7-1-1960

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S. S. Ivanoff

Clyde L. Blount

BULLETIN 602 JULY 1960

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And Its Control

MISSISSIPPI STATE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
CLAY LYLE, Director
STATE COLLEGE MISSISSIPPI

SUMMARY AND CONCLUSIONS

1. The leaf blotch disease of oats caused by **Helminthosporium avenae** is described and its importance in Mississippi is emphasized. No commercial varieties resistant to leaf blotch are available.

2. Good control has been achieved for the production of fall-sown oats for grazing by properly treating the seed with Ceresan M, 1/2 oz. per bu.

3. The seed treatment greatly eliminated or considerably delayed the appearance of the disease. It did not protect the crop throughout the season because of secondary infections that occurred in the spring.

4. It is suggested that growers purchase their seed already treated, preferably certified.

5. Treatment of seed in the seed box of the drill is necessary if no commercially treated seed is available.

6. Planting untreated seed may invite great risks of crop failure.

Figure 1. View of two adjoining fields of oats, variety Nortex 107, both planted at the same time with seed of the same source. Upper view — seed not treated, note gaps in the poor stand. Lower view — seed treated with Ceresan M; this field provided good grazing and produced fair yield of grain.

THE LEAF BLOTCH DISEASE OF OATS AND ITS CONTROL

By S. S. IVANOFF and CLYDE L. BLOUNT

During the last few years weather conditions in Mississippi have been such that many young stands of oats planted primarily for grazing have been lost from diseases. For the same reason grain yields have also been low at many locations, particularly in the southern part of the State, and much seed infection and contamination have resulted during the ripening period. Two main diseases have been involved, namely, Victoria blight and leaf blotch. Victoria blight may be controlled by the use of resistant varieties, such as Delta Red 88, Nortex 107, Delair, Mid-South, Moregrain, and Suregrain. There are no varieties resistant to leaf blotch, however. The purpose of this bulletin is to describe this disease as it occurs in Mississippi and to present data on its control by chemical seed treatment.

The fungus organism causing leaf blotch (**Helminthosporium avenae**) is an old parasite known for over 70 years. For a long time the disease was not considered important in the United States and little attention was paid to it. It is in recent years that the damage caused by it has become noticeable and at some locations has been very serious to fall-sown oats planted for grazing as well as to oats planted for grain. This change in the severity of the disease may possibly be explained by the unusually high rainfall during the last few years, since abundant moisture is the primary factor in its incidence and spread.

Another probable factor is that new and more potent strains of this particular species of parasite may have arisen which are capable of inducing the disease more quickly and in more destructive form. Laboratory and greenhouse tests have confirmed the existence of great differences in disease-producing capacity among the various fungus isolates ob-

