

CONTROLLING SEED-BORNE DISEASES / WHEAT, OATS, BARLEY, RYE



N. A. SMITH

Extension Specialist in Plant Pathology

PREPLANTING treatment of small grain seed with an effective volatile mercury fungicide is an economically practical way to control many seed-borne diseases. Failure to treat seed may result in excessive dockage when selling grain or even outright rejection, as in a recent case with stinking smut of wheat.

Harmful fungi produce spores which lodge on the seed, or between the kernel and seed hull, or make some growth in the seed before planting. An effective fungicide will kill these attached or imbedded spores. A good fungicide will also give some protection during germination, particularly under unfavorable wet soil conditions.

WHEAT

Seed treatments for wheat are particularly effective against the rough-spored fungus, *Tilletia caries* and the more common, smooth-spored *Tilletia foetida*. These fungi cause the stinking smut or common bunt of wheat. Dwarf bunt caused by *Tilletia controversa* is primarily soil-borne. The corn stalk rot fungus, *Gibberella zeae*, produces seedling blight and scab, or head blight, of wheat. The seedling blight phase can be controlled to some degree by seed treatments. Seed treatment will control some of the *Septoria* leaf

blotch caused by the fungus *Septoria tritici*. Loose smut caused by the fungus *Ustilago tritici* is carried over within the seed embryo and is not reached by chemical seed treatment. Either the hot water or the anaerobic water soak method is effective but practical only for small seed lots. Further information on these will be sent upon request. Planting only certified seed is the most practical for loose smut control.

BARLEY

Seed treatments for barley are particularly effective against covered smut caused by the fungi *Ustilago hordei* and *Ustilago nigra*. Loose smut caused by the fungus *Ustilago nuda* is within the embryo (as with loose smut of wheat) and therefore unaffected by seed treating chemicals. Methods for control of loose smut of barley are the same as for loose smut of wheat. Seed treatment is also effective against seed-borne phases of various *Helminthosporium*, *Gibberella zeae* and *Septoria passerinii*. Because some of these spores can lodge or be produced between the kernel and the seed hull, a volatile mercury fungicide is the most effective chemical. Adequate time must elapse between seed treatment and planting to permit thorough penetration of the seed by the fungicide.

OATS

Both smuts of oats are controlled by seed treatment. This includes covered smut caused by the fungus *Ustilago kolleri* and loose smut caused by *Ustilago avenae*. In addition, seed treatment is effective against the seed-borne phase of Septoria leaf blotch or black stem. This fungus disease causes lodging in oats and is common in the Upper Peninsula. Loose smut has also been observed in the Upper Peninsula recently.

RYE

Rye seed is treated for seed-borne spores of the fungus *Urocystis occulta*, the cause of stalk or stem smut. Seed treatment also affords some protection from seedling diseases.

METHODS OF TREATMENT

Mixing the fungicide as a dry dust directly with the seed, either by shovel or machine, was the method commonly used in the past. It was hazardous to the treater and the metering was not very accurate. Fungicides which can be used solely as a dust are not included in the listing.

The "slurry treater" was designed to treat seed by adding a mixture of the fungicide in some water and mixing this with the seed. Liquid concentrates can be used with this machine if diluted. The slurry treater is effective and satisfactory if used properly.

The "direct treater" mixes the fungicide undiluted with the seed. It is also effective and satisfactory but requires proper use.

The "mist-type" applicator places the fungicide upon the seed in mist form and mixes the grain.

Usually the fungicide from one manufacturer may be used in a seed treater from another manufacturer. However, the requirements of both manufacturers must be fulfilled; otherwise, seed protection is limited or seed injury occurs. Directions for both the chemical and machine are available from each manufacturer. Check the label and operator's manual.

Several acceptable fungicides are sold in a form suitable for drill box application. While this may be easier, it is not recommended because it is unlikely that the mixing will be sufficiently thorough to cover every seed. Also, there is insufficient time for the vapor action of volatile mercuries, particularly for barley and oats. Even in the case of wheat and rye, treating at least 24 hours before seeding is preferred. For oats and barley, 5 to 7 days should elapse between treatment and planting.

Some of the acceptable fungicides are marketed mixed with an insecticide. When one of these is used, additional precautions must be taken for the insecticide.

