantage (Bt11 corn borer (CB) property), and Protecta®.

The above "plants" include those provided with a capacity of producing an anti-pathogenic substance having selective activity, using a genetic recombination technique.

As the anti-pathogenic substance, for example, PR proteins are known (PRPs, described in EP-A-0 392 225).

These anti-pathogenic substances and transgenic plants producing the same are described in EP-A-0 392 225, WO 95/33818, and EP-A-0 353 191.

Examples of the anti-pathogenic substance expressed by these transgenic plants include ion channel inhibitors, such as a sodium channel inhibitor and a calcium channel inhibitor (KP1, KP4 and KP6 toxins produced by viruses are known); stilbene synthases; bibenzyl synthases; chitinase; glucanase; PR proteins; and substances produced by microorganisms, such as peptide antibiotics, antibiotics having a heterocyclic ring and protein factors involved in plant disease resistance (called as plant disease resistant genes and described in WO 03/000906). These anti-pathogenic substances and transgenic plants producing the same are described in EP-A-0 392 225, WO 95/33818, and EP-A-0 353 191.

The above "plants" include those provided with useful traits, such as oil component reforming and enhancement of amino acid content, by means of a genetic recombination technique. The crops are exemplified by VISTIVE® (low linolenic soybean with reduced linolenic acid content) and high-lysine (high-oil) corn (corn with increased lysine or oil content).

The plants further include stacked varieties, which can be made by combining the above classical herbicidal traits or useful traits of herbicide resistant genes, insecticidal pest resistant genes, anti-pathogenic substance-producing genes, oil component reforming and enhancement of amino acid content.

EXAMPLES

The present invention will be described in more detail by way of formulation examples, application examples and test examples, but the present invention is not limited only to the following examples. In the following examples, parts are by weight unless otherwise specified.

Formulation Example 1

A flowable formulation is obtained by mixing 5.0 parts of clothianidin, 1.0 part of metconazole, 5.0 parts of metalaxyl, 1.0 part of tolclophos-methyl, 0.5 parts of azoxystrobin, 5.0 parts of ethaboxam, 1.5 parts of sorbitan trioleate and 28 parts of an aqueous solution containing 2 parts of polyvinyl alcohol, finely grinding the resultant mixture by a wet grinding method, adding thereto an aqueous solution containing 0.05 parts of xanthan gum and 0.1 parts of aluminum magnesium silicate to make the total volume 90 parts, and then 10 parts of propylene glycol, and stirring and mixing the resulting mixture.

Formulation Examples 2 to 12

Flowable formulations are obtained by conducting the same operation as in Formulation Example 1, except that compounds described in [Table 1] were used in each amount described in [Table 1] in place of 0.5 parts of azoxystrobin.

Table 1

Formulation Example	Compound	Amount [Part]
2	Fluoxastrobin	0.5
3	Trifloxystrobin	1.0
4	Pyraclostrobin	1.0
5	Orysastrobin	2.0
6	Carboxin	10.0
7	Oxycarboxin	3.0
8	Fludioxonil	0.5
9	Thiuram	10.0
10	Captan	3.0
11	Thiophanate-Methyl	1.0
12	Thiabendazole	2.0

Formulation Example 13

A flowable formulation is obtained by mixing 10.0 parts of clothianidin, 0.1 parts of metconazole, 0.2 parts of metalaxyl, 0.2 parts of tolclophos-methyl, 0.2 parts of azoxystrobin, 0.2 parts of ethaboxam, 35 parts of a mixture of white carbon and polyoxyethylene alkyl ether sulfate ammonium salt (weight ratio 1:1), and water to make the total volume 100 parts, and finely grinding the resultant mixture by a wet grinding method.

Formulation Examples 14 to 24

Flowable formulations are obtained by conducting the same operation as in Formulation Example 13, except that compounds described in [Table 2] were used in each amount described in [Table 2] in place of 0.2 parts of azoxystrobin.

Table 2

Formulation Example	Compound	Amount [Part]
14	Fluoxastrobin	0.2
15	Trifloxystrobin	0.4
16	Pyraclostrobin	0.4
17	Orysastrobin	0.8
18	Carboxin	2.0
19	Oxycarboxin	1.2
20	Fludioxonil	0.2
21	Thiuram	0.2
22	Captan	1.2
23	Thiophanate-Methyl	0.4
24	Thiabendazole	0.8

Formulation Example 25

A wettable powder (100 parts) is obtained by grinding and mixing 20.0 parts of clothianidin, 0.8 parts of metconazole, 0.4 parts of metalaxyl, 4.0 parts of tolclophos-methyl, 0.4 parts of azoxystrobin, 0.8 parts of ethaboxam, 3 parts of calcium lignin sulfonate, 2 parts of sodium lauryl sulfate and synthetic hydrous silicon oxide (rest).

Formulation Examples 26 to 36

Wettable powders are obtained by conducting the same operation as in Formulation Example 25, except that compounds described in [Table 3] were used in each amount described in [Table 3] in place of 0.4 parts of azoxystrobin.

