Smut in Small Grains

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Abstract
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Smut in Small Grains

With Treatments for its Eradication

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Smut is one of the most common and widespread diseases of cereals and causes an annual loss on Iowa farms of many thousands and often millions of dollars. Smut not only cuts down yields, but it often seriously impairs the quality of grain and lowers the price per bushel. It is fortunate that smut is unlike many of the other fungus and bacterial diseases of farm crops, in that it can be destroyed easily and at very little expense.

To find out how much grain is lost in Iowa each year, the farm crops section of the Agricultural Extension department sent out about 12,000 circular letters to practical farmers asking for careful counts of per cent of smut in their fields. These were sent to farmers who attended state and local short courses and to two-year students at Iowa State College in 1911-12. Each was asked to make at least one count in a neighbor's field as well as his own. The large number of counts assures accuracy and gives just about the actual conditions existing in Iowa.

A total of 3,668 counts were returned complete. Of these 3,356 were made in fields where the seed was treated for smut and the remaining 312 in fields that were treated. The following are the results:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Smut Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oats not treated</td>
<td>7.3 per cent</td>
</tr>
<tr>
<td>Oats treated</td>
<td>1.9 per cent</td>
</tr>
<tr>
<td>Acres represented in untreated</td>
<td>11,037 A</td>
</tr>
<tr>
<td>Fields</td>
<td></td>
</tr>
<tr>
<td>Acres represented in treated</td>
<td>1,218 A</td>
</tr>
<tr>
<td>Fields</td>
<td></td>
</tr>
</tbody>
</table>

Taking these figures as a basis, it will be seen that less than 10 per cent of the seed oats used in Iowa last year were treated for smut. Considering the total loss represented, and the ease and slight expense required for its prevention, Iowa should be more interested in driving smut out of its oat fields.

While the average per cent of smut in all fields where the seed had not been treated was 7.3 per cent, the loss in some fields was over 45 per cent. Every man who fails to treat his seed oats risks such a heavy loss.

In the average treated fields there was 1.9 per cent of smut. Since repeated tests indicate that the smut can be entirely destroyed when the seed is properly treated, this loss indicates that much of the work was either too carelessly done or that the formalin used in some cases was not of the proper strength. Taking all fields, however, the treatment resulted in a reduction of 5.4 per cent in the number of smutted heads.
Basing calculations on the average given for 1912, we find that had all the seed oats used been treated with even the same degree of effectiveness, it would have meant a saving on our Iowa farms of 2.2 bushels per acre, or a total of 10,841,600 bushels.

**WHAT IS SMUT?**

Smut is a fungous plant. It cannot gather its own plant food from the soil and water and make it into plant tissue with the aid of sunlight. It must get its food supply from other plants and, therefore, it is called a parasite. The smut spores, which are most commonly seen, are caused by the growth of the seed or spores of the smut plant. The smut seed germinates in the ground along with the grain seed and then sends its shoots up within the tissue of the grain plant, feeding upon the juices of the latter. As the grain plant grows and its flowers develop, the smut plant steals the juices intended for the developing grains and uses them to make its own seed or spores. These spores are the black masses which appear in the place of the grain seed and number millions. As the smut ripens these spores are blown about by the winds, infecting other plants and thus continuing in the crop year after year.

**THE KINDS OF SMUT**

Several different kinds of smut attack our small grains, and the treatments which are effective against some of these have no injurious effect upon others.

The smut most commonly found in Iowa is the "loose smut" of oats. The smut which is second in importance is the "covered smut" in wheat (also called "stinking smut" or "bunt"). Both of these can be easily eradicated. The loose smut of barley and the loose smut of wheat are met with less rarely, particularly the latter, though both are of considerable importance. The covered smut of barley is met with still less frequently.

The smut of one grain does not affect any other kind of grain. For instance, oat smut is an entirely different smut from the one attacking wheat or barley.

**METHOD OF INFECTION**

The method of infection varies greatly with the different smuts. The spores of the loose smut in oats and stinking or covered smut in wheat ripen at about the same time as the grain and become attached to the seed grain just as dust particles might do. This may happen in the field or it may be distributed in threshing, as is probably the most usual method with the covered smut. When the infected seed grain is planted in the spring and germinates, the smut spore also germinates and the parasite plant develops within the tissues of the wheat or oat plant.

