Abstract:
The present invention relates to a plant disease control composition comprising ethaboxam and 1,1-dimethylethyl N-[6-[[1-(1-methyl-1H-tetrazol-5-yl)phenylmethylene]amino][oxy]methyl]-2-pyrimidyl carbamate.
DESCRIPTION

TITLE OF THE INVENTION

PLANT DISEASE CONTROL COMPOSITION AND PLANT DISEASE CONTROL

METHOD

TECHNICAL FIELD

[0001]

The present invention relates to a plant disease control composition and a plant disease control method.

BACKGROUND ART

[0002]

Conventionally, as active ingredients of a plant disease control agent, ethaboxam (see, for example, U.S. Patent No. 5514643) and 1,1-dimethylethyl N-[6-[[[(z)-[(1-methyl-1H-tetrazol-5-yl)phenylmethylene] amino]oxy]methyl] -2-pyrimidyl] carbamate (hereinafter, referred to as picarbutrazox) (see, for example, WO 2003/016303 Al) have been known.

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0003]

The present invention aims to provide a plant disease control composition that has an excellent plant disease control effect, and a plant disease control method.

SOLUTION OF PROBLEM

[0004]
As a result of intensive studies for finding a plant disease control composition that has an excellent plant disease control effect, the inventors of the present invention have found that a plant disease control composition containing ethaboxam and picarbutrazox exhibits an excellent effect on plant diseases.

That is, the present invention is as follows.

(1) A plant disease control composition containing ethaboxam and picarbutrazox.

(2) The plant disease control composition described in (1), wherein the weight ratio of ethaboxam to picarbutrazox is in the range of 1 : 0.01 to 1 : 50.

(3) A seed treatment agent comprising ethaboxam and picarbutrazox.

(4) A plant seed to which effective amounts of ethaboxam and picarbutrazox are attached.

(5) A plant disease control method wherein effective amounts of ethaboxam and picarbutrazox are applied to a plant or soil for growing a plant.

(6) Combined use of ethaboxam and picarbutrazox, for controlling a plant disease.

According to the present invention, a plant disease can be controlled.

DESCRIPTION OF EMBODIMENTS

Ethaboxam used for a plant disease control composition of the present invention is a compound described in the specification of U.S. Patent No. 5514643, and can be obtained from commercial
agents, or can be produced by a publicly known method.

[0008]

Picarbutrazox used for the plant disease control composition of the present invention is a compound described in WO 2003/016303 Al, and can be produced by a publicly known method.

[0009]

In the plant disease control composition of the present invention, the weight ratio of ethaboxam to picarbutrazox is normally in the range of 1 : 0.01 to 1 : 50, and preferably 1 : 0.04 to 1 : 25. In the case of using the plant disease control composition of the present invention as a seed treatment agent, the weight ratio of ethaboxam to picarbutrazox is normally in the range of 1 : 0.01 to 1 : 50, and preferably 1 : 0.04 to 1 : 25.

[0010]

The plant disease control composition of the present invention may be a simple mixture of ethaboxam and picarbutrazox, but may normally be a mixture of ethaboxam, picarbutrazox and an inert carrier such as a solid carrier or a liquid carrier, to which a surfactant and/or other adjuvants for a formulation are added as necessary so as to formulate the mixture into an oil solution, an emulsion, a flowable agent, a wettable powder, a granular wettable powder, a powder agent, a granular agent, or the like.

In the plant disease control composition of the present invention, the total amount of ethaboxam and picarbutrazox is normally in the range of 0.1% to 100% by weight, and preferably 0.2% to 90% by weight.

[0011]

Examples of the solid carrier used in formulation include fine powders, granules, and the like made of: minerals such as kaolin clay, attapulgite clay, bentonite, montmorillonite,
Japanese acid clay, pyrophyllite, talc, diatomaceous earth and calcite; natural organic substances such as corn cob powder and walnut shell powder; synthetic organic substances such as urea; salts such as calcium carbonate and ammonium sulfate; synthetic inorganic substances such as synthetic hydrated silicon dioxide; or the like. Examples of the liquid carrier include: aromatic hydrocarbons such as xylene, toluene 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 cotton seed oil; petroleum aliphatic hydrocarbons; esters; dimethyl sulfoxide; acetonitrile; and water.

[0012] Examples of the surfactant include: anionic surfactants such as alkylsulfonic acid ester salts, alkylaryl sulfonates, dialkylsulfo succinates, polyoxyethylene alkyl aryl ether phosphoric acid ester salts, lignosulfonates and naphthalenesulfonate formaldehyde polycondensates; non-ionic surfactants such as polyoxyethylene alkyl aryl ethers, polyoxyethylene alkyl polyoxypropylene block copolymers and sorbitan fatty acid esters; and cationic surfactants such as alkyltrimethylammonium salts.

