THE OCCURRENCE OF CEREAL ANTHRACNOSE IN ALBERTA

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Abstract

A survey of wheat, oats, barley, and rye in Alberta for anthracnose caused by Colletotrichum graminicola showed that the disease was most prevalent in north-central Alberta in 1963, while only trace amounts were found in southern portions of the province. Oats was most severely affected. Anthracnose was not associated with any general soil type, but the disease was most severe on crops grown on soils low in organic matter. Crops grown on soils with very high organic matter were nearly disease free. Soil factors such as mineral salt concentration, nitrate, free lime, reaction, and conductivity could not be related to disease incidence.

Introduction

The anthracnose disease of cereals incited by Colletotrichum graminicola (Ces.) G. W. Wils. was reported in Alberta for the first time in 1933 by Sanford (4). Two years later he (5) described its effects on oats and indicated that under certain conditions this crop could be severely damaged by the root-rot phase of the disease. The disease also appeared to be associated with degraded soil.

Cereal anthracnose is difficult to diagnose during the major period of plant growth. Gross symptoms include a general reduction in plant vigor, the production of weakened, thin stems, and premature ripening. These symptoms can be mistaken for those caused by low or unbalanced soil fertility or by drought. Signs of the disease consist of black, setose acervuli that appear at plant maturity. It is at this stage that the cause of the disease can be easily determined.

More recent observations on the extent and severity of cereal anthracnose in Alberta have aroused renewed interest in the disease. Casual observations have also indicated that the disease might be favored by certain types of soil or soil conditions.

The objective of the present investigation was to survey the cereal-growing areas of Alberta in order to ascertain the distribution and severity of anthracnose on wheat, oats, barley, and rye, and to note any association of the disease with soil type or condition.

Materials and methods

Survey of cereal anthracnose in Alberta

Six survey trips, representing 440 grain fields, were made in Alberta during the summer and fall of 1963. Fields of wheat, oats, barley, and rye were inspected at intervals of approximately 5 to 7 miles. The incidence of anthracnose could be determined most easily in stubble fields because acervuli appear most abundantly at the lower nodes. Disease ratings of 0 to 10 were made for each field and were based on the percentage of plants infected and the number of acervuli per unit area of stem. Soil characteristics such as color and texture were noted, and soil samples were collected from areas which represented variations in disease incidence.

Analysis of soils

Twenty-two soil samples were analyzed by the Provincial Soil and Feed Testing Laboratory, University of Alberta, for nitrate nitrogen, phosphorus, sulfate, free lime, reaction, and conductivity.

The total organic matter content of 26 samples was determined by the rapid wet oxidation method of Walkely (6). The results are expressed as the percentage (w/w) of organic matter in the soil. The organic matter was estimated as 1.72 times the determined organic carbon content, since soil organic matter is about 58% carbon.

Results

Anthracnose was found on wheat, oats, barley, and rye, the major cereal crops grown in Alberta. Oats was most severely affected. The area surveyed is shown in Figure 1. The prevalence of anthracnose is indicated by the relative density of

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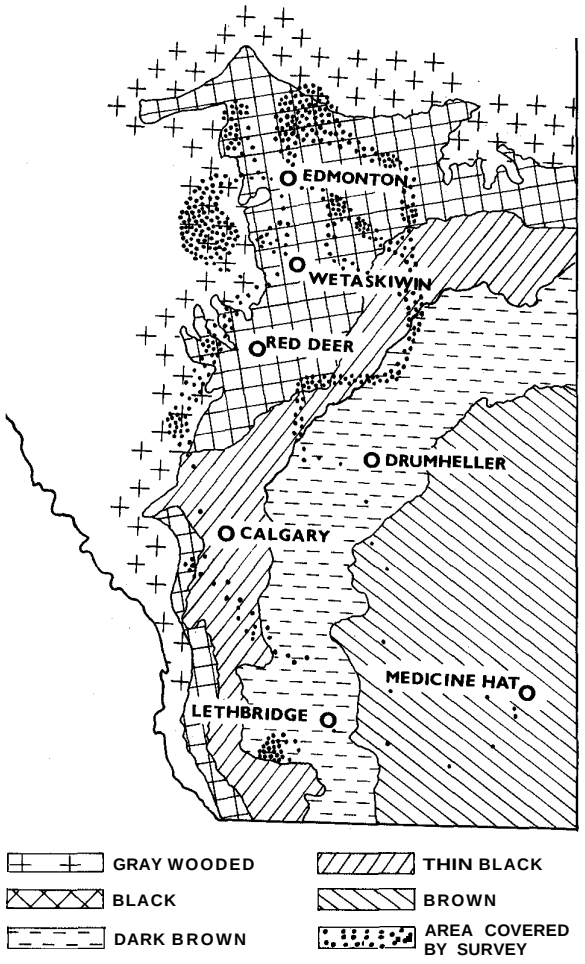

Figure 1. Distribution of cereal anthracnose in the major soil zones of Alberta in 1963. The density of dots indicates the prevalence of the disease.

black dots. Areas not showing dots were not surveyed. Also shown on the map are the major soil zones of Alberta: Brown, Dark Brown, Thin Black, Black, and Gray Wooded.

