

PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Mercury-Free Seed Treating Agents

We, FARBWERKE HOECHST A.G. vormal Meister Lucius & Brüning, a Company recognised by German Law, of 6230 Frankfurt (M)-Hoechst, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to mercury-free seed treating agents.

Nowadays, in order to protect seeds against various fungus diseases, for example *Tilletia caries*, *Fusarium* disease or *Rhizoktonia solani*, they are generally treated with mercury-containing preparations. Because of the objectionable toxicological properties of such preparations, especially of organic mercury compounds also used for seed treatment, attempts have been made to develop mercury-free seed treating agents. The compounds and combinations hitherto proposed have the disadvantage, however, that they are only effective against part of the fungi concerned. Moreover, many of these compounds cause damage to the germs which lead to considerable crop losses. In German Patent 1,140,392, for example, 3,3,4,4-tetrachlorotetrahydrothiophene - 1,1-dioxide has been described as an effective compound for soil and seed treatment in pea cultivation (cf. also British Patent 856,446). When using this compound for treating cereals, for example wheat and barley, it has been found, however, that its phytotoxicity is too high in the ranges of concentration in which it is fully effective, so that it cannot be used in practice as a so-called universal seed protectant.

The present invention provides a preparation for treating seeds which comprises as active substance a mixture of (a) 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide, with (b) pentachloronitrobenzene and/or tetrachloronitrobenzene and/or tetramethyl-

thiuramdisulphide and/or N-trichloromethylmercaptotetrahydrophthalimide and/or hexachlorobenzene, the weight ratio of components a) and b) present being within the range of from 1:1 to 1:10 in conjunction with an inert carrier material.

The present invention also provides a process for the manufacture of a seed protectant wherein 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide is mixed — in a weight ratio within the range of 1:1 to 1:10 — with pentachloronitrobenzene and/tetrachloronitrobenzene and/or tetramethylthiuramdisulphide and/or N-trichloromethylmercaptotetrahydrophthalimide and/or hexachlorobenzene, and the mixture so obtained is admixed with an inert material.

The following Examples illustrate the invention, the parts being by weight.

As can be seen from the Examples, the above combination has a stronger action on the fungi than its individual constituents. The active mixture of substances is applied in admixture with an inert substance.

EXAMPLE 1

Winter wheat infested with *Tilletia tritici* was treated with a preparation (A) containing as active substance

5 parts 3,3,4,4-tetrachlorotetrahydrothiophene-dioxide together with
15 parts pentachloronitrobenzene and
80 parts talcum as inert material.

For comparison, there were also used preparation (B) containing as active substance
20 parts tetrachlorotetrahydrothiophene dioxide alone and
80 parts talcum as inert material,
and a preparation (C) containing as active substance

20 parts pentachloronitrobenzene alone and
80 parts talcum as inert material.

A commercial seed protectant containing 2% of mercury was used as comparison pre-

paration (D). Each formulated preparation was applied in a concentration of 100 g, 50 g and 25 g, respectively, for 100 kg of seed grains. The treatment was carried out in a conventional drum.

One day after the treatment, the seed grains were sown in lots of 2 m² each with 5 replications. On harvesting, the sound ears and those infested with *Tilletia tritici* were counted and the figures so obtained were compared with those obtained in untreated control plants.

The results set forth in the following Table 1 show that combination (a) consisting of 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide and pentachloronitrobenzene is not only superior to individual constituents (B) and (C) but also to the commercial mercury-containing product (D) in low concentrations. Table 1 also shows that the plants were not damaged by preparation (A) whereas pronounced to strong phytotoxic symptoms were produced by preparation (B).

TABLE 1

Preparation	Infestation with <i>Tilletia tritici</i> in % with g of preparation per 100 kg of seeds			Damage to plants with 100 g/100 kg
	100 g/100 kg	50 g/100 kg	25 g/100kg	
A	0%	0%	0.2%	0
B	8.7%	10.3%	18.6%	2 — 3
C	1.4%	4.2%	7.4%	0
D	0.5%	1.9%	4.7 %	0
Untreated	59.3%	60.7%	56%	0

Damage to plants: 0 = no damage
5 = plants died down

EXAMPLE 2

Oats strongly infested artificially with *Ustilago avenae* (loose smut of oats) were treated with a preparation (A) containing as active substance 10 parts of 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide together with 20 parts of tetramethylthiuram disulphide (TMTD) and 70 parts of talcum as inert substance.

