A DISEASE SURVEY OF CEREALS IN CENTRAL AND NORTHERN ALBERTA, 1970

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Introduction

One of the objectives of the CDA research establishments in Alberta is to develop cereal varieties with greater yields, along with other desirable agronomic features. To implement such a programme it is desirable to be aware of the diseases occurring on cereals in Alberta and if possible to obtain some indication of yield losses. The report by McDonald et al. (2) indicated the presence of cereal diseases on the eastern prairies, many of which are generally not important in Alberta. McDonald et al. also indicated the losses from cereal diseases and the value of disease resistance in Manitoba. The development of resistant varieties has reduced the occurrence of epidemics in cereals, and the value of such varieties is obviously great. However, since the causal agents are also subject to environmental pressures, the development of pathogens virulent to hitherto resistant varieties is omnipresent and constant vigilance in the form of disease surveys is necessary to detect them.

This paper reports the occurrence of cereal diseases in northern and central Alberta in 1970 and provides an estimate of losses from the major diseases of cereals in central Alberta.

Materials and methods

More than 100 fields of cereals were surveyed during the third week of July along a route north from Beaverlodge, east to Sexsmith and north through Spirit River and Fairview to a point 20 miles north of Peace River. The survey continued south from Peace River to High Prairie via McLennan, west to Wanham, south to Grande Prairie and east to Valleyview. No attempt was made to calculate losses on cereals in northern Alberta because the survey was made earlier than desired and the incidence of disease was low in this area. Scald or net blotch on the upper two leaves of barley were found in only 5 of 60 fields.

In central Alberta the survey was conducted in Crop Districts 8, 10, 11, and 13 (Table 1). Crops were not examined in Crop District 9 because few cereals are grown in this area, and a lack of time prevented the surveying of fields in Crop District 12. Flax and rye were rarely seen in central Alberta and were not considered in the survey of this region.

The selection of fields for survey and the methods of assessing disease incidence and loss were essentially similar to those used by McDonald et al. (2). The following scale was used for assessing the severity of leaf diseases:

Trace - one or two lesions on 1 of 10 plants;
Slight - one or two lesions on one half of the plants;
Moderate - several lesions on all lower leaves of all plants;
Severe - lesions on all leaves of all plants, the lower leaves totally diseased and the disease present on all upper leaves.

The incidence of smut and ergot was measured by counting the numbers of affected heads in 100-head samples at several locations in a field. An average of less than one affected head per field was considered trace infection; one and two affected heads were considered slight and moderate, respectively.

Root rot intensity was rated by noting the amount of tissue discoloration at the subcoronal internode (4).

Results

NORTHERN ALBERTA

The crops in the west and south of the area surveyed were more mature than in the northeast where rainfall was more abundant. The low rainfall was associated with a low incidence of leaf diseases, whereas root rot of barley was more evident in the areas of low rainfall.

Barley

Table 2 illustrates the intensities of the various diseases. Scald caused by Rhynchosporium scalis (Oud.) Davis was found more frequently than net blotch (Drechslera teres [Sacc.] Shoem.) on barley in 1970. Smut (loose and covered) was found in 14% of the fields visited.

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Table 1. Number of farms growing wheat, oats, or barley and percentage of farms surveyed in four crop districts in central Alberta in 1970

Crop District	Wheat		Oats		Barley	
	No. of farms*	% farms surveyed	No. of farms*	% farms surveyed	No. of farms*	% farms surveyed
8	1700	0.7	3500	0.5	4500	1.0
10	8000	0.3	7000	0.05	5000	0.2
11	3400	0.5	5300	0.5	4800	0.4
13	4000	0.1	4000	0.1	4700	0.3

* Data supplied by the Alberta Department of Agriculture, Economics Division.

Table 2. Percentage of 60 barley fields showing various intensities of five diseases in northern Alberta, 1970

Intensity of disease	Net blotch	Scald	Root rot	Loose smut	Covered smut
0	23	9	35		
Trace	54	49	32	5	9
Slight	7	19	16		
Moderate	12	17	14		
Severe	4	6	3		

Fifty-five percent of the barley examined was sown on summerfallow and 45% on stubble. The incidence of moderate and severe root rot was greater on summerfallow-sown barley than on stubble. Approximately 35% of fields of barley from both stubble and fallow were free from root rot.