[0013] Examples of other adjuvant for a formulation include: water-soluble polymers such as polyvinyl alcohol and polyvinylpyrrolidone; polysaccharides such as gum Arabic, alginic acid, alginic acid salts, CMC (carboxymethyl cellulose) and xanthan gum; inorganic substances such as aluminum magnesium silicate and alumina sol; preservatives; colorants; and stabilizers such as PAP (isopropyl acid phosphate) and BHT.
The plant disease control composition of the present invention can be prepared also by formulating ethaboxam and picarbutrazox separately by the above-described methods, diluting the formulations with water as necessary, and mixing these formulations or diluted solutions.

The plant disease control composition of the present invention may further contain one or more other fungicides and/or pesticides.

Examples of the plant disease that can be controlled by the present invention include the following diseases.

Plant diseases of rice: blast (Magnaporthe grisea), brown spot (Cochliobolus miyabeanus), sheath blight (Rhizoctonia solani), and bakanae (Gibberella fujikuroi).

Plant diseases of wheat: powdery mildew (Erysiphe graminis), fusarium head blight (Fusarium graminearum, F. avenacerum, F. culmorum, Microdochium nivale), rust (Puccinia striiformis, P. graminis, P. recondita), pink snow rot (Micronectriella nivale), typhula snow blight (Typhula spp.), loose smut (Ustilago tritici), smut (Tilletia caries), eyespot (Pseudocercospora herpotrichoides), leaf blight (Mycosphaerella graminicola), septoria leaf spot (Stagonospora nodorum), and tan spot (Pyrenophora tritici-repentis).

Plant diseases of barley: powdery mildew (Erysiphe graminis), fusarium head blight (Fusarium graminearum, F. avenacerum, F. culmorum, Microdochium nivale), rust (Puccinia striiformis, P. graminis, P. hordei), loose smut (Ustilago nuda, leaf blotch (Rhynchosporium secalis), net blotch (Pyrenophora...
teres), leaf spot (Cochliobolus sativus), leaf stripe (Pyrenophora graminea), and rhizoctonia damping-off (Rhizoctonia solani).

Plant diseases of corn: smut (Ustilago maydis), brown leaf spot (Cochliobolus heterostrophus), copper spot (Gloeocercospora sorghi), southern rust (Puccinia polysora), gray leaf spot (Cercospora zeae-maydis), rhizoctonia damping-off (Rhizoctonia solani), and downy mildew (Peronosclerospora philippinensis).

[0017]

Plant diseases of citrus plants: melanose (Diaporthe citri), scab (Elsinoe fawcetti), penicillium rot (Penicillium digitatum, P. italicum), brown rot (Phytophthora parasitica, and Phytophthora citrophthora).

Plant diseases of apple: blossom, blight (Monilinia mali), canker (Valsa ceratosperma), powdery mildew (Podosphaera leucotricha), alternaria leaf spot (Alternaria alternata apple pathotype), scab (Venturia inaequalis), bitter rot (Colletotrichum acutatum), crown rot (Phytophthora cactorum), blotch (Diplocarpon mali), ring rot (Botryosphaeria berengeriana), and violet root rot (Helicobasidium mompa).

Plant diseases of pear: scab (Venturia nashicola, V. pirina), black spot (Alternaria alternata Japanese pear pathotype), rust (Gymnosporangium haraeanum), and phytophthora fruit rot (Phytophthora cactorum).

Plant diseases of peach: brown rot (Monilinia fructicola), scab (Cladosporium carpophilum), and phomopsis rot (Phomopsis spp).

Plant diseases of grape: anthracnose (Elsinoe ampelina), ripe rot (Glomerella cingulata), powdery mildew (Uncinula
necator), rust (Phakopsora ampelopsidis), black rot (Guignardia bidwellii), and downy mildew (Plasmopara viticola).

Plant diseases of persimmon: anthracnose (Gloeosporium kaki), leaf spot (Cercospora kaki and Mycosphaerella nawae).

Plant diseases of gourd: anthracnose (Colletotrichum lagenarium), powdery mildew (Sphaerotheca fuliginea), gummy stem blight (Mycosphaerella melonis), fusarium wilt (Fusarium oxysporum), downy mildew (Pseudoperonospora cubensis), phytophthora rot (Phytophthora spp.), and damping-off (Pythium spp.).

