

THE NATURE OF CERCOSPORA LEAF SPOT OF SUGAR BEETS
AND PREVENTIVE MEASURES BEING USED IN OHIO

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This disease is familiar to everyone who is associated with sugar beet culture in the United States, Canada and Europe and especially to those of us who work here in the humid region which surrounds the Great Lakes. We realize that it is an ever present threat to the successful culture of sugar beets because of the damage which can be inflicted and the subsequent loss of sugar production from the crop.

Let's discuss the nature and history of this disease as it relates to our area.

What is Cercospora beticola?

It is a parasitic fungus which develops within the leaf tissue of the sugar beet plant. During favorable environmental conditions, a spore (germ) which has settled on the underside of the leaf surface, will germinate and the resulting germ tube will enter a stoma (air opening in leaf) and begin to grow between the plant cells. The fungus obtains its nourishment from food which is present in the plant cells. As the cells begin to die the fungus develops fruiting bodies on the top surface of the beet leaf and the thousands of spores which develop on these fruiting bodies are scattered upon the foliage in the immediate area.

After infection of the leaf and under optimum conditions, the spots can be seen within three to five days and the whole cycle of development can be accomplished within eight to ten days.

How long has leaf spot been a problem?

The Sugar Beet Journal has several articles dating back to the 1920's which relate the presence of the disease. No doubt it existed before that! Of particular interest are the articles in the Journal which tell of the epidemics which occurred in the late 1930's and the preventive measures used at that time.

What are the environmental conditions which may result in the infection of the beet leaf?

High humidity in the range of 92-98% and warm temperatures between 75° F. and 90° F. in the immediate vicinity of, and at, the leaf surface are the most important. Repeated dews, fog, mist and rain result in these higher humidities at the leaf surface. Since germination of the spores and entry through the stomata can occur within three to six hours, infection can take

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place in those many situations when the leaves are wet. Spore formation is inhibited and fungus growth within the leaf is greatly curtailed below 50 F., however, with warm daytime temperatures the activity will soon resume.

How are the spores transmitted?

An old theory held that spores were carried by the wind, but recent investigations by Dr. Lucas Calpouzos of the U.S.D.A. at locations in Minnesota, revealed that few spores were wind carried except during a rainstorm. In other studies he found that the spores can only be loosened from the fungus growth by water. This leads one to believe that dissemination of spores over a large area would occur during a windy rainstorm. With dews and showers, though, the spores could still spread locally from one plant to another.

What other plants are susceptible to and capable of spreading the disease?

In 1933, Dr. Vestal at Iowa State University was able to inoculate 24 other plant species with Cercospora beticola and, in turn, inoculated beet leaves with spores from these other plants. Some of these other species most familiar to us are lambsquarters, redroot pigweed and curled dock.

How can early symptoms of the disease be detected in the field?

Since the first infection generally takes place on fully matured leaves, the disease is rarely seen before July 1. Symptoms can show up in some areas by mid-July, therefore, vigilance should increase in the succeeding weeks.

The earliest symptom which can be seen and described, looks like a small white dot surrounded by a purple ring. The total diameter of the infected spot at this stage is no larger than a pinhead. As the fungus grows, the purple ring tends to disappear and the center of infection takes on a gray color which is due to the fruiting bodies and spores being developed there.

Occasionally when infection takes place late in the summer (late August and September), the purple ring does not develop and the infected spot quickly turns black with spores.

How much damage can this disease inflict upon the beet crop?

This depends entirely on the severity of the disease. If only a few spots are present on the foliage at harvest time, very little or no loss of sugar production would be expected. It is my considered opinion, however, that when the first leaf of an infected plant dies and falls to the ground (assuming most plants are similarly infected), the crop as a whole will have lost one to two tons production per acre and up to one percentage point

in sugar content. With further loss of leaves and repeated infection, the loss up to mid-October can amount to four or five tons per acre, 3-4 percentage points in sugar and 2-3 percentage points in purity. This loss is in the neighborhood of 2500 pounds of sugar per acre.

How can the incidence of disease be reduced or prevented?

Crop rotations, good plant nutrition and weed free fields tend to help, and tare dirt and refuse should not be dumped on next year's beet ground. Resistant varieties of beets are the most logical step in preventing the disease and plant breeders are working on this aspect now. At present, a fungicide applied to the foliage to prevent germination of the spores is the only effective practice in those areas which are plagued with leaf spot. Since sugar is manufactured in the beet leaves it is of paramount importance that they remain disease free throughout the summer so that the maximum amount of sugar is produced from every acre.

Those chemicals and rates which have been found particularly effective by Dr. J. D. Wilson, Ohio Agricultural Experiment Station, in preventing leaf spot are listed below along with the maximum length in days between spray applications.

<u>Product Rate Lb./A.</u>	<u>14-day Intervals</u>
6 lbs.	Basic Copper Sulfate (a number of brands are available)
4½ "	COC-S (Copper Oxychloride Sulfate)

An orchard dormant spray oil (4½ pints per acre) may be added to these copper chemicals which will greatly increase their effectiveness.

3 lbs.	Manzate
3 "	Dithane M-22
3 "	Dithane M-45
3 "	Polyram

The Northern Ohio Sugar Company recommends 6 pounds of tri-basic copper sulfate plus 4½ pints of oil per acre. The cost is approximately \$2.25 for the combination of materials. With a 14-day spray interval the farmer receives excellent disease prevention at a minimum cost. A few individual farmers who do not wish to alternate chemicals when spraying both beets and tomatoes are using Maneb (Manzate or Dithane M-22).

What type of spraying equipment will result in the most effective coverage of the fungicides?

Properly operated, air-blast and high-pressure hydraulic boom machines are best. We recommend no other machines for obtaining season long control.

When should a spraying program begin?

This is largely a matter of judgment based on previous experience by those concerned. The crop should be sprayed at least one week before the spots would begin to show on the leaf. Usually an average date to commence spraying is selected according to different geographical locations and expected severity of disease. Mid-July has been our recommendation in those areas which develop disease in epidemic proportions. Other areas are advised to begin spraying about the first of August.

The number of sprays needed will be determined by the starting date, spray interval and the conclusion of the spraying schedule early in September.

Will it pay to spray?

I doubt if it would be economically feasible to spray if it is expected that less than one-third of the area of each individual leaf will be infected at the time of harvest. But if there is a degree of "burning" such that a loss of leaves will occur before harvest, economic returns from spraying will more than offset the costs. Again, past experience will have to guide you in this determination, but we say - "When in doubt, spray."