Wheat

Spring wheat was found to be relatively free from disease. Leaf and stem rust as well as head diseases such as ergot, smut, and bacterial black chaff were not found in the 25 fields of wheat examined. Approximately one-half of all wheat plants examined had considerable powdery mildew (Erysiphe graminis D.C. ex Merat) on the lower leaves. Septoria leaf spot was found in about 10% of the fields and a slight incidence of common root rot (Bi laris sorokiniana [Sacc. in Sorok.] Sh ——— Fusarium sp.) occurred in 75% of all wheat examined.

Oats

One third of the oats examined had 1 to 2% of the kernels missing. This is probably a physiological condition called blast. Gray speck caused by manganese deficiency was observed in about 10% of all oats seen and was restricted to about 5% of the total leaf area. No other diseases were seen.

Flax

No diseases were observed in the six fields of flax inspected.

Rye

Powdery mildew was seen on the lower leaves of all of the rye inspected. Scald (Rhynchosporium secalis [Oud.] Davis) was found on the lower leaves from one field, as was bacterial leaf stripe (Xanthomonas translucens [Jones, Johnson & Reddy] Dows.). No rust or ergot was observed.

CENTRAL ALBERTA

A more intensive survey of cereal crops was conducted in central Alberta during the period August 10 to August 31 when most of the crops were in the soft dough stage.

Barley

Losses caused by the major leaf and head diseases in barley in central Alberta were estimated at 9.91% of potential yield. The two leaf diseases, scald (Rhynchosporium secalis) and net blotch (Drechslera teres) were generally not found associated in the same field. Scald was more severe than net blotch in 1970 and was most prevalent in Crop Districts 10 and 13 in the northeast area of the central region (Table 3).

Leaf spot (Septoria spp.) was found in trace amounts in 9% of the fields. and bacterial leaf stripe Xanthomonas translucens in sliqht amounts in 4.5% of the fields: spot blotch- (Bipolaris sorokiniana) and ergot (Claviceps purpurea [Fr.] Tul.) were observed in trace amounts in 1% of the fields. These diseases were not considered to cause a significant loss in yield.

Common root rot was recorded in 74.4% of all fields seen and was estimated to have

Table 3. Yield losses from diseases of barley in central Alberta, 1970

Crop District†		Yield losses from scald	Yield losses from Net blotch	Yield losses from Smut	Total	Average yield (bu/acre)*	Potential yield (bu/acre)*	Acres ('000)*	Potential yield production ('000 bu)
8	Range (%)	0–32	0–41	0–5					
	Mean (%)	5.1	2.03	0.28	7.41	41.6	44.9	616	27,658
	Bu ('000)	1410.6	516.4	77.4	2004.4				
	% fields with disease	91.3	65	40					
10	Range (%)	0–58	0–3.2	0-1.0					
	Mean (%)	10.4	0.35	0.5	11.25	43.1	48.6	490	24,014
	Bu ('000)	2476.6	83.35	138.6	2698.6				
	% fields with disease	88	66	78					
11	Range (%)	0–30	0–6	trace					
	Mean (%)	7.0	0.55	trace	7.55	42.7	46.2	444	20,513
	Bu ('000)	1435.9	112.8	trace	1548.7				
	% fields with disease	90	68	47					
13	Range (%)	0–58	0–10.8	trace					
	Mean (%)	14.4	6.54	trace	20.94	35.0	44.3	400	17,720
	Bu ('000)	2551.7	1159.9	trace	3711.6				
	% fields with disease	91	91.7	16					

* Data supplied by the Alberta Department of Agriculture, Economics Division.

† The total number of barley fields examined in each Crop District (CD) was as follows: CD 8, 46; CD 10, 10; CD 11, 19; CD 13, 12.

reduced yields by approximately 20% (unpublished data).

