SMUT IN WHEAT.

PRESS BULLETIN NO. 6.

UNIVERSITY EXPERIMENT STATION.

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In 1894, and again in 1895, this Station issued a bulletin calling the attention of the farmers of the state to the great damage wheat bunt or stinking smut is doing to the wheat raiser and the wheat and flour trade of the state. Remedies were given and the very slight cost of treatment, as compared with the benefit, were pointed out. The wholesale dealers in blue-stone report a strongly growing demand for this remedial material. Last season over forty thousand copies of our special bulletins were issued and the remedies were copied by numerous papers circulating among the farmers. In spite of all this the natural spreading of wheat smut has gone on more rapidly than the destruction. Farmers and owners of threshing machines are almost, if not quite, criminally negligent. Farmers too often do not inspect their seed to see if it is smutted. They too often use for seed, without treatment and sometimes without cleaning, wheat which has come from a smutted field or has run through a threshing machine which has previously threshed smutted wheat. The comparatively few smut spores gotten from the infested threshing machine multiply in a few years and the farmer's whole crop is badly smutted. Wheat purchased for seed from an elevator or from a neighbor may have only a small amount of smut, but in a few years the smut will have so multiplied as to have seriously infested the entire crop.

Bunt or stinking smut of wheat is a disease caused by small spores. These are very small, seed-like, spherical bodies which are produced in the diseased kernels of wheat. These kernels are broken in threshing and handling the grain and the minute spores scattered about cling to the grains of wheat. When the seeds are planted the spores germinate much like small seeds, and some of them lying on the kernel against the sprouting plantlet send their thread-

like stems into the wheat plant. Here the disease thrives, branches, grows upward as the wheat grows, and when the wheat forms its seeds some of the branches of the smut will have found their way into the kernels of wheat. Here it developes its seed like spores, and when the grain is ripe the diseased kernel of wheat is a mass of smut spores enclosed in the shrunken or even enlarged wheat bran. These spores or germs live until the next year. If chance favors them they germinate on another young and tender wheat plant. These smut spores are very small and we cannot dislodge all of them from the seed grains by thoroughly cleaning the wheat. Some method of destroying them by heat or by the use of fungicides is necessary.

EXPERIMENTS IN TREATING SMUTTY SEED WHEAT.

In 1895 a quantity of very smutty Fife wheat was secured and on April 24th twenty-four plots of about one-thirtieth of an acre each were planted on good and quite uniform soil—Field H, I, University Farm. The soil had borne our nursery crop of field peas the year before, which was practically a hoed crop, as the plants were three feet apart each way. All plots grew uniformly and the comparison was fair and successful in so far as we could judge. The blue-stone dipping method, the blue-stone sprinkling method, the hot water treatment and a few other remedies were tried. The table below explains the kind and manner of treatment and gives the results. The main effort was to find how best to apply the simple remedies we advertised a year ago. Plots 2, 7, 13 and 22 were untreated.

TREATMENT OF SMUTTY SEED WHEAT.