Plant diseases of tomato: early blight (Alternaria solani), leaf mold (Cladosporium fulvum), and late blight (Phytophthora infestans).

Plant diseases of eggplant: brown spot (Phomopsis vexans) and powdery mildew (Erysiphe cichoracearum).

Plant diseases of Cruciferous vegetables: alternaria leaf spot (Alternaria japonica), white spot (Cercospora brassicae), clubroot (Plasmodiophora brassicae), and downey mildew (Peronospora parasitica).

Plant diseases of welsh onion: rust (Puccinia allii) and downy mildew (Peronospora destructor).

Plant diseases of soybean: purple seed stain (Cercospora kikuchii), spacheloma scad (Elsinoe glycines), pod and stem blight (Diaporthe phaseolorum var. sojae), septoria brown rot (Septoria glycines), frogeye leaf spot (Cercospora sojina), rust (Phakopsora pachyrhizi), brown stem rot (Phytophthora sojae), and rhizoctonia damping-off (Rhizoctonia solani).

Plant diseases of kidney bean: anthracnose (Colletotrichum lindemthianum).
Plant diseases of peanut: leaf spot (Cercospora personata), brown leaf spot (Cercospora arachidicola), and southern blight (Sclerotium rolfsii).

Plant diseases of pea: powdery mildew (Erysiphe pisi) and root rot (Fusarium solani F. sp. pisi).

Plant diseases of potato: early blight (Alternaria solani), late blight (Phytophthora infestans), pink rot (Phytophthora erythroseptica), powdery scab (Spongospora subterranean F. sp. subterranea), and black scurf (Rhizoctonia solani).

Plant diseases of strawberry: powdery mildew (Sphaerotheca humuli) and anthracnose (Glomerella cingulata).

Plant diseases of tea: net blister blight (Exobasidium reticulatum), white scab (Elsinoe leucospila), gray blight (Pestalotiopsis spp.), and anthracnose (Colletotrichum theae-sinensis).

Plant diseases of tobacco: brown spot (Alternaria longipes), powdery mildew (Erysiphe cichoracearum), anthracnose (Colletotrichum tabacum), downy mildew (Peronospora tabacina), and black shank (Phytophthora nicotianae).

Plant diseases of rapeseed: sclerotinia rot (Sclerotinia sclerotiorum) and rhizoctonia damping-off (Rhizoctonia solani).

Plant diseases of cotton: rhizoctonia damping-off (Rhizoctonia solani).

Plant diseases of sugar beet: cercospora leaf spot (Cercospora beticola), leaf and root blight (Rhizoctonia solani) and aphanomyces root rot (Aphanomyces cochlioides).

Plant diseases of rose: black spot (Diplocarpon rosae), powdery mildew (Sphaerotheca pannosa), and downy mildew (Peronospora sparsa).

Plant diseases of chrysanthemum and asteraceous
vegetables: downy mildew (Bremia lactucae), leaf blight (Septoria chrysanthemi-indici), and white rust (Puccinia horiana).

Plant diseases of various groups: diseases caused by Pythium spp. (Pythium debaryanum, Pythium graminicola, Pythium irregulare, Pythium ultimum), gray mold (Botrytis cinerea), sclerotinia rot (Sclerotinia sclerotiorum), and southern blight (Sclerotium rolfsii).

Plant diseases of Japanese radish: alternaria leaf spot (Alternaria brassicicola).

Plant diseases of turfgrass: dollar spot (Sclerotinia homeocarpa) and brown patch and large patch (Rhizoctonia solani).

Plant diseases of banana: sigatoka (Mycosphaerella fijiensis and Mycosphaerella musicola).

Plant diseases of sunflower: downy mildew (Plasmopara halstedii).

Seed diseases or plant diseases at an initial stage of the growth of various plants, which are caused by Aspergillus spp., Penicillium spp., Fusarium spp., Gibberella spp., Trichoderma spp., Thielaviopsis spp., Rhizopus spp., Mucor spp., Corticium spp., Phoma spp., Rhizoctonia spp., Diplodia spp., and the like.

Viral diseases of various plants, which are mediated by Polymixa spp., Olpidium spp., and the like.

Specific examples of the diseases expected to have high activity during treatment of seeds, bulbs, or the like include: damping-off and root rot diseases caused by Pythium spp. (Pythium debaryanum, Pythium graminicola, Pythium irregulare, and Pythium ultimum) of wheat, barley, corn, rice, sorghum, soybean, cotton, rapeseed, cucumber, sunflower, sugar beet and wheat grass; aphanomyces root rot (Aphanomyces cochlioides) of sugar beet;
brown stem root (Phytophthora sojae) of soybean; late blight (Phytophthora nicotianae) of tobacco; downy mildew (Plasmopara halstedii) of sunflower; late blight ( Phytophthora infestans) of potato; downy mildew (Peronosclerospora philippinensis) of corn; and the like.