Wheat

Only two diseases of wheat were considered important enough to reduce yield. Common root rot was estimated to have reduced yield by 6% (R.J. Ledingham, unpublished data). A head blight that has been observed during the past 5 years, causing the neck, rachis, and glumes to become dark brown or purple, was responsible for severe losses in Crop District 11 where an 18% yield reduction was estimated (Table 4). This condition was noticed in 23% of the fields visited. The causal agent has not been discovered, although a similar condition referred to as pseudo black chaff has been described by Ausemus et al. (1) who regarded it as a physiological condition occurring under certain conditions of heat and humidity. This condition appeared in large patches in the field, in some cases affecting nearly all plants. Affected heads yielded only a few small shrivelled kernels. Yield losses were estimated after examining affected heads and grain from many sites in a field.

Ergot (Claviceps purpurea) was more abundant this year in wheat than in previous years (Table 4). Quality was affected more than quantity.

Leaf diseases such as septoria (Septoria spp.), powdery mildew (Erysiphe graminis) and leaf rust (Puccinia recondita Rob. ex Desm.) were restricted chiefly to the lower leaves. These diseases appeared late in the season.

Oats

Very little disease was found in oats in 1970. Blast (possibly a physiological condition) was found in 75% of all oats examined, preventing approximately 5.3% of the kernels from developing. Several plants were affected by barley yellow dwarf virus. Several cases of halo blight (Pseudomonas coronafaciens [Elliott] Stev.) and loose or covered smut were seen. Leaf spot (Drechslera avenacea [Curt. ex Cke.] Shoem. was seen in about 12% of all fields. but incidence was rated at trace.

Discussion

This survey was made in an attempt to measure the severity of some of the common diseases of cereals. The percentage of farms surveyed (Table 1) was generally less than desired but it was felt that the number of samples obtained was sufficient to give some indication of loss. Major epidemics of diseases such as leaf rust are rarely seen in Alberta, possibly because rust resistant varieties are grown througout the prairies. Smut diseases of barley are also kept to a minimum because of the large acreage sown to 'Conquest' barley and because of the use of

Table 4. The distribution of diseases and yield losses in 49 fields of wheat inspected in central Alberta, 1970

Disease	Percentage of fields with disease	Distribution and losses due to disease
Common root rot	29	Slight occurrence in all Crop Districts. Losses estimated at over 6%.
Take-all	14	Slight occurrence in Crop Districts 8 (10 fields) and 11 (14 fields). One field with 1% loss.
Leaf spot (*Septoria* sp.)	40	Of moderate occurrence in all Crop Districts. Disease restricted to lower leaves. One field with estimated loss of 5%.
Ergot	31	Of moderate occurrence in Crop District 11 (14 fields). One field with ergot in one quarter of all heads. Quality losses greater than yield loss.
Mildew	6	Of moderate occurrence in Crop Districts 8 and 11. One field seen with mildew on upper leaves as well as lower leaves.
Leaf rust	14	Present only on lower leaves in Crop Districts 8 and 11.
Head discoloration (black chaff) (pseudo black chaff)	58	Melanosis of the head was severe in Crop District 11 (14 fields), where 18% loss in yield was calculated. Losses in two individual fields were calculated at 80%. A condition suspected to be black chaff was found in about one third of all fields seen, where it did not cause appreciable damage.

seed dressings. Smut was not seen in wheat. The relative freedom of wheat from diseases may be due to the relatively small acreage of wheat in northern and central Alberta as compared to barley and oats.

The loss of yield in a crop from a disease, as shown in Tables 3 and 4, is the cumulative value of all diseases in the crop. Under certain conditions this estimate of loss might be too high. An example is the loss suffered by barley affected with two major diseases such as root rot (20%) and leaf diseases (9.6%), where the actual reduction in yield would probably be less than the 29.6% calculated.

McDonald et al. (2) stated that the methods of relating disease intensity to yield losses selected from the literature are subject to more variability than other phases of a survey. This is especially the case where comparable losses in leaf area from barley plants grown under high and low fertilizer regimes have quite different losses in yield (3). If the sample is large enough, however, such variation should be minimized.

The loss in yield due to root rot in wheat and barley appears to be of significant importance. The rather high loss in barley might stimulate research into the development of varieties resistant to this disease.

Literature cited

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