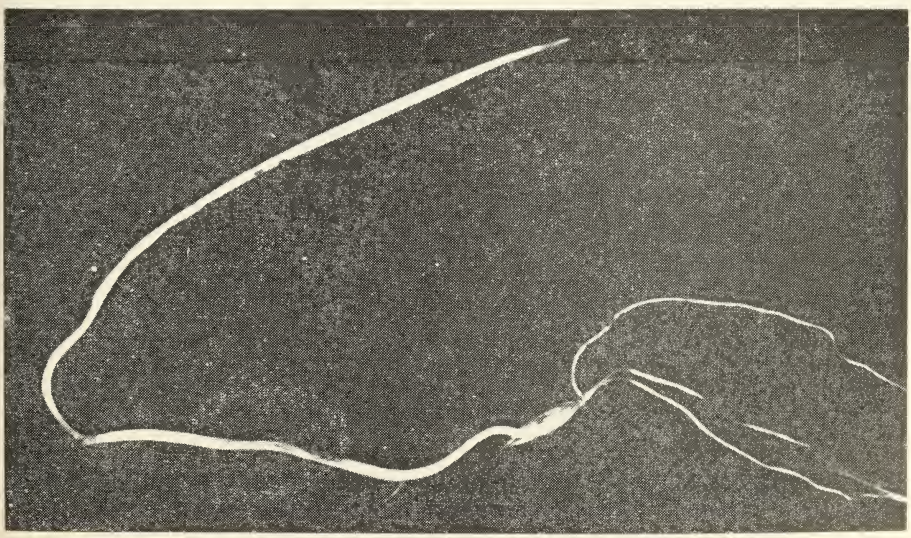

Figure 2. Oat seedling 12 days old showing a dark lesion (sometime streaked) on the coleoptile and two small spots on the first leaf. These symptoms were induced in the laboratory by artificially inoculating the seed with pure cultures of the fungus.

tained from naturally infected seed and other oat material grown in Mississippi and other southern states. Evidence is also increasing about the existence of other species of **Helminthosporia**, that are morphologically different from the well known **H. avenae**, and which seem capable of inducing much the same disease symptoms on oats.

The fungus is carried mainly on the seed but may also be carried on the stubble and other plant refuse left in the field from previous croppings. It is not known to live in the soil for any length of time, as other parasites do. However, contaminated or infected seed is the main concern.

Primary infection starts as soon as the seed begins to germinate under conditions of abundant soil moisture and moderate temperatures. In laboratory and greenhouse trials it has been established that the best conditions for seedling infection are a temperature ranging from 75 to 82°F, and a very high relative humidity with some excess moisture. The fungus on the seed may be located on the glumes, and between the glumes and the kernel, and sometimes within the kernel proper.

In the germination of the seed the roots develop first, approximately 2 to 3 days after it is planted, if the growing conditions are ideal. Three to five days later, the young shoot protrudes through the seed coat, but still remains underground. The shoot consists of the coleoptile, a

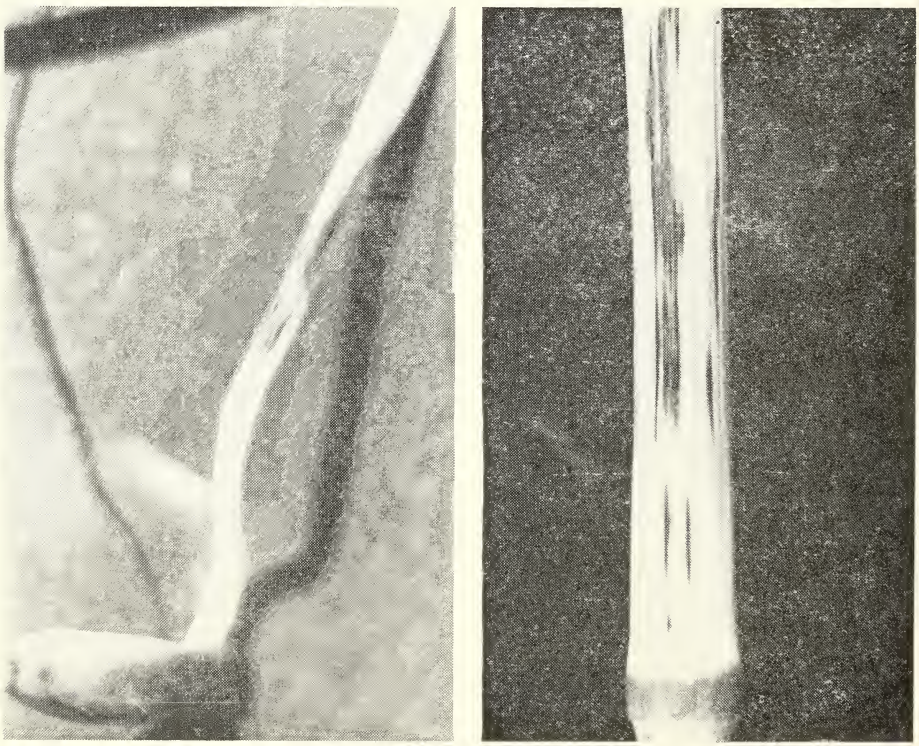

Figure 3. Left: Another very young oat seedling showing the first symptoms of infection in the form of long dark streaks just above the kernel. Right: The same streaks, causing dry rot, as they appeared 7 months later on the mature stem or culm.

membranous leaf-like structure, one to two inches long, which envelops like a gloved finger the embryonic stem and true leaves inside. It is at the moment when the shoot breaks through the seed coat that infection of the young seedling begins to take place.