[0020] By applying effective amounts of ethaboxam and picarbutrazox to a plant or soil for growing a plant, the plant diseases can be controlled. The plant to which ethaboxam and picarbutrazox are applied may be stems and leaves of the plant, seeds of the plant, bulbs of the plant, or the like. Herein, the bulb means a discoid stem, a corm, a rhizome, a tuber, a tuberous root and a rhizophore.

In the case of applying ethaboxam and picarbutrazox to a plant, soil for growing a plant, or the like, ethaboxam and picarbutrazox maybe applied separately in the same period of time, but for the ease of the application, ethaboxam and picarbutrazox are usually applied as the plant disease control composition of the present invention.

Specific examples of the control method of the present invention include treatment of stems and leaves of a plant such as foliage spraying, treatment of a cultivation land of a plant such as soil treatment, treatment of seeds and bulbs such as seed disinfection and seed coating, and the like.

Specific examples of the treatment of stems and leaves of a plant in the control method of the present invention include a treatment method of allowing the plant before transplantation to absorb ethaboxam and picarbutrazox directly, and a treatment method of applying ethaboxam and picarbutrazox to surfaces of the plant such as foliage spraying and trunk spraying. Examples of
the treatment method of allowing the plant before transplantation to absorb ethaboxam and picarbutrazox directly include a method of immersing the whole or a root of the plant therein, and the method of immersing the root may be a method of attaching a substance that is formulated using a solid carrier such as mineral powder to the root.

Examples of the treatment of a cultivation land of a plant in the control method of the present invention include spraying to soil, admixing with the soil, chemical irrigation to soil (chemical liquid application, soil injection, and chemical liquid dripping), and examples of a spot to be treated include a planting hole, a planting row, around a planting hole, around a planting row, the whole area of a cultivation land, a ground side part of a plant, intrarow spacing, under a tree crown, a main stem ridge, earthing up, a seedling raising box, a seedling raising tray, a seedbed, and the like. Examples of a treatment time include before seeding, at the time of seeding, immediately after seeding, raising period, before fix planting, at the time of fix planting, growing period after fix planting, and the like. Moreover, in the treatment of a cultivation land of a plant, the active ingredients may be applied to the plant at the same time, and a solid fertilizer such as a paste fertilizer containing such active ingredients may be applied to the soil. Further, the active ingredients may be mixed into irrigation liquid, and examples thereof include injection into irrigation equipment (an irrigation tube, an irrigation pipe, a sprinkler, or the like), mixing into interrow flooding liquid, mixing into a water culture medium, and the like. Also, the irrigation liquid and the active ingredients may be mixed in advance, and the mixture can be applied by an appropriate irrigation method such as, for example, the
above-described irrigation methods, or other sprinkling, inundation, and the like.

The treatment of seeds and bulbs in the control method of the present invention is, for example, a method of applying the plant disease control composition of the present invention to seeds, bulbs, or the like of the plant which is to be protected from the plant diseases, and specific examples thereof include: a spray treatment in which a suspension of the plant disease control composition of the present invention is sprayed over seed surfaces or bulb surfaces in a mist form; a smearing treatment in which a wettable powder, an emulsion, a flowable agent, or the like of the plant disease control composition of the present invention, which may be mixed with a small amount of water or as it is, is applied to seeds or bulbs; an immersion treatment in which seeds are immersed in a solution of the plant disease control composition of the present invention for a certain period of time; a film coating treatment; and a pellet coating treatment.

[0021]

In the case of applying ethaboxam and picarbutrazox to a plant or soil for growing a plant, the application amount thereof may vary depending on the kind of the plant to be treated, the kind of the plant disease to be controlled, the kind and the degree of the plant disease to be controlled, the form of formulation, the treatment time, meteorological conditions, and the like. The total amount of ethaboxam and picarbutrazox (hereinafter, referred to as an "amount of the present active ingredients") is normally in the range of 1 g to 5,000 g, and preferably 2 g to 500 g, per 10,000 m² of the soil.

Normally, the emulsion, the wettable powder, the flowable agent, or the like is sprayed after being diluted with water. In
this case, the total concentration of ethaboxam and picarbutrazox normally ranges from 0.0001% to 3% by weight, and preferably ranges from 0.0005% to 1% by weight. In the case of a powder agent, a granular agent, or the like, the treatment is normally carried out as they are without dilution.