		Grains germinated per sq. yd.	Yield straw per acre.	Yield grain per acre.	Per cent. smutted.
1.	½ lb. blue stone in 24 lbs. water sprinkled on 10 bu. wheat....	231	1.1	31.7	6.5
2.	Untreated.....	233	0.6	26.9	20.6
3.	1 lb. blue stone in 24 lbs. water sprinkled on 10 bu. wheat....	214	0 8	28.8	2.4
4.	2 lbs. blue stone in 24 lbs. water sprinkled on 10 bu. wheat...	166	0.9	30.1	1.2
5.	Same as 1st., dried by rolling in air slaked lime.....	227	1.0	33.6	1.5
6.	Same as 1st and dried by rolling in land plaster.....	215	0.8	27.5	.5
7.	Untreated.....	185	0.6	21.8	13.4
8.	½ lb. blue stone dissolved in 16 lbs. water, wheat dipped.....	172	0.9	31.4	2.9
9.	1 lb. blue stone dissolved in 16 lbs. water, wheat dipped.....	101	0 9	31.5	.9
10.	2 lbs. blue stone in 16 lbs. water, wheat dipped.....	96	0.8	28.8	.8
11.	Same as 8th but wheat dried in lime.....	150	0.9	31.7	.1
12.	Same as 8th but wheat dried in land plaster.....	193	0.9	29.9	.2
13.	Untreated.....	246	0.6	22.2	13.2
14.	Soaked 15 minutes in saturated solution of common salt.....	211	0.8	29.1	3.3
15.	Soaked in water at temperature of 50 deg. F. for 15 minutes.	212	0.7	25.1	10.4
16.	Soaked in water at 120 deg. for 10 min. and 130 deg. 5 minutes	194	0.9	32.3	.5
17.	Soaked in water at 120 deg. 10 min., and at 130 deg. 10 min ...	193	0 9	31.4	.4
18.	Soaked in water at 120 deg. 10 min., and at 130 deg. 5 minutes	169	0.8	26.5	.3
19.	Soaked in water at 120 deg. 10 min., and 133 deg. 10 minutes..	217	0.8	27.4	.3
20.	Soaked in water at 120 deg. 10 min., and 135 deg. 5 minutes...	151	0.8	27.7	.3
21.	Soaked in water at 120 deg. 10 min., and 135 deg. 10 minutes..	139	0.7	25.6	.1
22.	Untreated.....	227	0.6	19.6	11.0
23.	Soaked in water at 120 deg. 2 min., and 135 deg. 2 minutes....	177	0.7	24.8	.4
24.	Soaked in water at 120 deg. 2 min., in 133 deg. 2 minutes.....	180	0.7	24.5	.5

SUMMARIES FROM THE TABLE.

(1) So many of the kernels in the crop on untreated plots were smutted and therefore light, or possibly the disease had such a depressing effect on the plants that they did not yield nearly as well as thetreated plots. The four untreated plots averaged 22.6 bushels, while the average of all plots treated with blue-stone by

the dipping and the sprinkling methods was 30.5 bushels per acre, a gain of 8 bushels, for the cost of one to one and a half cents worth of blue-stone and the labor of treating one and one-fourth bushels of wheat. Besides this 14.5 per cent of the kernels in the four untreated plots were smutted, while only 1.5 per cent of those in the ten plots treated in various ways with blue-stone were thus affected.

(2) The six plots Nos. 16, 17, 18, 19, 20 and 21 treated in nearly the ordinary way of hot water treatment yielded 28.5 bushels as compared with the 22.6 bushels of the four untreated plots, and 30.5 bushels of the ten treated with blue-stone, and the wheat was only .3 per cent smutted as against 14.5 per cent in the untreated and 1.7 per cent in that treated with blue-stone.

(3) The five plots treated with blue-stone by the sprinkling method yielded 30.3 bushels per acre, while the five treated by the dipping method yielded 30.7 bushels and of the former 2.4 per cent of the kernels were smutted and of the latter only 1 per cent.

REMEDIES FOR WHEAT SMUT.

Where practicable choose wheat which has no smut among it, or which has comparatively little. Clean the wheat thoroughly by running it through a fanning mill with the "blast" turned on strong so as to blow out as many as possible of the bunty kernels; or use any other efficient means for cleaning. It is often necessary to treat the wheat for successive years before the farm is free from the disease.

THE BLUE-STONE SPRINKLING METHOD.