The development of this infection is as follows: The growing shoot at the very beginning must pass by the glumes, which have sharp, scratching points and edges, while the coleoptile is tender, thin, and almost transparent. The coleoptile, as it grows, is forced to rub itself against the edges of the glumes, thus suffering wounds and bruises in the form of minute punctures and streaks. Also at this time the various parts of the fungus that are within or lodged between the glumes "lie in wait" to gain entrance into the young shoot as soon as it is wounded and to invade its tissue. Through the coleoptile the infection reaches the first true leaf, forming one or more brown lesions.

By the time the top of the seedling reaches above ground, some 10 to 12 days after planting, the young stem also shows symptoms of infection in the form of dark lesions or streaks, just above the kernel (Fig. 2).[1] It is of interest that the same dark streaks induced so early on the very young and short underground stem persist and elongate, and develop later into a culm rot condition of the mature plant (Fig. 3). If at this early stage the conditions for the development of the disease continue to be favorable, and the disease-producing fungus is of high potency, then the seedling rots at the base very quickly and is killed before it has ever had an opportunity to emerge above the ground (Fig. 4). By this time the primary roots also begin to show a decay usually near the base of the kernel which in some measure contributes to the trials of the striving plant.

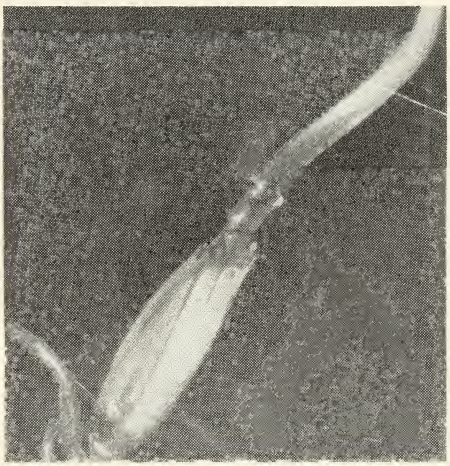

Figure 4. Severe rotting (dark area) on very young oat seedling, just above the seed coat, showing some fungus growth. Such rotting may occur before or shortly after the seedling emerges from the ground, leaving gaps in the field.

This failure to emerge has been often observed in many commercial fields in south Mississippi and sometimes in other parts of the state, particularly in the early planted oats. Frequently, however, a young stand of oats may appear, and even though the plants are infected, they give the illusion of health, since they seem at first green, because the lesions on the first leaves are rather small and inconspicuous.

All of these developments have been studied in the field and have been reproduced with remarkable similarity in the laboratory and in the greenhouse by artificial inoculation techniques. The symtoms of leaf blotch are distinct from those of Victoria blight. (4).

Secondary infection, given the proper conditions, may occur about two weeks after the first stand has been more or less established. The new leaves become infected from the old ones, the blotches now appearing longer. Eventually the plants are killed before much grazing has been obtained. Following warm

[1]Other workers (9) have previously observed the formation of the dark lesion on the coleoptile of young seedlings in the field and have considered it as a constant symptom of the disease.