For comparison, there were used a preparation (B) which contained as active substance 20 parts (higher concentrations cause too much damage to the plants) of 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide with 80 parts of talcum as inert material, and a preparation (C) containing as active substance 30 parts of TMTD alone in addition to 70 parts of talcum. Furthermore, a commercial preparation containing 2% of mercury was used as comparison preparation (D).

The seed grains were treated for 10 minutes with 100 g, 50 g and 25 g, respectively, of the formulated preparations for 100 kg of seed grains and sown after 24 hours in lots of 2 m² each with 4 replications.

On harvesting, the comparison was evaluated and the numbers of sound panicles and panicles infested with loose smut were determined.

The average result obtained by the four replications is indicated in the following Table 2. It shows that the active substance combination (A) of the invention has a distinctly improved action against *Ustilago avenae* in comparison with that of individual components (B) and (C). It even shows that the action of active substance combination (A) is distinctly superior to that of mercury preparation (D).

TABLE 2

Preparation	Infestation of panicles in % with concentrations of g of preparation for 100 kg of seed grains		
	100 g/100 kg	50 g/100kg	25 g/100kg
A	0%	0.1%	0.8%
B	5.7%	9.5%	12.0%
C	8.6%	13.2%	15.4%
D	0.7%	4.3%	6.8%
Untreated	23.2%	29.6%	26.3%

EXAMPLE 3

Cotton seed strongly infested with *Rhizotonia solani* was treated with a preparation (A) containing as active substance a combination of

10 parts 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide with

60 parts N-trichloromethylmercaptotetrahydrophthalimide (captan) in addition to

30 parts talcum as carrier material.

For comparison, there were used a preparation (B) containing as active substance

20 parts (higher concentrations cause too much damage to the plants) of 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide alone in addition to

80 parts talcum

and a preparation (C) containing

30 parts talcum as inert material and

70 parts N-trichloromethylmercaptotetra-

hydrophthalimide (captan) as active substance.

A commercial seed protectant (D) containing 2% of mercury was also used for comparison.

The formulated preparations were used in concentrations of 400 g, 200 g and 100 g, respectively, for 100 kg of seed grains. The treatment lasted 10 minutes. The seed grains were sown in a hot-house in pots with six replications and the result was ascertained by the number of the sound plants that had germinated.

The result so obtained is indicated in the following Table 3. The Table shows that combination (A) of the invention has a considerably improved action in comparison with all the other preparations including mercury seed protectant (D).

TABLE 3

Preparation	% of germinated sound plants with concentrations of g of preparation for 100 kg of seed grains		
	400 g/100kg	200g/100 kg	100g/100 kg
A	99%	96%	84%
B	76%	65%	58%
C	81%	71%	64%
D	85%	72%	60%
Untreated	50%	49%	51%

EXAMPLE 4

Winter rye seeds naturally infested to a high degree with *Fusarium nivale* were treated with a preparation (A) containing, as active substance, a combination of

- 10 parts 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide and
- 20 parts hexachlorobenzene in addition to
- 70 parts talcum as inert material.

For comparison, there were used a preparation (B) which contained as active substance 20 parts (higher concentrations cause too much damage to the plants) of 3,3,4,4-tetrachlorotetrahydrothiophene-1,1 - dioxide alone and

- 80 parts talcum as inert material
- and a preparation (C) containing as active substance
- 30 parts hexachlorobenzene alone and
- 70 parts talcum as inert material.

A commercial seed protectant (D) containing 2% of mercury was also used as comparison preparation.

The formulated preparations were used in concentrations of 100 g, 50 g and 25 g, respectively, for 100 kg of seed grains. The treatment lasted 10 minutes.

24 hours after the treatment, the treated seed grains were sown in germination boxes with sterile garden mould with eight replications, each comprising 100 seed grains, and then caused to germinate under optimum infestation conditions in an air-conditioned room at a temperature of 5 to 8°C and 90 to 100% of relative atmospheric moisture.

The elevation of the experiment is set forth in the following Table 4. The Tables shows that the effectiveness of combination (A) is considerably higher than that of the individual components (B) and (C) and reaches that of the mercury seed protectant (D).

This result is very surprising since the component hexachlorobenzene is almost ineffective against *Fusarium* when used alone, as can be seen from the Table.

