LEAF RUST (Puccinia secalina). Tr. infection occurred on Storm rye in University plots, Vancouver, B.C. (H.N.W. Toms). One sev. diseased field was found in 6 examined in s. Alta. (J.S.H.) and 2-sl. and 1-tr. infections were found in 3/8 fields in central Alta. (W.P.C.). Tr. infection was found in 2/5 fields at Carlyle and s. of Swift Current, Sask. (H.W.M.).

SCALD (Rhynchosporium secalis). One field at Beaver Lodge had tr. infection in 8 examined in Alta. (W.P.C.).

SPECKLED LEAF BLOTCH (Septoria secalis). Infections were 2-sl. 2-mod. in 4/8 fields examined in Alta. (W.P.C.).

BACTERIAL BLIGHT (Xanthomonas translucens). A trace was reported from 1/6 fields examined in Alta. (J.S.H.).

CEREAL RUSTS IN CANADA IN 1956

T. Johnston, G.J. Green, B. Peturson and D.J. Samborski

The complete report was issued as Report No. 12 by the Plant Pathology Laboratory, Winnipeg, Man., in February 1957. Of the 15 tables in the original report only the first is reproduced as Table 4 in this condensation. Figure 3 is adapted from the map in the same report.

Cereal Rust Development in Western Canada in 1956

In 1956, several factors favorable to cereal rust development operated throughout Western Canada. Seeding was delayed, rainfall was frequent and above normal, heavy dews were frequent, and the prevailing temperatures were favorable for rust development. Despite these favorable factors, very little rust occurred on cereals in the Prairie Provinces and there was almost no rust damage.

The low incidence of cereal rusts can be attributed largely to two factors: the scarcity of spores in the air and the culture of rust resistant cereal varieties over large areas in the north central parts of the United States and in the eastern part of the Prairie Provinces.

The low incidence of air-borne rust spores in May and June was conditioned largely by drought in Texas and adjoining areas. Despite rather

widespread drought during the winter the rusts of wheat and oats overwintered in Texas along the Gulf coast and by the middle of March oat stem rust was general in the south central parts of the state and was considered to present a serious threat. Crown rust was prevalent though less widespread, and stem rust and leaf rust of wheat were present though less commonly. However, the intensification of drought conditions in April destroyed much of the rusted crop and prevented further rust development with the result that little inoculum was produced in Texas for distribution to more northerly areas. The spore content of the air over the winter wheat belt was low and little rust developed on winter wheats.

In Western Canada, air-borne rust spores were much less numerous than for many years. The reduction in numbers of leaf rust spores as compared with former years was most marked. The tabulation below gives the total numbers of spores of leaf rusts and stem rusts caught in June and July on each square inch of the slides exposed in spore traps at Winnipeg, Morden and Brandon in Man. and at Regina in Sask. for 1956, 1955 and 1954.

Year	Stem Rust	Leaf Rust
1956	105	334
1955	3,740	5,870
1954	70,900	192,800

The fact that almost the entire wheat and oat acreage in Man. and eastern Sask. was sown to rust resistant varieties in 1956 strongly militated against any rapid increase of such rust inoculum as was blown in from the south. However, owing to very favorable conditions for rust development there was a surprisingly rapid increase of oat stem rust on wild oats and of wheat stem rust on wild barley (Hordeum jubatum) after the end of July, and in late August there was considerable development of leaf rusts and stem rusts wherever susceptible wheat and oat varieties could be found.

Stem Rust of Wheat:

The first infections were found on 22 June on fall-sown and headed Kharkov wheat at the University of Manitoba, Winnipeg. Further development of stem rust was very slow as is indicated by the failure on 26 July to find stem rust in farmers' fields in a trip through southern Man. At that date, however, stem rust was present in small infection centres on susceptible wheats at the Experimental Farm at Morden. At the end of the season, stem rust was negligible in farmers' fields, but infection had become severe on some late-sown susceptible wheat and oat varieties in experimental stations in southern Man. In Sask. stem rust was first reported at Saskatoon on 12 July. Further increase of the rust was slow; a month later there was only a

light, though rather general, infection on wheat in the southern and west central parts of the province. Subsequently, a light to moderate infection developed, chiefly on durum wheat, in an area extending about 100 miles north from Swift Current. (See Fig. 1). In Alta., stem rust was first collected 13 July at Lethbridge. The chief subsequent rust development occurred in south-central Alta. Infection was mostly trace to slight though heavy infection was observed on Lemhi soft wheat in the Lethbridge, Vauxhall, Brooks, and Strathmore districts. Occasional cases of severe infection were found as far north as Castor and trace infection northwards to Vermilion and Clandonald.

