PREVENTION OF SMUTS IN OATS

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The smuts are among the most destructive enemies of the oat crop. It has been estimated that the total losses from oat smut in this country amount to about $10,000,000 to $15,000,000 annually. Estimates have been made for the various states of the damage caused by oat smut and these usually show the loss to be very considerable. The damage according to such estimates varies from 5 to 10 per cent of the state’s production.

Such material losses are now known to be unnecessary, since by the use of simple precautions we are able to eliminate smut entirely from our oat crops. A brief account of the nature and cause of these smuts, together with recommendations for seed treatment may help the farmers to avoid much disappointment and loss in the future.

The objects of this bulletin, therefore, are (1) to call attention to the unnecessary waste from oat smuts, (2) to explain their cause and nature, (3) to point out the ways by which they are introduced and (4) to suggest a simple method of seed treatment by which they can be gotten rid of.

OAT SMUT CAUSED BY MINUTE PLANT

Oat smut is caused by a very minute plant which lives parasitically within the tissues of the oat plant. It gains entrance in the seedling stage, about the time the plant is emerging from the soil. When once inside it grows upward thru the tissues of the stem giving little or no external evidence of its presence until the heads are produced. At this time it enters the developing kernels and destroys them by forming black powdery masses in their places. The black powdery substance is found to be made of millions of small, spherical, dark bodies called “spores”. Spores represent the reproductive phase of the parasite and are important in that they are the means by which the smut is spread. They are of very light weight and easily carried by air currents for long distances. They find lodgement upon, or underneath, the chaff of healthy grains and remain there until the grain is sown. Under favorable conditions the spores germinate soon after germination
of the grain itself. They produce a tiny, transparent infection thread which soon penetrates the young tissues of the growing seedling and thereafter keeps pace with the upward growth of the stalk. By the time the plants arrive at maturity the original infection threads have grown so extensively that they enter the developing kernels and produce the characteristic large masses of dark spores. This simple life cycle of the smut fungus is completed but once during the growing season, and, unless it is checked by means of effective seed treatment, may continue indefinitely in succeeding crops.

Above, oat kernel greatly enlarged; note groove in which smut spores lodge. Below, smut spores in various stages of germination. (Enlarged 1,200 times.)

**APPEARANCE OF SMUT IN THE FIELD**

Oat smut is therefore apparent in the fields at the time of heading. It is found to destroy the entire kernel and more or less of the chaff. The affected panicles or heads appear stunted and do not spread out like the unaffected ones. Smut-bearing stalks appear noticeably shorter than healthy ones and are generally barren of kernels, that is, all the kernels of a smutted head become destroyed.
KINDS OF OAT SMUT

There are two kinds of smuts affecting oats, distinguishable by the characteristic appearance of the affected kernels. In one kind the smut masses are enclosed by the chaff until broken down in threshing. When mature the chaff appears whitish and translucent, rendering the dark spore masses faintly visible. This kind of smut is known as "closed smut".

In the other kind, the "naked" or "loose" smut, the spore masses are freed at flowering time and the spores are spread some
time before the grain is ripe. In this smut the heads are notice­ably smaller and the stalks barren at maturity. Naked or loose smut is by far the most abundant, but is not more destructive than the other, both kinds possessing the same life habits, and requir­ing the same form of seed treatment.

**ADVISABILITY OF TREATING ALL SMUTTED SEED**

There is scarcely a fungus disease known which can be so readily and completely controlled as smut in oats. In view of this fact the farmer can not well afford to tolerate even the smallest amount of smut in this crop, particularly when he con­siders that the cost of treatment does not exceed 2 cents per bushel. It must be remembered that the amount of smut increases year by year, and unless proper precautions are taken, the amount may increase in a few years from 1 or 2 per cent to 10 or 15 and in some cases 25 or 30 per cent.