In the treatment of seeds, the application is normally carried out in the amount of the present active ingredients within a range of 0.001 g to 10 g, and preferably 0.01 to 3 g, per kg of the seeds. The plant seeds of the present invention to which the effective amounts of ethaboxam and picarbutrazox are attached can control the plant disease. The amount of the present active ingredients that are attached to the seeds is normally in the range of 0.001 g to 10 g, and preferably 0.01 g to 3 g, per kg of the seeds.

[0022]

The control method of the present invention may be carried out in crop lands such as an upland field, a paddy field, a lawn and an orchard, or non-crop lands.

Moreover, the present invention can be used for controlling the plant disease in a crop land without providing any chemical damage to the plant, or the like in the crop land, or the like for growing following plants:

Agricultural crops: corn, rice, wheat, barley, rye, oat, sorghum, cotton, soybean, peanut, buckwheat, sugar beet, rapeseed, sunflower, sugar cane, tobacco, and the like;

Vegetables: Solanaceous vegetables (eggplant, tomato, green pepper, hot pepper, potato, etc.), Cucurbitaceous vegetables (cucumber, pumpkin, zucchini, watermelon, melon, squash, etc.), Cruciferous vegetables (Japanese radish, turnip, horseradish, kohlrabi, Chinese cabbage, cabbage, brown mustard,
broccoli, cauliflower, etc.), Asteraceous vegetables (burdock, garland chrysanthemum, artichoke, lettuce, etc.), Liliaceous vegetables (welsh onion, onion, garlic, and asparagus), Ammiaceous vegetables (carrot, parsley, celery, parsnip, etc.), Chenopodiaceous vegetables (spinach, Swiss chard, etc.), Lamiaceous vegetables (Perilla frutescens, mint, basil, etc.), strawberry, sweat potato, Dioscorea japonica, colocasia, and the like,-

Flowers;

Foliage plants;

Turf grasses;

Fruits: pomaceous fruits (apple, common pear, Japanese pear, Chinese quince, quince, etc.), stone fleshy fruits (peach, plum, nectarine, Japanese plum, yellow peach, 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, and the like; and

Trees other than fruit trees: tea, mulberry, flowering trees and shrubs, Jatropha curcas, 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), and the like.

The control method of the present invention can be used for controlling plant diseases in crop lands for growing, in particular, corn, rice, wheat, barley, sorghum, cotton, soybean, sugar beet, rapeseed, turf grass and potato among the above-listed plants.
Incidentally, the above-listed plants include their genetically modified plants.

EXAMPLES

The present invention will be described in more detail below by way of formulation examples, seed treatment examples and test examples, but the present invention is not limited to the following examples. Incidentally, in the following examples, "part(s)" represents "part(s) by weight", unless otherwise specified.

Formulation Example 1

A formulation is obtained by mixing 10 parts of ethaboxam, 2 parts of picarbutrazox, 14 parts of polyoxyethylene styrylphenyl ether, 6 parts of calcium dodecylbenzenesulfonate and 76.5 parts of xylene well.

Formulation Example 2

A formulation is obtained by mixing 8 parts of ethaboxam, 2 parts of picarbutrazox, 35 parts of a mixture of white carbon and ammonium polyoxyethylene alkyl ether sulfate (1:1 in weight ratio) and 55 parts of water, and then fine-grinding the mixture by wet milling.

Formulation Example 3

A formulation is obtained by mixing 2 parts of ethaboxam, 10 parts of picarbutrazox, 1.5 parts of sorbitan trioleate and 31.5 parts of an aqueous solution that contains 2 parts of
polyvinyl alcohol, subsequently fine-grinding the mixture by wet milling, then adding 45 parts of an aqueous solution that contains 0.05 parts of xanthan gum and 0.1 parts of aluminum magnesium silicate to the obtained mixture, further adding 10 parts of propylene glycol thereto, and then stirring and mixing the thus obtained mixture.

[0028]

Formulation Example 4

A formulation is obtained by mixing 40 parts of ethaboxam, 5 parts of picarbutrazox, 5 parts of propylene glycol, 5 parts of potassium polyoxyethylene tristyrylphenol phosphate, 0.2 parts of a silicone-based defoaming agent, 0.3 parts of 1,2-benzisothiazolin-3-one and 49.5 parts of ion exchanged water, and then fine-grinding the mixture by wet milling.

[0029]

Formulation Example 5

A formulation is obtained by pulverizing and mixing 10 parts of ethaboxam, 40 parts of picarbutrazox, 38.5 parts of kaolinite, 10 parts of a sodium salt of naphthalene sulfonic acid formalin condensate, and 1.5 parts of alkyl naphthalene sulfonate well.