FUNGICIDES

The most effective fungicides are volatile mercuries. Non-mercuries, such as captan and thiram, are less toxic to the operator and to the seed if overtreated. But they do not penetrate all the seed crevices to kill fungus spores. They act as protectants only, rather than as disinfectants. Other fungicides are effective against only certain seed-borne fungi. Pentachloronitrobenzene (PCNB) works against stinking smut of wheat. Hexachlorobenzene (HCB) is sold under many trade names and is particularly effective against the two bunt fungi on wheat. Seed is treated in Michigan to also kill other seed-borne fungi and hence neither PCNB nor HCB can be suggested.

The following volatile mercury compounds have been found to be effective for seed treatment of small grains under severe disease conditions:

- 1. Methyl mercury 2,3-dihydroxy propyl mercaptide - 2.89% plus methyl mercury acetate - 0.62%.**
Total mercury as metallic mercury - 2.25%. Trade name: Ceresan L, liquid mercurial seed disinfectant by E. I. du Pont de Nemours & Co., Wilmington, Delaware. Ceresan L is designed to replace Ceresan 75, Ceresan 100, and Ceresan 200, which contained these two active ingredients.
- 2. Ethyl mercury p-Toluene Sulfonanilide - 7.7%.**
Total mercury expressed as metallic mercury is 3.2%. Trade name: Ceresan M, seed disinfectant by E. I. du Pont de Nemours & Co., Wilmington, Delaware. Ceresan M-2X is discontinued and no longer available.
- 3. Methyl mercury nitrile.**
 - (a) Active ingredient - 1.85% equivalent to 1.5% metallic mercury. Trade name: Chipcote 75 - Ready-Mix Liquid Mercurial Seed Disinfectant, by Chipman Chemical Co., Inc., Bound Brook, New Jersey.
 - (b) Active ingredient - 5.41% equivalent to 4.5% metallic mercury. Trade name: Chipcote 25 - Concentrated Liquid Mercurial Seed Disinfectant, by Chipman Chemical Co., Inc., Bound Brook, New Jersey.
- 4. Methylmercury dicyandiamide.**
 - (a) Active ingredient - 2.2% with mercury equivalent of 1.5%. Trade name: Panogen 15 Liquid Seed Treatment, by Morton Chemical Co., Chicago, Illinois.
 - (b) Active ingredient - 6.3% with mercury equivalent of 4.2%. Trade name: Panogen 42 Liquid Seed Disinfectant, by Morton Chemical Co., Chicago, Illinois.
- 5. Methyl mercury 8-hydroxyquinolinolate.**
 - (a) Active ingredient - 2.25% equivalent to 1.25%

mercury. Trade name: Ortho LM Liquid, by California Chemical Co.

The following are some other mercury compounds which are generally not as fully endorsed as the above, because of less control under severe conditions, lack of availability, or incomplete testing.

1. Phenyl mercuric acetate (PMA) plus ethyl mercuric acetate (EMA).

(a) Active ingredients: PMA - 2.25% plus EMA - 1.60%. Equivalent to 2.25% mercury. Trade name: Setrete Mist Liquid Seed Disinfectant, by W. A. Cleary Corp., New Brunswick, New Jersey.

(b) Active ingredients: PMA-4% plus EMA-0.8%. Trade name: Mer-Sol 48 Seed Disinfectant, by Stauffer Chemical Co., Omaha, Nebraska.

(c) Active ingredients: PMA - 5% plus EMA - 1%. Trade name: Mer-Sol-51 Seed Disinfectant, by Stauffer Chemical Co., Omaha, Nebraska.

(d) Active ingredients: PMA - 5.0% plus EMA - 1.0%. Trade name: Setrete Fortified—Liquid Seed Disinfectant, by W. A. Cleary Corp., New Brunswick, New Jersey.

(e) Active ingredients: PMA - 5% plus EMA - 1%. Trade name: Gallotox 51, by Gallowhur Chemical Corp., Ossining, New York.

2. Phenylmercuric ammonium acetate.

(a) Active ingredient - 3.5%; mercury equivalent 2.0%. Trade name: Mist-O-Matic Liquid Seed Disinfectant, by Gustafson Manufacturing Co., Inc., Minneapolis, Minnesota. Federal Registration No. 7501-2

(b) Active ingredient - 7% equivalent to 4.0% mercury. Trade name: Gallotox Liquid Seed Disinfectant, by Gallowhur Chemical Corp., New York, New York.