TABLE 4

Preparation	% of infestation with <i>Fusarium</i> with concentrations of g of preparation for 100 kg of seed grains		
	100g/100 kg	50g/100 kg	25g/100 kg
A	0%	1.2%	3.5%
B	2.7%	8.9%	15.4%
C	29.1%	35.0%	40.3%
D	0.1%	0.8%	2.3%
Untreated	63%	51.7%	53.4%

EXAMPLE 5

Winter rye seeds naturally infested to a high degree with *Fusarium nivale* were treated with a preparation (A) containing as active substance a combination of

5 parts 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide and

40 parts tetrachloronitrobenzene in addition to

55 parts talcum as inert material.

For comparison there were used a preparation (B) containing as active substance

20 parts ^{+) 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide alone in addition to}

80 parts talcum as inert material

and a preparation (C) containing as active substance

^{+) higher concentrations cause too much damage to the plants.}

45 parts tetrachloronitrobenzene alone in addition to

55 parts talcum as inert material.

A commercial seed protectant (D) containing 2% of mercury was also used as comparison preparation.

The formulated preparations were applied in concentrations of 100 g, 50 g, and 25 g, respectively, for 100 kg of seed grains.

One day after the treatment the seed grains were sown in the usual germination boxes filled with sterile garden mould and caused to germinate under optimum infestation conditions in an air-conditioned room at a temperature of 5 to 8°C and a relative atmospheric moisture of 90 to 100%.

An evaluation of this experiment shows that the effectiveness of combination (A) is superior to that of comparison preparations (B) and (C) and is equal to that of mercury seed dressing (D).

TABLE 5

Preparation	% of infestation with <i>Fusarium</i> with concentrations of g of preparation for 100 kg of seed grains		
	100g/100 kg	50g/100 kg	25g/100 kg
A	0%	0.3%	1.8%
B	2.7%	7.2%	17.3%
C	8.9%	20.6%	28.3%
D	0%	0.8%	1.3%
Untreated	57.3%	54.8%	59.3%

WHAT WE CLAIM IS:—

1. A preparation for treating seeds, which comprises as active ingredient a mixture of
5 (a) 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide with (b) pentachloronitrobenzene and/or tetrachloronitrobenzene and/or tetramethylthiuramdisulphide and/or N-trichloromethyl-
10 mercaptotetrahydrophthalimide and/or hexachlorobenzene, the weight ratio of component (a) to component (b) present being within the range of from 1:1 to 1:10, in conjunction with an inert carrier material.
2. A process for the manufacture of a
15 seed protectant wherein 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide is mixed — in a weight ratio within the range of 1:1 to 1:10 — with pentachloronitrobenzene and/or

tetrachloronitrobenzene and/or tetramethylthiuramdisulphide and/or N-trichloromethyl-
20 mercaptotetrahydrophthalimide and/or hexachlorobenzene, and the mixture so obtained is admixed with an inert material.

3. A method of treating seeds to protect
25 them from fungi, which comprises applying to the seeds a preparation as claimed in claim 1.

4. A preparation for treating seeds according to claim 1 and substantially as described
30 in any of the Examples herein.

ABEL & IMRAY,
Chartered Patent Agents,
Quality House, Quality Court,
Chancery Lane, London, W.C.2.

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Abel. Imray

TABLE 5

Preparation	% of infestation with <i>Fusarium</i> with concentrations of g of preparation for 100 kg of seed grains		
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A	0%	0.3%	1.8%
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Untreated	57.3%	54.8%	59.3%

WHAT WE CLAIM IS:—

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5 (a) 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide with (b) pentachloronitrobenzene and/or tetrachloronitrobenzene and/or tetramethylthiuramdisulphide and/or N-trichloromethylmercaptotetrahydrophthalimide and/or hexachlorobenzene, the weight ratio of component
10 (a) to component (b) present being within the range of from 1:1 to 1:10, in conjunction with an inert carrier material.
2. A process for the manufacture of a
15 seed protectant wherein 3,3,4,4-tetrachlorotetrahydrothiophene-1,1-dioxide is mixed — in a weight ratio within the range of 1:1 to 1:10 — with pentachloronitrobenzene and/or

tetrachloronitrobenzene and/or tetramethylthiuramdisulphide and/or N-trichloromethylmercaptotetrahydrophthalimide and/or hexachlorobenzene, and the mixture so obtained is admixed with an inert material.

3. A method of treating seeds to protect them from fungi, which comprises applying to the seeds a preparation as claimed in claim 1.

4. A preparation for treating seeds according to claim 1 and substantially as described in any of the Examples herein.

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