[0030]

Formulation Example 6

A formulation is obtained by pulverizing and mixing 3 parts of ethaboxam, 2 parts of picarbutrazox, 1 part of synthetic hydrated silicon dioxide, 2 parts of calcium lignin sulfonate, 30 parts of bentonite and 62 parts of kaolin clay well, adding water to the mixture, kneading the mixture well, and then granulating and drying the thus kneaded mixture.

[0031]

Formulation Example 7
A formulation is obtained by pulverizing and mixing 20 parts of ethaboxam, 15 parts of picarbutrazox, 3 parts of calcium lignin sulfonate, 2 parts of sodium lauryl sulfate and 60 parts of synthetic hydrated silicon dioxide well.

[0032]

Formulation Example 8

A formulation is obtained by pulverizing and mixing 5 parts of ethaboxam, 1 part of picarbutrazox, 84 parts of kaolin clay and 10 parts of talc well.

[0033]

Formulation Example 9

A flowable formulation is obtained by mixing 5 parts of ethaboxam, 1 part of metalaxyl, 1.5 parts of sorbitan trioleate and 28 parts of an aqueous solution that contains 2 parts of polyvinyl alcohol, subsequently fine-grinding the mixture by wet milling, then adding an aqueous solution that contains 0.05 parts of xanthan gum and 0.1 parts of aluminum magnesium silicate to the obtained mixture so that the total amount thereof may become 90 parts, further adding 10 parts of propylene glycol thereto, and then stirring and mixing the thus obtained mixture.

[0034]

Formulation Example 10

A flowable formulation is obtained by mixing 5 parts of ethaboxam, 5 parts of picarbutrazox, 1 part of tolclofos methyl, 1.5 parts of sorbitan trioleate and 28 parts of an aqueous solution that contains 2 parts of polyvinyl alcohol, subsequently fine-grinding the mixture by wet milling, then adding an aqueous solution that contains 0.05 parts of xanthan gum and 0.1 parts of aluminum magnesium silicate to the obtained mixture so that the total amount thereof may become 90 parts, further adding 10
parts of propylene glycol thereto, and then stirring and mixing
the thus obtained mixture.

[0035]
Formulation Examples 11 to 26

Operations are carried out similarly to those of
Formulation Example 10, except that compounds shown in Table 1
were used in the usage amounts shown in Table 1 instead of 1 part
of tolclofos methyl, whereby flowable formulations were obtained.

[0036]

<table>
<thead>
<tr>
<th>Formulation Example</th>
<th>Compound</th>
<th>Usage Amount (Part)</th>
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</thead>
<tbody>
<tr>
<td>11</td>
<td>Ipconazole</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>Thiuram</td>
<td>5</td>
</tr>
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<td>13</td>
<td>Captan</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Carboxin</td>
<td>5</td>
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<td>15</td>
<td>Thiabendazole</td>
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<td>16</td>
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<td>Prothioconazole</td>
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<td>26</td>
<td>Fluopicolide</td>
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</tr>
</tbody>
</table>

[0037]
Seed Treatment Example 1

On 100 kg of sorghum dry seeds, 500 ml of the formulation
produced according to Formulation Example 1 is smeared by using
a rotary seed treatment machine (seed treater, Hege 11 produced
by WINTERSTEIGER), thereby obtaining treated seeds.

[0038]
Seed Treatment Example 2

On 10 kg of rapeseed dry seeds, 50 ml of the formulation
produced according to Formulation Example 2 is smeared by using the rotary seed treatment machine (seed treater, Hege 11 produced by WINTERSTEIGER), thereby obtaining treated seeds.

[0039]

Seed Treatment Example 3

On 10 kg of corn dry seeds, 40 ml of the formulation produced according to Formulation Example 3 is smeared by using the rotary seed treatment machine (seed treater, Hege 11 produced by WINTERSTEIGER), thereby obtaining treated seeds.

[0040]

Seed Treatment Example 4

On 10 kg of rice dry seeds, 60 ml of the formulation produced according to Formulation Example 4 is smeared by using the rotary seed treatment machine (seed treater, Hege 11 produced by WINTERSTEIGER), thereby obtaining treated seeds.

[0041]

Seed Treatment Example 5

Corn dry seeds (10 kg) are powder-coated with 50 g of the formulation that was produced according to Formulation Example 5, thereby obtaining treated seeds.

