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DUSTING SEED WHEAT TO CONTROL SEED-BORNE SMUT IN OREGON

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INTRODUCTION

Extensive cooperative tests were started in 1934 to determine the most satisfactory seed treatment for controlling seed-borne bunt or smut under present conditions in Oregon. Plots were maintained with the cooperation of growers and at the experiment stations at Corvallis, Moro and Pendleton. The results of three years' study plus the experiences of previous investigations permit certain definite recommendations to be made.

THE FIRST STEPS TO TAKE

Before treating seed wheat for bunt it is desirable to:

1. Select, if possible, adapted wheat varieties that are resistant to some of the races (strains) of smut. These varieties include such wheats as Rex, Hymar, Oro, Albit, Redit and Rio.
2. Obtain seed from a field relatively free from smut.
3. Avoid mixing clean seed with smutty seed.
4. Clean all seed before treating to remove smut balls, chaff, weeds, dirt and foreign grain.

It is important to treat all wheat varieties because even the more resistant commercial varieties are subject to attack by some races of smut.

Investigations conducted cooperatively by the Division of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, and the Oregon Agricultural Experiment Stations.

THREE TREATMENTS ARE RECOMMENDED

Three chemical dusts that are recommended for various places in Oregon are:

1. **NEW IMPROVED CERESAN.** This is a mercury dust (ethyl mercury phosphate) and is sold in air tight cans, with a measuring spoon in each can. NEW IMPROVED CERESAN and not just CERESAN must be used as CERESAN proper is a slightly different chemical (ethyl mercury chloride) sold in the northwest specifically for treating certain ornamental bulbs. Be sure that the name "New Improved Ceresan" is plainly shown on the label.
2. **BASIC COPPER SULPHATE** is a blue copper dust with approximately 50 per cent copper content. It is not to be confused with ground bluestone (copper sulfate or blue vitriol). Basic copper sulphate, which is a recent addition to commercial seed treating chemicals, does not injure the stand but ground bluestone sometimes does. Basic copper sulphate is sold in Oregon under at least the following names: Basi-Cop, Basul, Mountain basic copper sulphate, and Kopper King.
3. **COPPER CARBONATE.** This is the well known blue-green copper dust. It is usually sold in two grades: The 52 per cent copper carbonate contains 52 percent copper; and the so-called extended or dilute grade contains 18-20 percent copper. The 52 percent copper carbonate is recommended for fall seeded grain. The 18-20 per cent grade may be used on spring grain in dry land areas, but experience has shown that usually no financial advantage is gained by its use instead of the 52 per cent grades, because the 18 per cent grades have to be applied at a slightly higher rate. Any of the brands of 52 per cent copper carbonate manufactured for seed treatment purposes and at present sold in Oregon are satisfactory.

WHAT ARE THE RELATIVE MERITS OF THESE PRODUCTS?

Experiments have shown the relative merits of these several dusts to be as follows:

Items compared	New Improved Ceresan	Basic copper sulphate	52 percent Copper car- bonate	18-20 percent Copper carbonate
Rate used (Ounces per bushel)	$\frac{1}{2}$ -1	2-4	2-4	3-5
Approximate cost (cents per bushel in 1937)	1.6-3.5	2.0-5.0	2.2-5.0	2.8-5.8

Table cont'd.