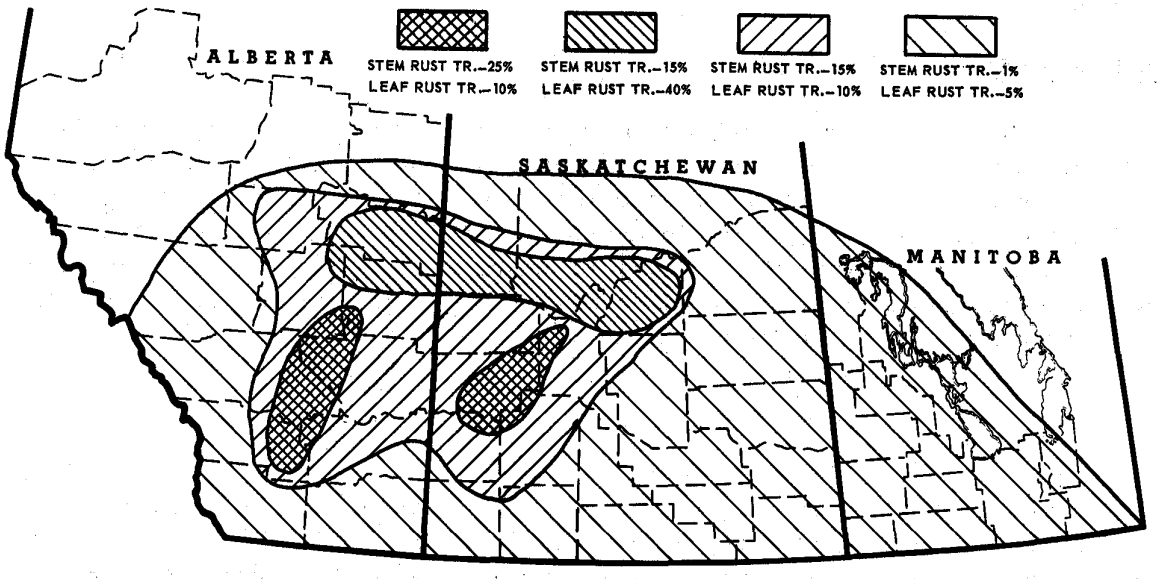

Fig. 1. Map of the Prairie Provinces showing approximate intensities of stem and leaf rust in 1956 on susceptible common wheat.

Leaf Rust of Wheat:

Two leaf rust pustules were found on Kharkov wheat on 17 May at the University of Manitoba, Winnipeg. The plots on which they occurred were heavily rusted in October, 1955 and were protected with a thick cover of snow from early November until spring. As numerous infections were found on these plots a few days later it is highly probable that the rust infection arose from overwintered spores and mycelium.

Apart from this outbreak the first infection of leaf rust was found near Winnipeg on 29 June, 16 days later than in 1955 and 13 days later than in 1954.

Further increase of leaf rust was very slow. On a trip through southern Man., 26-27 July, only a single leaf rust infection was observed in farmers' fields. At the middle of August infection was generally present in Man. but only in trace amounts. In Sask., at the same time, trace to slight amounts of rust were present throughout the southern part of the province, the incidence being greatest in the west central area where leaf-rust susceptible wheat predominates. Infection did not appear to be severe enough in any of the crops seen to cause appreciable damage. In Alta., leaf rust occurred at least as far north as Edmonton in light or trace amounts. At the end of the crop season, especially in Man., leaf rust infection increased considerably on late-sown susceptible varieties, as for example, in the rust nurseries at Brandon, Morden and Winnipeg.

Stem Rust of Oats:

Oat stem rust was first found on wild oats south of Winnipeg on 11 July, exactly three weeks later than in 1955. Owing to weather favorable to rust infection this rust increased rather rapidly on wild oats in southern Man., but it had little opportunity to develop in farmers' fields as the rust resistant varieties Rodney and Garry were grown on more than 80% of the Man. acreage seeded to oats. Infection diminished westwards but occurred in trace or light amounts as far west as Lacombe, Alta.

Crown Rust of Oats:

Crown rust was first seen near Winnipeg on wild oats on 10 July. The date of its appearance was nearly four weeks later than in 1955. At the middle of August crown rust could be found in most oat fields in southern Man. in amounts ranging from trace to 5%. Most oat fields seen were sown to the moderately resistant varieties Rodney and Garry. That late-sown, susceptible oat varieties might be damaged by crown rust infection was indicated by a 70% infection on late-sown Exeter at the Brandon Experimental Farm. Infection diminished westwards and was not reported west of central Sask.