[0042]

Seed Treatment Example 6

On 100 kg of sugar beet dry seeds, 500 ml of the formulation produced according to Formulation Example 1 is smeared by using the rotary seed treatment machine (seed treater, Hege 11 produced by WINTERSTEIGER), thereby obtaining treated seeds.

[0043]

Seed Treatment Example 7

On 10 kg of soybean dry seeds, 50 ml of the formulation produced according to Formulation Example 2 is smeared by using
the rotary seed treatment machine (seed treater, Hege 11 produced by WINTERSTEIGER), thereby obtaining treated seeds.

[0044]

Seed Treatment Example 8

On 10 kg of wheat dry seeds, 50 ml of the formulation produced according to Formulation Example 3 is smeared by using the rotary seed treatment machine (seed treater, Hege 11 produced by WINTERSTEIGER), thereby obtaining treated seeds.

[0045]

Seed Treatment Example 9

On 10 kg of sunflower dry seeds, 70 ml of the formulation produced according to Formulation Example 4 is smeared by using the rotary seed treatment machine (seed treater, Hege 11 produced by WINTERSTEIGER), thereby obtaining treated seeds.

[0046]

Seed Treatment Example 10

Cotton dry seeds (10 kg) are powder-coated with 40 g of the formulation that was produced according to Formulation Example 5, thereby obtaining treated seeds.

[0047]

Test Example 1

Method of preparing chemical solution

First, 10 parts of ethaboxam or picarbutrazox, 35 parts of a mixture of white carbon and ammonium polyoxyethylene alkyl ether sulfate (1:1 in weight ratio) and 55 parts of water were mixed. Thereafter, the thus obtained mixture was fine-ground by wet milling to obtain each flowable formulation. The each obtained flowable formulation was diluted with water, and they were mixed so that the mixed solution might have concentration shown in Table 2, thereby preparing each the solution for this test.
A plastic pot having a diameter of 5.5 cm was filled with culture soil, and tomatoes (patio) were sowed therein. After the sowing, 15 ml of each chemical solution prepared by the above-described method was sprayed with a spray gun to stems and leaves of the tomatoes that had been grown for 21 days. On the next day, the stem and leaves were treated by spraying a zoospore suspension of Phytophthora infestans with a concentration of $1.0 \times 10^4$/ml by using an atomizer. The tomatoes were grown at 20°C and a humidity of 100% for 24 hours, and were subsequently grown in a greenhouse set at 20°C for 12 days. Thereafter, the infected areas of the tomato were measured, and the infected area rates were obtained according to Formula 1 (hereinafter, referred to as the infected area rate of the treated section).

Formula 1

$$\text{Infected area rate} = 100 \times \frac{\text{Area of infected tomato leaves}}{\text{Area of tomato leaves}}$$

Operations were carried out similarly to the above except that only water was used instead of the chemical solution, and each infected area rate was obtained according to Formula 1 (hereinafter, referred to as the infected area rate of the non-treated section).

From each infected area rate of the treated section and each infected area rate of the non-treated section, each control value was calculated according to Formula 2.

Formula 2

$$\text{Control value (\%)} = 100 \times \frac{A - B}{A}$$

A: Infected area rate of the non-treated section
B: Infected area rate of the treated section

The results are shown in Table 2.
[0048]

Table 2

<table>
<thead>
<tr>
<th>Treatment Concentration (ppm)</th>
<th>Control Value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethaboxam</td>
<td>Picarbutrazox</td>
</tr>
<tr>
<td>1 0.1</td>
<td>2.0</td>
</tr>
<tr>
<td>2 0.5</td>
<td>2.0</td>
</tr>
<tr>
<td>3 1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>4 2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>5 2.0</td>
<td>0.1</td>
</tr>
<tr>
<td>6 2.0</td>
<td>-</td>
</tr>
<tr>
<td>7 1.0</td>
<td>-</td>
</tr>
<tr>
<td>8 0.5</td>
<td>-</td>
</tr>
<tr>
<td>9 0.1</td>
<td>-</td>
</tr>
<tr>
<td>10 -</td>
<td>2.0</td>
</tr>
<tr>
<td>11 -</td>
<td>1.0</td>
</tr>
<tr>
<td>12 -</td>
<td>0.5</td>
</tr>
<tr>
<td>13 -</td>
<td>0.1</td>
</tr>
</tbody>
</table>

[0049]

Test Example 2

An acetone solution of ethaboxam and an acetone solution of picarbutrazox were mixed so as to prepare chemical solutions, each of which has concentrations of ethaboxam and picarbutrazox as shown in Table 3. Each chemical solution containing ethaboxam and/or picarbutrazox was smeared on surfaces of soybean ("Hatayutaka") seeds, which was left still for one night. A plastic pot was filled with culture soil, and these seeds were sowed therein. Then, the seeds were covered with sandy loam which was mixed with a bran medium in which Pythium damping-off pathogen (Pythium ultimum) had been cultured. After irrigation, the seeds were grown at 25°C for 8 days, and their incidence of disease was examined according to Formula 3 (hereinafter, referred to as the incidence of disease of the plant in the treated section).