Items compared	New Improved Ceresan	Basic copper sulphate	52 percent Copper carbonate	18-20 percent Copper carbonate
Average Relative Effectiveness in -				
Spring Wheat Belt	Excellent	Excellent to good	Excellent to good	Very good to fair
Central Oregon	Excellent to very good	Excellent to fair	Excellent to fair	Good to fair
Umatilla and Union Counties	Excellent to very good	Excellent to fair	Excellent to fair	Good to fair
Western Oregon	Excellent	Excellent	Excellent	Very good
At recommended rates are stands reduced?	No	No	No	No
How much can safely be applied per bushel without reducing stand?	1 oz.	6 oz.	6 oz.	6 oz.
Is it poisonous to humans?	Yes	Yes	Yes	Yes
Can it cause temporary nausea to workers?	Yes	Yes	Yes	Yes
Is there evidence that it causes accumulate poisoning?	No	No	No	No
Does it "fog"?	Slight	Slight to moderate	Slight to heavy	Usually heavy
Can the treated grain be fed?	No	No	No	No
Is it better to keep treated grain covered 24 hours after treating?	No	No	No	No
Does it clog the drill?	No	Moderate	Yes, at heavy dosages	Yes, at heavy dosages
Can it also be used in all cases for treating oats and barley?	Yes	Undetermined but doubtful	No	No
How is it applied?	Rotary treater with accurate dust feeder; or gravity treater	Rotary treater	Rotary treater	Rotary treater
How soon after treating should grain be seeded for best results?	Within six weeks	Within a year	Within a year	Within a year
What is effect on stand after storing seed one year?	Usually only moderate reduction	No apparent reduction	Usually no reduction	Usually no reduction
Is it effective against soil-borne smut?	Slightly to moderate	Slightly	Slightly	Slightly

HOW MUCH DUST TO APPLY

Smut is harder to control in some localities than in others. For example it is easier to control smut in the dry parts of Umatilla county than in the moister parts near Adams and Athena. West of the Cascade mountains, however, bunt is controlled with comparative ease. Therefore the state is roughly divided into districts with slightly different recommendations for these separate areas as follows:

Area and type of wheat	Dusts and recommended ounces per bushel
Umatilla county Winter wheat	New Improved Ceresan, $\frac{1}{2}$ -1 oz; Basic copper sulphate, 3-4 oz; 52 percent Copper carbonate, 3-4 oz; Copper Hydro-40, 3-4 oz.*
Union and Wallowa counties Winter wheat	New Improved Ceresan, $\frac{1}{2}$ -1 oz.; Basic copper sulphate, 2-4 oz.; 52 percent Copper carbonate, 3-4 oz; Copper Hydro-40, 3-4 oz.*
Central Oregon Winter Wheat	New Improved Ceresan, $\frac{1}{2}$ - $\frac{3}{4}$ oz.; Basic copper sulphate, 2-4 oz.; 52 percent Copper carbonate, 2-4 oz.; Copper Hydro-40, 3-4 oz.*
Spring wheat	New Improved Ceresan, $\frac{1}{2}$ oz.; 52 percent Copper carbonate, 2-3 oz.; Basic copper sulphate 2-3 oz.; Copper Hydro-40*, 3 oz.; 18 percent Copper carbonate, 3 oz.
Columbia Gorge Area (Wasco, Sherman counties in part) Winter wheat	New Improved Ceresan, $\frac{1}{2}$ oz.; 52 percent Copper carbonate, 3-4 oz.; Basic copper sulphate, 2-4 oz.; Copper Hydro-40*, 3-4 oz.
Western Oregon Winter or Spring wheat	New Improved Ceresan, $\frac{1}{2}$ oz.**
Southern Oregon Winter wheat	New Improved Ceresan, $\frac{1}{2}$ oz.; Basic copper sulphate, 2-3 oz.; 52 percent Copper carbonate, 2-4 oz.; Copper Hydro-40*, 3-4 oz.
Spring Wheat (general)	New Improved Ceresan, $\frac{1}{2}$ oz.; Basic copper sulphate, 2-3 oz.; 52 percent Copper carbonate, 2-3 oz.; Copper Hydro-40*, 2-3 oz.; 18 percent Copper carbonate, 3 oz.

*Copper Hydro-40 is a blue copper dust containing 26 percent copper. It is said to be a copper hydroxide. It classifies as being close to copper carbonate. It appears to be more effective than 18-20 percent copper carbonate but may not be quite as effective as 52 percent copper carbonate. It is at present considerably cheaper than 52 percent copper carbonate. Further studies are being made with this product.

** Since most of the farms in western Oregon grow oats and barley as well as wheat, and usually none of these crops are grown on the large scale of eastern Oregon, in most cases, it is more convenient to use New Improved Ceresan. Where wheat is grown in more extensive operations in some parts of the Willamette Valley, Basic copper sulphate, 2-3 oz. per bushel; or 52 percent Copper carbonate, 2-3 oz. per bushel are optional recommended treatments.