As stated above, the naked smut is spread largely by the wind at heading time, and by the time the grain is ripe almost all trace of the disease has disappeared. This often leads the farmers to underestimate greatly the amount of damage done, and to over­look the significance of even a small amount in the crop. When­ever any noticeable number of smutted stalks are seen in the field, the smut is causing a material loss to the farmer and the seed from such a field should not be used unless treated.

The seed treatment is very simple and can be performed with a very small outlay and a minimum of trouble. The principle of seed treatment is a matter of killing the smut spores lodged on the surface of the grain by the application of a disinfectant solu­tion. Obviously, the solution must be of a strength sufficient to kill the spores but effect no injury to the grain itself. For this purpose a commercial disinfectant solution known as formalin is employed. Formalin is sold by nearly all druggists at a price ranging from 50 to 70 cents per pound. In purchasing formalin, it is important to require it to be guaranteed 40 per cent strength. No other strength should be accepted for the purposes of seed treatment.

**METHOD OF TREATING THE SEED**

**Solution required:** 1 pound of 40 per cent formalin mixed with 40 gallons of water. This amount is sufficient to treat about 40 bushels of seed.

**Application to grain:** Use a clean granary floor or wagon bed or a canvas in the open. A few bushels of grain should be
piled upon the floor and sprinkled with the formalin solution. A common garden sprinkling can is best for this purpose, and the solution should be applied at the rate of about one gallon to each bushel of grain. Then the grain should be well shoveled, the idea being to wet all the kernels with the solution. A thorough mixing will insure contact of the solution and the grain, which is necessary to render the treatment entirely successful.

After all the grain has been treated by adding both grain and solution to one pile as long as convenient, the entire amount should be shoveled into a pile and covered with wet blankets or canvas in order to thoroughly moisten the kernels and keep in the formalin gas.

The grain should be left in the pile eight to twelve hours, after which it must be spread out to dry. A convenient arrangement is to finish treatment in the evening, about 6 o'clock, pile the grain and leave till the following morning, when it may be dried. Care should be taken to see that the grain dries properly.

If convenient, the grain should be put into clean sacks or stored in a clean bin, so as to prevent spores from coming in contact with it later. In no case should it be returned to the bin from which it was taken until the bin has been cleaned with formalin solution. Sweeping in the granary before the treated grain is removed should never be done since large quantities of smut spores settle on the floor and walls and may find their way back again to the grain.

With this method, two men can treat large quantities of seed in a single day. It proves more satisfactory than the dipping method from the standpoint of convenience, since it is much less laborious and permits of the treatment of much larger amounts in a given time.

**DISSEMINATION OF SPORES**

The smut that produces most of the infection is the loose or naked smut which is blown on the seed in the field. Nothing of a practical nature can be done to prevent this. The closed smut, however, is disseminated in the process of threshing. Owing to the presence of smaller amounts of the naked smut in oat fields, the threshing machine is perhaps of less significance in the spread of oat smut than in the case of stinking smut of wheat. Mixing of smutted and healthy grain in the bin should not be practiced.
RECOMMENDATIONS

1. All utensils such as sacks, seeders, etc., if likely to be contaminated should be cleaned before being used.

2. Grain should not be left covered for more than twelve hours and should be dried thoroughly if it is to be stored any length of time.

3. Treated grain may be kept indefinitely so long as protected from further contamination.

4. The formalin solution does not lose strength with age, but, rather, increases in strength; the water evaporates before the gas.

5. Wetted grain should not be exposed to frost, because serious injury will result to the germinative power of the grain.

6. The formalin should be exactly of 40 per cent strength. The grain should be thoroughly scooped in the process of treatment, so that all kernels may be wetted.

7. Grain thus treated may afterwards be fed to stock; the formalin leaving no poisonous substance upon evaporation.

8. It is strongly recommended that farmers treat at least enough grain to furnish clean seed for another year. When this is done, treated seed should always be sown by itself to give the best results, and no other oats should be mixed with it in harvesting.