Anthracnose was most prevalent in north-central Alberta. Only traces of the disease were found in most areas south of Drumheller. However, a higher incidence of anthracnose was found near the foothills and in one small area of degraded soil southwest of Lethbridge (Fig. 1). The disease was often severe in localized areas where the soil was usually low in organic matter. A comparison of disease severity with the amount of organic matter in representative soil samples (Fig. 2) indicates that the level of organic matter influences the severity of anthracnose. In areas of low organic matter the disease was widely distributed and severe, but in areas where the level of organic matter was very high anthracnose was more limited or absent. However, in soils having moderate levels of organic matter (sample numbers 6 - 17), there was a less definite relationship. Such soil factors as conductivity, reaction, and the quantities of nitrate nitrogen, phosphorus, potassium, sulfate, or free lime did not show any relationship to severity of anthracnose (Table 1).

Some interesting observations were made in the Gray Wooded soil zone with respect to the possible influence of organic matter on disease levels. In this area the upland soils are generally composed of degraded soil of relatively low organic matter content. Some fields in this area contained low spots composed of peaty soils with very high organic matter. Crops in the portions of the field containing

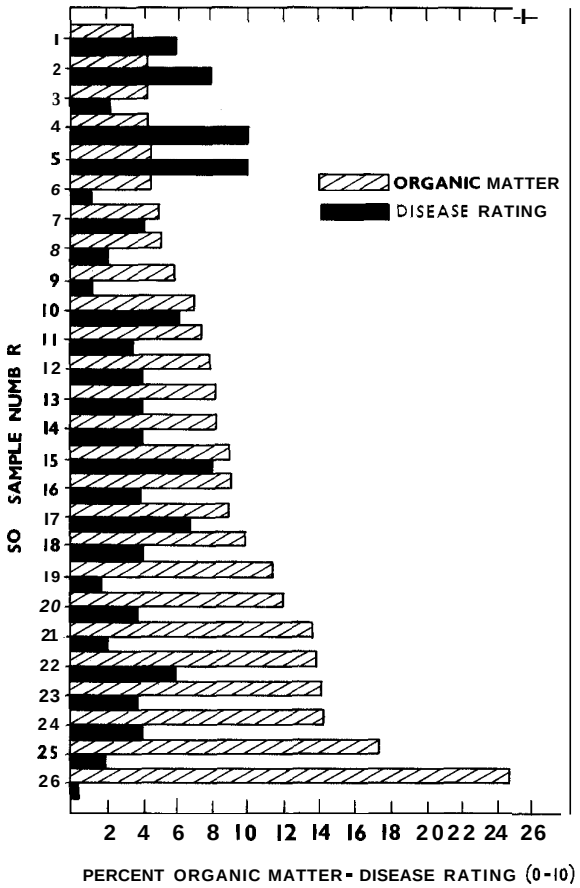

Figure 2. Levels of organic matter in soil and the severity of anthrocnose in cereal fields. The disease ratings are based on a scale of 0 to 10, where 0 = no disease and 10 = severe disease, accompanied by the production of numerous acervuli of Colletotrichum *graminicola* on affected plants.

Table 1. Analysis of 22 **soil** samples from areas showing differences in severity of anthracnose on cereal crops

Sample no.	Nitrate nitrogen (lb/ac)	Phosphorus (lb/ac)	Potassium (lb/ac)	Soil reaction (pH)	Conductivity (mmhos)	Sulfate	Free lime	Disease rating*
1	20	51	100	6.3	0.8	0	0	6
2	13	80	76	6.7	0.3	0	0	8
3	13	46	74	6.3	0.2	0	0	2
4	38	0	206	7.7	4.3	700	veryhigh	10
5	13	23	144	7.3	0.8	0	0	10
6	9	6	104	7.6	0.4	0	0	1
7	11	16	106	6.5	0.2	0	0	4
8	13	28	204	6.4	0.2	0	0	2
9	18	26	600	7.9	0.7	0	high	1
10	18	44	396	7.6	0.5	0	0	6
11	13	39	208	7.8	0.4	0	0	3
12	13	32	128	7.7	0.3	0	0	4
13	18	4	60	6.8	0.4	0	0	4
14	16	39	316	6.1	0.3	0	0	4
15	16	9	384	7.8	0.5	0	very high	8
16	11	73	272	7.0	0.5	0	0	4
17	18	41	232	7.4	0.4	0	0	7
18	20	23	318	7.8	0.9	0	high	4
19	11	8	48	7.1	0.4	0	0	2
20	7	144	208	6.9	0.3	0	0	4
21	11	52	74	5.5	0.3	0	0	2
22	18	30	48	5.4	0.3	0	0	6

* Where 0 = no disease; and 10 = severe symptoms and the production of numerous acervuli of Colletotrichum graminicola on affected plants.

degraded soil often showed a high incidence of anthracnose, but there was no trace of the disease in the peaty areas of the same field. Crops in other peat soils were also free from disease.

Discussion

The organic matter content appeared to be the only soil factor that was correlated with the severity of anthracnose. Attempts to correlate disease incidence with other soil factors may not be practicable because the cropping history of the individual fields was not known and because the soil samples represented widely divergent areas of climate and farming methods. Host specialization which has been shown for C. graminicola (1, 2, 3) was also not considered. The good correlation between organic matter content and disease incidence was especially evident in soils with very low or very high levels of organic matter. Support is given to the existence of such a relationship by the fact that anthracnose occurred in the degraded portions of a number of fields but not in peaty areas of the same fields. This situation isolates the influences of cropping history, soil management practices, or climate, and makes possible a direct comparison between organic matter content and disease incidence.

Further investigations are underway to determine how soil organic matter influences the occurrence of cereal anthracnose.

Acknowledgment

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