

THE LOOSE AND STINKING SMUTS IN INDIANA.

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The season of 1924 was exceptional in the general prevalence of loose smut of wheat throughout the state. In the northern part of the state where this disease is not commonly of primary importance, much interest and some alarm was aroused among the farmers because of the prevalence of the disease. There is no question but that the losses from loose smut in 1924 were double those of an average year. The behavior of wheat from hot water treated seed was of particular importance and significance under these conditions.

In Clinton County several farmers treated their wheat with hot water in 1922 and obtained their seed from these fields in 1923. Ray Gaskill's wheat in the spring of 1924 was practically free from the loose smut, while certain of the neighboring fields from untreated seed had from 10 to 15 per cent of loose smut. Chas. Jarrell's own wheat had only a trace of the loose smut, whereas wheat that he had purchased from another farmer was affected with three to four per cent of the disease. Mathius Keller, a farmer in Knox County, has treated small amounts of wheat each year since 1919 and has planted two or three acres as a seed plot. In 1924 his wheat was practically free from smut, whereas the neighboring fields had an average of 10 per cent of loose smut. These and many other cases show that the hot water treatment when carried out on a comparatively large scale, will effectively control the loose smut and maintain the wheat relatively free from the disease for several years.

The relative freedom of wheat from loose smut following treatment by hot water can best be illustrated by following certain of the records of certified seed. For example, let us follow the records of Michikoff as it was distributed from Purdue in 1920. This wheat had been hot water treated and was practically free from the smuts. In 1921 it was used by five farmers and also on the Purdue farms. In no case was there more than a trace of loose smut. In 1922 fifteen farmers, who had used this untreated seed of the 1921 crop, reported their wheat for certification and the highest amount of smut found was but .8 per cent in one case. The other fields had from a trace to .2 per cent. During this year none of the wheat was treated with hot water. The season of 1923 found 31 farmers requesting certification and of this number 20 had less than .5 per cent of loose smut in their wheat. Only four fields showed more than one per cent of the disease. During the past season (1924) 16 men offered their wheat for certification and only one of them had more than .5 per cent of loose smut in it. This is especially significant since 1924 was a season of serious infestation. Similar facts can be shown in certified Michigan Amber, Rudy, Poole and Fulz varieties.

During this period of five years the hot water treatment has been used in two cases in 1923. These facts show that wheat seed can be maintained relatively free from smut over a considerable period. However, there are undeniable cases of sudden increases in the amounts of loose smut in certified wheat. Last season (1924) in Vigo County, wheat raised from certified seed had approximately ten per cent of smut, far more than developed in the wheat raised locally. It has been determined, however, that this seed came from a locality where the hot water treatment is not used extensively and where the loose smut was also serious last season. The facts available indicate that in order to maintain comparative freedom from this disease, it is essential that wheat be grown in smut-free areas or at least in relatively isolated fields.

Some peculiar types of injury have resulted in hot water treated wheat aside from the actual killing of seed which always occurs in a certain percentage of the wheat. In no case, however, can these injuries be said to be the fault of the treatment. They merely serve to emphasize certain precautions that should be taken.

In Bartholomew County, in 1921, the treated wheat generally was lower grade than the untreated wheat, the grain being shriveled and light. A study of the situation showed that the treatment of the wheat had prolonged its period of growth a week or more. During the critical period when the grains were filling, the weather became unseasonably hot and dry and caught the treated wheat in a more immature condition. The premature ripening of the wheat resulted in a poorer quality of grain which was most evident in the treated wheat.

In another case the autumn was exceptionally dry and no rain occurred for weeks after the wheat was sown. The treated seed, being thoroughly wet, sprouted in the dry soil and quickly died. The water needed for the subsequent development of the seedling was totally lacking. On the other hand, the untreated wheat remained dormant and unharmed in the dry soil until the fall rains started, when the wheat was able to make a good growth. This illustrates the need of thorough drying of the treated wheat under conditions like these.