ADDITIONAL SUGGESTIONS

The actual amount of dust to use depends largely on how smutty the seed is. If the seed is evidently smutty, or if its smuttiness is not definitely known, it is better to use the maximum amounts suggested for the various regions. New Improved Ceresan when used at the $\frac{1}{2}$ ounce rate gives fairly good control but at the 1 ounce rate usually gives almost if not complete control of seed borne smut.

In using any of the dusts as great care as possible should be taken to avoid inhaling them. While there is no evidence that any of the dusts have an accumulative poisoning effect, they all cause temporary nausea. Treating therefore should be done in the open or in a well ventilated room, and nose respirators should be used. After finishing work the hand and face should be thoroughly washed as soon as possible.

Because New Improved Ceresan is used in smaller amounts than the copper dusts, growers have found that there is less fogging in the drilling operations. Most of the more clinging types of basic copper sulphate have also proven less dusty than some brands of copper carbonate, which latter have sometimes caused violent illness.

When a rotary type of duster is used with New Improved Ceresan it is necessary to use a positive dust feeder that feeds small amounts of dust accurately. Several of these are on the market and have proven satisfactory, but, they require some experimenting to make certain that they work correctly. Fairly good coverage is also obtained with New Improved Ceresan by the use of gravity-type dusters. In these the grain is poured into a vertical drum or hopper with baffles below. The grain and the dust tumble from one level to another and thus become mixed by the time they fall into the sack at the bottom. Because New Improved Ceresan is a volatile dust, sufficiently good coverage is obtained by this method. The manufacturers of New Improved Ceresan furnish, gratis, blueprints of a simple, gravity-type treater. A less expensive, gravity-type treater is recommended by the Oregon Experiment Station. This treater is based on a proved type developed at the Minnesota Agricultural Experiment Station. Write to your County Agent for information on these.

It is important that New Improved Ceresan be applied in recommended amounts as excess dosage is likely to cause a reduction in stand. In experimental plots and in fields sown with seed treated with New Improved Ceresan the $\frac{1}{2}$ -ounce rate, or even at the 1-ounce rate, the stands have always been thicker than in nearby plots or fields sown with untreated seed. If, however, this dust is applied at 2 ounces or more per bushel, severe injury to stands will result.

While New Improved Ceresan should be seeded within a few days after treating to insure an increase in stand and yield experimental trials in Oregon show that no reduction in stand will result if the grain is held for several weeks. Even if the grain is held for several months the stand is only slightly reduced. When held for a year the grain should be seeded about 10 percent to 20 percent heavier, depending on whether $\frac{1}{2}$ oz. or 1 oz. per bushel is used. Under Oregon conditions New Improved Ceresan is a relatively safe dust to use if directions are followed.

The grades of basic copper sulphate that cling well to the seed do not give the appearance of as good coverage as do some of the chalkier, sometimes less effective copper dusts. However, fair control is obtained with basic copper sulphate in early seedings in the fall, even at the rate of 2 ounces per bushel. In seedings made later in the fall, however, or in seedings made in the dust, three or even four ounces are advisable. The same holds true for copper carbonates. Experimental trials show that grain seeded in cold moist soil is better protected by basic copper sulphate than by copper carbonate, but when the soil is dry, the 52 per cent copper carbonate is usually slightly superior to basic copper sulphate. Therefore, in average years, in parts of Umatilla county and in Union county, basic copper sulphate is likely to be superior to copper carbonate, and in central Oregon, the reverse may be expected.

The amount of copper dust that will stick to a given lot of seed is dependent on the moisture content of the grain; the moister the grain the more dust it will hold. In haphazard operations, where the copper dusts are applied by guess this last mentioned point is important.

Wheat fields in Wasco county are within possible range of infection of the area in Klickitat county, Washington, where the so-called "low" race of smut is prevalent. This race complicates the control program, because, being soil-borne and apparently not seed carried, it cannot be satisfactorily controlled by seed treatment. The variety Rex is resistant to this race and therefore where there is danger from this race of smut, such as in the Columbia Gorge region, Rex should be grown where practicable. The seed of this variety should be treated to prevent smut from the seed-borne races.

Further information may be obtained from your county agent, Experiment Station or the United States Department of Agriculture.