Table 3

Formulation Example	Compound	Amount [Part]
26	Fluoxastrobin	0.4
27	Trifloxystrobin	0.8
28	Pyraclostrobin	0.8
29	Orysastrobin	1.6
30	Carboxin	4.0
31	Oxycarboxin	2.4
32	Fludioxonil	0.4
33	Thiuram	4.0
34	Captan	2.4
35	Thiophanate-Methyl	0.8
36	Thiabendazole	1.6

Application Example 1

Treated seeds are obtained by smearing 100 kg of Sorghum dry seeds with 500 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 2

Treated seeds are obtained by smearing 100 kg of Sorghum dry seeds with 1000 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that

respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 3

Treated seeds are obtained by smearing 10 kg of corn dry seeds with 40 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 4

Treated seeds are obtained by smearing 10 kg of corn dry seeds with 100 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 5

Treated seeds are obtained by dressing 10 kg of corn

dry seeds with 50 g of the wettable powder produced in Formulation Example 25.

Respective treated seeds are obtained by conducting the same operation as described above, except that respective wettable powders produced in Formulation Examples 26 to 36 are used in place of the wettable powder produced in Formulation Example 25.

Application Example 6

Treated seeds are obtained by smearing 10 kg of soybean dry seeds with 50 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 7

Treated seeds are obtained by smearing 10 kg of soybean dry seeds with 100 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable

formulation produced in Formulation Example 1.

Application Example 8

Treated seeds are obtained by smearing 10 kg of cotton dry seeds with 50 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 9

Treated seeds are obtained by smearing 10 kg of rapeseed dry seeds with 50 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 10

Treated seeds are obtained by smearing 10 kg of rapeseed dry seeds with 100 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed

treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

Application Example 11

Treated seeds are obtained by smearing 10 kg of seed potato with 25 ml of the flowable formulation produced in Formulation Example 1 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH).

Respective treated seeds are obtained by conducting the same operation as described above, except that respective flowable formulations produced in Formulation Examples 2 to 24 are used in place of the flowable formulation produced in Formulation Example 1.

The effects of the present invention are illustrated by test examples.

Test Example 1

Treated seeds are obtained by smearing corn seeds with the flowable formulation described in Formulation Example 13 using a rotary seed treating machine (seed dresser, manufactured by Hans-Ulrich Hege GmbH). The treated seeds are allowed to stand overnight and placed on the soil filled in plastic pots and then covered with the soil mixed with Rhizoctonia solani cultured separately in a

bran culture medium. While sprinkling, culture is conducted in a greenhouse (hereinafter referred to as the chemical-treated section). Ten days after seeding, the number of seeds that did not show epicotyl emergence is examined and severity is calculated by "Equation 1" shown below. Using non-treated corn seeds, seeding, soil covering and culture are conducted in the same manner as in the case of the chemical-treated section (hereinafter referred to as the non-chemical-treated section). Ten days after seeding, the number of seeds that did not show epicotyl emergence is examined and severity is calculated by "Equation 1" shown below. By calculating the control value of the chemical-treated section by "Equation 2" shown below based on the severity of the chemical-treated section and that of the non-chemical-treated section, it can be confirmed that the chemical-treated section exhibits a satisfactory pest control effect.

Severity (%) = [(Number of seeds that did not show epicotyl emergence)/(Total number of inoculated seeds)] × 100 Equation 1

Control value (%) = [(A - B)/(A)] × 100 Equation 2

A: Severity (%) of plants in the non-chemical-treated section

B: Severity (%) of plants in the chemical-treated section

Test Example 2

In a 15 ml centrifuge tube, corn seeds are smeared with the wettable powder described in Formulation Example 26 in the amount of 5 µl per one corn seed and placed in a

1/10,000 are Wagner pot in which the soil is spread. After growing the plant in a greenhouse for 12 days, five Rhopalosiphum padi are released (hereinafter referred to as the test section). Using corn seeds which are not treated with the wettable powder described in Formulation Example 26, seeding, growing and release are conducted in the same manner as in the case of the test section (hereinafter referred to as the control section).

Seven days after release, the number of Rhopalosiphum padi is examined with respect to the test section and the control section. As a result, since the number of insects in the test section is smaller than the number of insects in the control section, it is possible to confirm that the test section exerts a satisfactory pest control effect.

INDUSTRIAL APPLICABILITY

According to the present invention, it is possible to provide a pest controlling composition having high activity, and a method capable of effectively controlling pests.

CLAIMS

1. A pest controlling composition comprising clothianidin, metconazole, metalaxyl and tolclophos-methyl.

2. The pest controlling composition according to claim 1, wherein the total content of metconazole, metalaxyl and tolclophos-methyl is from 2 to 10,000,000 parts by weight based on 1,000 parts by weight of clothianidin.

3. The pest controlling composition according to claim 1 or 2, further comprising compound(s) selected from the following Group (A):
Group (A) consisting of:
azoxystrobin, fluoxastrobin, trifloxystrobin, pyraclostrobin, orysastrobin, carboxin, oxycarboxin, fludioxonil, thiuram, captan, thiophanate-methyl and thiabendazole.

4. The pest controlling composition according to claim 3, wherein the content of compound(s) selected from Group (A) is from 2 to 10,000,000 parts by weight based on 1,000 parts by weight of clothianidin:

5. A method for controlling pests, which comprises the step of applying an effective amount of the pest controlling composition according to any one of claims 1 to 4 to pests or habitats of the pests.

6. A method for controlling pests, which comprises the step of applying an effective amount of the pest controlling composition according to any one of claims 1 to 4 to plant seeds.

7. The method for controlling pests according to claim 6, wherein the plant seeds are seeds of corn, cotton, soybean, sugar beet, rapeseed or rice.

8. The method for controlling pests according to claim 6, wherein the plant seeds are transgenic plant seeds.

9. The method for controlling pests according to claim 6, wherein the plant seeds are seeds of herbicide-resistant transgenic soybean or herbicide-resistant transgenic cotton.