Two farmers in Marion County had a most peculiar experience with treated wheat in 1922. The wheat was treated on October 5, but during the wet weather it could not be sown till October 15. The weather remained cold and wet and not more than 25 per cent of the treated wheat sprouted. This wheat was examined, a considerable amount being dug up, and it was found that every grain was heavily covered with molds like *Penicillium* and *Aspergillus*. Many seeds had sprouted and died. Apparently the low temperature had checked the germination of the seed but the development of the molds continued unchecked on the soft water-soaked grain. Untreated grain under the same conditions grew well.

In contrast to these injuries are cases of apparent harsh treatment of treated wheat which has not caused injury. A farmer in Fountain County treated wheat in 1923 and left it in the care of his hired man to be stirred and dried. The wheat was neglected and when it came time to sow it, the layer of wheat was almost a solid mat of sprouts. In

order to get the seed through the drill, it was necessary for the men to tramp on the matted seed sufficiently to separate them. This seed was planted, the resulting crop was smut-free and yielded 29 bushels per acre, 6 bushels more than the untreated seed.

For the past two years (1923 and 1924) the stinking smut of wheat has been especially severe throughout Indiana. In 1923, the smut dust, created about a threshing machine on the Poor Farm in Henry County, exploded. Part of the machine was blown off and the inside was charred by the fire that ensued. Though no serious damage was done, this incident illustrates one type of loss that may result from severe infestations of stinking smut. Farmers in various places have reported that they suffered dockages of five to fifty cents a bushel at the elevators



Fig. 1. One type of treating apparatus used to mix the wheat with the copper carbonate. The dust is sufficiently poisonous to cause sickness, and operators should avoid breathing it.

owing to the presence of this disease. In a few instances the wheat was absolutely refused and had to be used as chicken feed.

In 1923, the copper carbonate treatment of seed was first introduced and gained immediate popularity among the farmers. It was recommended that three ounces of copper carbonate be used per bushel and that it be thoroughly mixed for two minutes with the wheat by shaking or revolving the grain and carbonate in a closed container.

This treatment was completely successful so far as the control of smut is concerned. An example of its efficiency is shown in one report from Shelby County where one farmer treated his wheat and secured a

clean crop. Another man used the same wheat but did not treat it and harvested wheat that was so infested with stinking smut that the grain dealers would not accept it.

Many types of apparatus have been devised by the farmers for this treatment. Some have used milk cans in which a half bushel was shaken up with the carbonate dust. Others have built box-like containers having an axle passing through the center. The wheat revolved in such an apparatus was very satisfactorily treated. Tight barrels with a door cut in one side were also used in the same way (fig. 1). One of the most convenient means of treatment is with a revolving churn in which about a bushel of wheat can be treated at one time. In a few cases an ordinary barrel type of concrete mixer has been used.

A number of farmers have not realized the poisonous nature of the copper carbonate dust when it is inhaled. In certain cases the men did not do the treating in closed containers or else worked in a closed room so that they breathed the dust continually for an hour or more. These men were very sick for a short time, sufficiently at least to impress on them the imperative need of a handkerchief or wet sponge over their mouths and noses to prevent the entrance of the dust.

Another rather peculiar effect of the copper carbonate that does not seem to have been noted elsewhere is its action on the wheat. In a very short time after the seed is coated with the dust it seems to become hard and, when handled, feels and sounds like so much gravel. After a longer time this characteristic is accentuated. No tests have been made to show that the wheat actually does become harder and it may be that this is just an illusion resulting from the friction between the dust-coated surfaces. It is known, however, that this treatment has no detrimental effects on the germination so far as can be judged by the stands of treated and untreated seed.

In 1924, seven farmers reported that the treated wheat caused breaking of their drills. In some cases the vertical shaft driving the horizontal shaft to which the forced feed wheels are attached, was broken. In other cases the teeth of the cog gears were so worn that they would slip, preventing the operation of the machine. These men stated that the wheat seemed to pack in the drill box like so much gravel. It is a question whether this trouble is due to the friction between the seed or to the carbonate dust sifting into the bearings. The former idea seems most probable and that the trouble is in some way connected with the peculiar action of the carbonate on the wheat. This question is being further investigated.