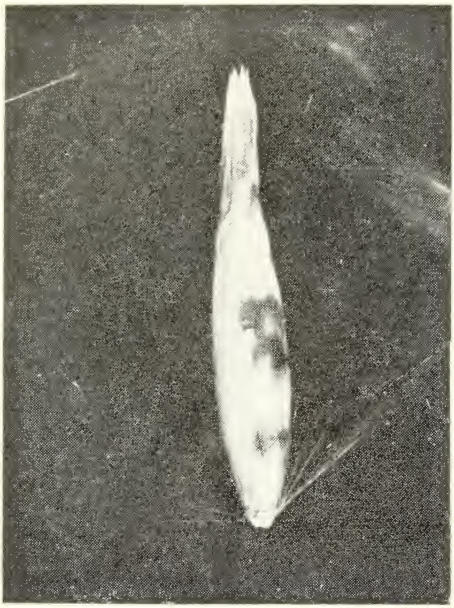

Figure 5. A mature oat seed, greatly enlarged, showing infection by the blotch fungus. This type of infection may go deep into the kernel and is difficult to eliminate by seed treatment. Consequently, badly infected seed crop should not be used for planting.

showers in the spring, surviving plants may become further infected, causing discoloration (pinking, purpling, then blackening) of leaf sheaths and stems, dry-rotting of same, spotting of the glumes, infection of flowers resulting in abortion, and of course, great reduction in grain yields (Fig. 5 and 6). These changes take place gradually and are frequently unnoticed by the average grower, except for the general poor appearance of the crop by harvest time. In the absence of rains or heavy dews the disease does not develop so quickly and the above damage may be light or completely absent. A good healthy stand may be had and good grazing assured without leaf blotch, if clean, healthy, or treated seed is used for planting.

Control of Leaf Blotch by Seed Treatment

Seed treatment of oats with vaporizing organic mercury compounds in the form of dusts or liquids for the control of some smuts and other seedborne diseases has been recommended for some time. The reports on control have been variable, but on the whole encouraging. It was thought necessary, however, to reinvestigate critically this measure of control because of the possibility that there are new strains of parasites, in view of the unprecedented severity of this disease.

Laboratory trials were first conducted with locally grown seed thoroughly infested with the causal organism. The seed was treated with Ceresan M[2] dust at the rate of 1/2 oz. per bushel as recommended by the manufacturer. For checks, healthy seeds were used from a field kept free from the disease. After 3 trials with a total of 30 replications and under conditions most favorable for the disease, it was established that complete control may be achieved by this

[2]Active ingredients: Ethyl, mercury, T-toluene, sulfonanilide 7.7%; (Total mercury as metallic 3.2%). Inert ingredients 92.3%.

Table 1. Control of leaf blotch of oats (Helminthosporium avenae) by seed treatment with Ceresan M, ½ oz. to the bushel.

	Untreated		Treated	
Kind of seed employed	Germination %	Healthy plants obtained %	Germination %	Healthy plants obtained %
Lot 1. Oat seeds naturally infected with leaf blotch	98	33	100	100
Lot 2. Healthy seeds with no disease-producing fungi on them	95	95	95	95

method (Table 1). It was kept in mind, however, that even though the fungus mycelium had invaded the glumes of the seeds used in these trials, and its spores were found upon the surfaces and between the surfaces of the various parts of the seed, still there may be some rare instances in which the parasite has deeply invaded the seed, in which cases the seed treatment may not be one hundred percent effective.

In field tests with small replicated plots, the treated seed gave a good healthy stand, but some disease appeared at about maturity, probably because of contamination from nearby diseased oats. The untreated seed under wet conditions produced rather poor stands, small unthrifty plants, with the disease becoming evident early, reducing the grain yield in some cases very considerably.