Dissolve one pound of blue-stone (copper sulphate) in two and one-half gallons of water. Spread out ten bushels of wheat on a tight floor in barn or house or in a tight wagon-box and with broom, sprinkling pot or with pail or dipper, sprinkle on the solution. With scoop-shovel turn the grain several times during the sprinkling till every kernel is thoroughly wetted. The solution needs to penetrate even the hairs at the blossom end of each kernel and to penetrate the crease in the grain. In three hours the wheat will be ready for the seeder and as the blue-stone somewhat injures the seed it should not be prepared long before it is sown. A good plan is to prepare in the evening the seed to be used the next day. That prepared in the morning can be used in a few to several hours, or if dried with lime, plaster or dust, it may be used in half an hour. By hand or in some machines it may be seeded almost at once without drying, though it should remain wet in the solution half an hour or more that the blue-stone may have time to kill the smut spores. As the seed is somewhat swollen a few quarts more per acre should be sown than of dry wheat. The blue-stone solution can be made by the barrel, using care to get the right proportions of blue-stone and water, and then it can be measured out one ten quart pailful to each ten bushels of wheat. The wheat should be turned four or five times within an hour after sprinkling. If a water-tight floor is not available the solution should be sprinkled on slowly so that little or none runs through.

THE BLUE-STONE DIPPING METHOD.

Fill a barrel two-thirds full of the solution of one pound of blue-stone (sulphate of copper) to two to four gallons of water, using the weaker solution for wheat little or none affected and a stronger

solution for wheat badly infected. Partially fill gunny sacks or other open receptacle with wheat and immerse in the solution for a few minutes, moving the sack up and down and shaking or kneading it so that every kernel is thoroughly wetted, stirring if necessary. Place sacks or other receptacles containing the wet wheat where the solution will drain out. If convenient catch and save the drip. The solution should reach all surfaces of every kernel and it is desirable to have the wheat as little wet as necessary to avoid trouble in drying. When the water ceases dripping pour the wheat on the barn floor and shovel every few hours till dry enough to sow, or if to be kept some days, dry thoroughly enough to store without danger of heating. The drying may be facilitated by mixing with the wet wheat land plaster or slacked lime, or even dust or ashes which contain no grit which might injure the feeding device of the seeding machine. Slaked lime stops the action of the blue-stone and it should not be applied till after the solution has been on the wheat for half an hour. The lime not only helps to dry the wheat but stops the slightly injurious action of the blue-stone on the seed. It is necessary to renew the quantity of the solution, and for this purpose the prepared solution may be kept ready in other barrels.

THE HOT WATER METHOD.

Fill two barrels or washtubs two-thirds full of water. Keep the water in No. 1 at 120 degrees Fahr. and No. 2 at 130 to 135 degrees. Fill gunny sacks, or bags of other open-meshed material, partly full of wheat; immerse in No. 1 till the wheat is warmed up so as to not cool the water in No. 2; drain the bag a few seconds and then immerse in No. 2 for five minutes, raising and lowering the bag or kneading the wheat, so that the water thoroughly penetrates to and heats every kernel. Spread out at once and shovel over until dry. It is a good plan to dip the bag of wheat in cool water, so as at once to cool the wheat. Care must be taken to add hot water so as to keep the water in No. 2 at 130 to 135 degrees F.; 133 degrees is the temperature preferred. This is the most practical way of treating smutty seed oats and gives good results in treating smutty wheat. Where warm rooms enable one to dry the wheat, this would be the best plan by which to get the wheat ready during winter.

Blue-stone is offered by local druggists and grocers at eight to ten cents per pound in Minnesota, possibly twelve cents where freights are highest. This makes the cost only about a cent to a cent and a half per acre for blue-stone. The above table shows that blue-stone not only causes the wheat to yield more, if the seed is badly infested, but the grades are better and with clean wheat grades can far better be maintained in the local and in the terminal market, and the No. 1 hard reputation abroad of our wheat can only be maintained with smutless grain.

It is not a duty a farmer owes himself alone, but to the state and to the country to market only good wheat. The remedies given above have been tried by many, and no criticisms, but many commendations show that they are practical and very useful. The experiments above reported show remarkable benefits. It will doubtless pay to treat nearly every bushel of wheat sown in Minnesota.

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