(c) Active ingredient - 7% with mercury equivalent of 4.0%. Trade name: Mist-O-Matic Liquid Seed Disinfectant, by Gustafson Manufacturing Co., Inc., Minneapolis, Minnesota. Federal Registration No. 7501-1.

(d) Active ingredient - 7% with mercury equivalent of 4.0%. Trade name: Setrete Liquid Seed Disinfectant, by W. A. Cleary Corp., New Brunswick, New Jersey.

(e) Active ingredient - 7% with mercury equivalent of 4%. Trade name: Mer-Sol 7, by Stauffer Chemical Co. Mer-Sol 7 is discontinued and no longer available.

3. Phenyl mercury formamide (PMF) plus Anilino-cadmium dilactate (ACD).

(a) Active ingredients: PMF - 6.25% equivalent to 3.8% metallic mercury plus ACD—6.25% equivalent

to 1.8% metallic cadmium. Trade name: Pura-seed, by Gallowhur Chemical Corp., Ossining, New York.

(b) Active ingredients: PMF - 6.25% plus ACD—6.25%. Trade name: Mer-Cad, by Stauffer Chemical Co. Mer-Cad is discontinued and no longer available.

4. Phenyl Mercury Urea.

(a) Active ingredient - 6.70% equivalent to 4% metallic mercury. Trade name: Agrox - A Mercurial Seed Disinfectant, by Chipman Chemical Co., Inc., Bound Brook, New Jersey.

5. Methoxy Ethyl Mercury Acetate.

(a) Active ingredient - 11.4% equivalent to 7.17% metallic mercury. Trade name: Mema - A Liquid Mercurial Seed Disinfectant, by Chipman Chemical Co., Ind., Bound Brook, New Jersey.

(b) Active ingredient - 4.88% equivalent to 3.07% metallic mercury. Trade name: Mema RM - Liquid Seed Disinfectant, by Chipman Chemical Co., Inc., Bound Brook, New Jersey.

PRECAUTIONS

Mercury fungicides are toxic and poisonous to seed, man, and other animals. They should be used safely. The label on the fungicide package should be read carefully and followed.

Fumes rise from the exposed fungicide and treated seed. Therefore, adequate ventilation is essential to carry away these toxic fumes. When a treater is placed in an out-of-way place, there should be plenty of forced ventilation.

Mercury fungicides can be readily absorbed through the skin. The operator should be protected during treating. The eyes and face should be protected by goggles and face shield. These are to be worn whenever handling chemicals. Rubber or rubber impregnated gloves should be worn. All parts of the body should be covered. Clothing should be changed daily. Hands should be washed thoroughly with soap and water after exposure, particularly before eating or smoking. In case of emergency, consult the label. Keep label visible and legible at all times.

All chemicals should have their proper storage place away from possible contamination of food or danger to people. Chemicals stored in the nearest convenient nook may lead to unforeseen accidents.

Treated grain requires "curing" for an appropriate time before planting. Containers should be labeled as directed. Storage should not be in air-tight containers, but instead in well-ventilated, dry places away from other food items.

Some mercury fungicides are corrosive to aluminum, copper, zinc, or their alloys. Follow directions. If

precautions on the label are incomplete, ask the manufacturer to provide you with other instructions on safety.

Leftover grain should be marked plainly as required.

Most of the recent seizures by the Food and Drug Administration of contaminated grain in commerce have been due to mixing of grain with seed treating chemicals with other clean grain.

THE FEDERAL SEED ACT

The Federal Seed Act requires certain labeling of treated seed.

Seed treated with a mercurial or similarly toxic substance, if any amount remains with the seed, shall be labeled to show a statement such as Poison, Poison treated, or Treated with Poison. The word 'Poison' shall be in type no smaller than 8 points and shall be in red letters on a distinctly contrasting background. In addition, the label shall show a representation of a skull and cross bones at least twice the size of the type used for the name of the substance and the statement indicating that the seed has been treated. —Quoted from: USDA Consumer and Marketing Service, Grain Division, Hyattsville, Md., August 1965.