A study was made of fourteen commercial oat fields in 1959-1960 in Pearl River County, in south Mississippi, in order to determine the effect of treated and non-treated commercial seed planted in the fall. Plantings in this part of the State had been particularly disappointing in recent years because of frequent destruction of the young crop stands. The results may be summarized as follows:

(1) Treated seed invariably gave good stands; untreated seed gave poor stands;

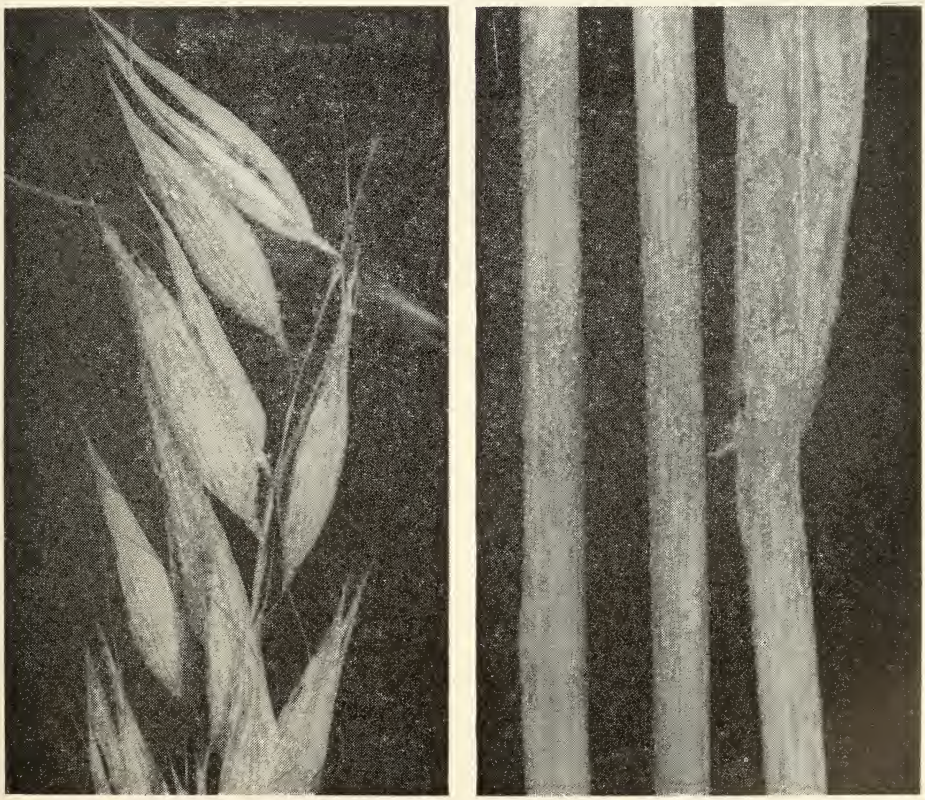

Figure 6. Maturing grain and stems of oats infected with leaf blotch. The fungus is spread from plant to plant, and from field to field, by wind and splashing rains. The disease is transmitted through the seed unless the seed is chemically treated.

(2) treated seed did not control leaf blotch one hundred percent, but the limited extent of the disease found did not materially reduce the quality or quantity of grazing; (3) fields planted with treated seed and harvested for grain after grazing, produced a fair to good crop of grain; (4) none of the fields planted with untreated seed reached satisfactory maturity. Early planted oats seemed to be damaged more severely than late planted oats. It was further observed that aphids or "green bugs" **(Toxoptera graminum)** were more destructive on the unthrifty plants grown from untreated seed.

Growers should use treated seed to avoid serious losses. Besides Ceresan M, Panogen is also used (3/4 oz. per bu.) for general purpose seed treatments, but this material was not included in the tests. The seed may be treated by commercial houses, but in cases where this has not been done, instead of planting the untreated seed, the practice by some growers of treating the seed in the drill box may be followed, being certain to take ordinary precautions against harm to the operator. About one-half of the seed is spread in the drill box, then one-half of the Ceresan M is dusted over it. The rest of the seed is added and the remainder of the fungicide again spread on top. The mixture is stirred as well as possible and drilled. A waiting period of some minutes between stirring and planting may be of benefit.

Just as varieties resistant to Victoria blight were produced through breeding, so resistance to leaf blotch may eventually be obtained through breeding. This would be the best solution to this problem. In the meantime it may be said: plant treated seed of an adapted variety and avoid planting oats on low, wet land.

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