Moreover, for calculating their control value, their incidence of disease without use of the chemical solution was examined as well (hereinafter, referred to as the incidence of
The control value was calculated according to Formula 4 from the incidence of disease of the plant in the treated section and the incidence of disease of the plant in the non-treated section.

Formula 3
Incidence of disease = (Number of non-germinated seed(s) + Number of infected seedling(s)) x 100 / (Total seeding number)

Formula 4
Control value (%) = 100 x (C - D) / C

C: Incidence of disease of the plant in the non-treated section
D: Incidence of disease of the plant in the treated section

The results are shown in Table 3.

<table>
<thead>
<tr>
<th>Treatment amount (gAI/100 kg of Seeds)</th>
<th>Control Value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethaboxam</td>
<td>Picarbutrazox</td>
</tr>
<tr>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>5</td>
<td>0.4</td>
</tr>
<tr>
<td>6</td>
<td>0.08</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
</tr>
</tbody>
</table>

INDUSTRIAL APPLICABILITY

According to the present invention, a plant disease can be controlled.
CLAIMS

1. A plant disease control composition comprising ethaboxam and 1,1-dimethylethyl

\[ N-\{6-\left\{\left\{\left(1\right)-\text{methyl}-1H\text{-tetrazol-5-yl}\right)\text{phenylmethylene}\right\}\right\}\text{amino}\]
\[\text{oxy}\text{methyl}\text{-2-pyrimidyl}\text{carbamate.}\]

2. The plant disease control composition according to claim 1, wherein the weight ratio of ethaboxam to 1,1-dimethylethyl

\[ N-\{6-\left\{\left\{\left(1\right)-\text{methyl}-1H\text{-tetrazol-5-yl}\right)\text{phenylmethylene}\right\}\right\}\text{amino}\]
\[\text{oxy}\text{methyl}\text{-2-pyrimidyl}\text{carbamate is in the range of 1:0.01 to 1:50.}\]

3. A seed treatment agent comprising ethaboxam and 1,1-dimethylethyl

\[ N-\{6-\left\{\left\{\left(1\right)-\text{methyl}-1H\text{-tetrazol-5-yl}\right)\text{phenylmethylene}\right\}\right\}\text{amino}\]
\[\text{oxy}\text{methyl}\text{-2-pyrimidyl}\text{carbamate.}\]

4. A plant seed to which effective amounts of ethaboxam and 1,1-dimethylethyl

\[ N-\{6-\left\{\left\{\left(1\right)-\text{methyl}-1H\text{-tetrazol-5-yl}\right)\text{phenylmethylene}\right\}\right\}\text{amino}\]
\[\text{oxy}\text{methyl}\text{-2-pyrimidyl}\text{carbamate are attached.}\]

5. A plant disease control method wherein effective amounts of ethaboxam and 1,1-dimethylethyl

\[ N-\{6-\left\{\left\{\left(1\right)-\text{methyl}-1H\text{-tetrazol-5-yl}\right)\text{phenylmethylene}\right\}\right\}\text{amino}\]
\[\text{oxy}\text{methyl}\text{-2-pyrimidyl}\text{carbamate are applied to a plant or soil for growing a plant.}\]

6. Combined use of ethaboxam and 1,1-dimethylethyl
N-[[6-[[[(Z)-[(1-methyl-1H-tetrazol-5-yl)phenylmethylene] amino](oxy)methyl]-2-pyrimidyl] carbamate, for controlling a plant disease.
INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/053161

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. A01N4/3/78 (2006.01) i. A01C1/06 (2006.01) i. A01N25/00 (2006.01) i. A01N7/18 (2006.01) i. A01P3/00 (2006.01) i.

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)
Int.Cl. A01N4/3/78, A01N25/00, A01N7/18, A01P3/00

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
CAplus/REGISTRY (STN)
JSTPlus/ JMEDPlus/ JST85 80 (JDreamHJ)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
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<th>Relevant to claim No.</th>
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</thead>
</table>

* Special categories of cited documents:

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Date of the actual completion of the international search
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Form PCT/ISA/210 (second sheet) (July 2009)
### DOCUMENTS CONSIDERED TO BE RELEVANT

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