The loose smuts of barley and wheat infect the grain crop in an entirely different manner. The spores develop somewhat in advance of the grain crop, the spores being blown about just at the time when the flowers of the wheat or barley are open for fertilization. Many of the smut spores lodge within the glumes or hulls of the small grain. They come in contact with the ovary, sprout and enter the plant cells which are ultimately to be a part of a seed. Here they lie dormant until the seed is planted, when both seeds germinate, the smut plant growing up within the tissues of the wheat or barley plant. As the grain crop
is about to produce seed the smut plant announces itself by developing its own seed or spores in place of the grain.

METHODS OF TREATING SEED TO PREVENT SMUT

The spores of the small grain smuts which are blown about by the wind and fall upon the ground, are ineffective in producing smut in the following year's crop. To prove effective the smut spores must come in direct contact with the grain seed. This fact makes it possible to prevent smut in the following crop by treating the seed grain.

The method of treatment varies with the manner in which the smut infects the crop. In case of the loose smuts of barley and wheat when the smut is lodged in the tissues within the wheat or barley kernel, it is apparent that any treatment which affected only the outside of the kernel, would be entirely ineffective. The treatment of seed to prevent this smut becomes therefore rather complicated, owing to the danger of injuring the vitality of the seed grain in an attempt to reach and kill the smut spore. Fortunately, however, these smuts are not nearly so prevalent in the state as the loose smut of oats and the covered smut of wheat in which the infection is on the outside of the grain where it can easily be reached.

Several very effective methods are known for treating the various smuts. Only one of the most practical and simplest methods will be mentioned for each type of smut.

TREATMENT OF SMUT OF OATS, STINKING OR COVERED SMUT OF WHEAT, AND COVERED SMUT OF BARLEY

The formalin treatment for these smuts is without doubt the easiest applied, one of the cheapest, and most effective. The formalin can be bought at any drug store at a cost of 50 cents to $1.00 per pound, or pint. It should be procured in sealed bottles if possible to insure its strength. Many failures in treating can be traced to weak formalin. This product is a solution of formaldehyde gas in water and will lose its strength rapidly if left uncorked or kept long in unsealed bottles.

One pint of formalin is added to 40 gallons of water, mixed thoroughly and applied to the grain at once. This amount of solution will treat about 40 bushels of seed.

One good method of applying the solution is to spread the grain on a floor, or in the bottom of a wagon-bed. Use a common garden sprinkler to put on the solution and sprinkle until wet, mix the grain with a shovel and sprinkle again. Every grain must be thoroughly wet with some of the mixture or the smut will not be killed. After sprinkling, put the grain in a pile and cover with blankets or sacks for 10 to 12 hours or over night. This will kill some smut which otherwise would not be touched. Spread the grain out and sow as soon as sufficiently dry.

Another method often used in treating is to put the grain in coarse sacks and immerse in a barrel of the solution, where they should remain for 10 minutes, at the end of which time they should be raised above the solution and allowed to drain for a short time when they may be spread out and dried as when sprinkled.

The idea to keep in mind is that each grain must be thoroughly wet with the solution or the smut spores will not be killed.
TREATMENT FOR LOOSE SMUT OF WHEAT AND BARLEY

The treatment for these smuts must necessarily be different from the others just mentioned. As before stated the growth is entirely different. The modified hot-water treatment is recommended for these smuts.

The seed is soaked in cold water for four or five hours. It is then removed, drained and given the regular hot-water treatment. That is done by first placing in water kept at a temperature of about 120 degrees F., then for wheat it is placed in water at 129 degrees F., for 10 minutes, and for barley 126 degrees F., for 13 minutes. If the temperature should be lower than that recommended the grain should be soaked slightly longer.

It is of the utmost importance that the temperature should be kept at very near the temperature given. If it becomes too hot the vitality of the grain may be seriously injured and if cooler the smut may not be killed.

Seed grain treated by the hot water method should be tested for vitality before seeding in order that the rate of seeding may be increased if necessary.