Other Cereal Rusts:

Leaf rust of barley was found only in southern Man. in trace amounts. Trace and very light infections of stem rust of rye were found in a few places in Man. and Sask. and leaf rust of rye occurred in amounts diminishing from light or moderate in Man. to trace or light in areas west of central Sask.

Cereal Rusts and Other Diseases in the Rust Nurseries

A summary is given below of observations on diseases occurring on varieties of wheat, oats, barley and rye grown in 1956 in the uniform rust nurseries. These observations are recorded in Table 4.

The cereal varieties grown in the rust nurseries in 1956 were as follows: Wheat: McMurachy, Lee, Kenya Farmer, Little Club, Marquis, Mindum, Thatcher, Selkirk, Redman, Exchange and Frontana. Oats: Bond, Trispernia, Exeter, Garry, Clinton, Landhafer, and Rodney. Barley: Montcalm, Black Hulless, Vantage, and Feebar. Rye: Prolific.

Wheat Stem Rust:

In the rust nurseries in Western Canada, stem rust occurred in appreciable amounts only in those in Man. and at Indian Head, Sask., Lethbridge, Alta., and Creston, B.C. (Table 4). In Ont. and Que., there was moderate infection in the nurseries except at St. Catharines and Kapuskasing, Ont. and Normandin, Que. In the Maritime Provinces, infection was light or absent except at Kentville, N.S., where a moderate amount of rust developed.

The reaction of the varieties to rust calls for only a few comments. McMurachy carried appreciable rust infection only at Winnipeg and in several rust nurseries in Ont. and Que. where infection of 20 to 30% was common. Race analysis has shown that the infection was caused chiefly by races 29 and 48A. These same races caused infection on this variety in Eastern Canada in 1955 and in 1954. Before 1954 McMurachy was almost free from stem rust in the rust nurseries. Selkirk, though it is descended from McMurachy and contains rust-resistance genes derived from it, was almost free from stem rust at all points.

The rusting of McMurachy in Eastern Canada was evidently due to the presence of races 29 and 48A and its resistance in Western Canada was the result of the scarcity of these races in the respective areas. Presumably, the annual source of stem rust inoculum is the same -- the southeastern States and northeastern Mexico. But there is reason to suppose that a barrier of wheat varieties resistant to these races largely prevents their movement through the north-central States into Western Canada.

Lee, Thatcher, and Redman showed very little stem-rust infection at most places and Kenya Farmer and Frontana showed high resistance.

Table 4: Incidence of certain pathogenic fungi on wheat, oats, barley and rye at 35 locations in Canada in 1956.

Locality	WHEAT					OATS			BARLEY				RYE	
	P. gr. tritici	P. triticina	Erysiphe graminis	Septoria nodorum	S. avenae f. sp. triticea	P. gr. avenae	P. cor. avenae	S. avenae f. sp. avenae	P. graminis	P. hordei	Erysiphe graminis	S. passerinii	P. gr. secalis	P. secalina
Saanichton, B.C.	0	2	2	0	2	0	0	0	0	0	0	1	0	0
Agassiz, B.C.	0	0	-	0	1	0	0	3	0	0	0	0	0	0
Creston, B.C.	4	4	0	1	0	1	0	0	3	0	1	0	3	3
Beaverlodge, Alta.	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Edmonton, Alta.	1	1	1	0	0	1	0	0	0	0	0	0	0	1
Lethbridge, Alta.	2	2	-	1	3*	0	0	0	1	0	0	0	0	0
Lacombe, Alta.	1	2	0	0	4*	1	0	0	0	0	0	4	0	2
Scott, Sask.	1	2	-	-	-	2	0	-	1	0	-	-	0	0
Melfort, Sask.	1	3	0	2	0	1	1	0	1	0	0	3	0	1
Indian Head, Sask.	2	3	0	3	0	1	1	0	0	0	0	4	1	3
Dauphin, Man.	3	3	4	0	2	2	2	-	1	0	0	4	1	4
Brandon, Man.	3	4	0	2	3	3	4	0	1	0	0	4	1	4
Morden, Man.	4	4	0	0	4	4	2	2	1	1	0	4	1	4
Winnipeg, Man.	3	4	0	2	3	4	4	2	1	0	0	4	1	3
Fort William, Ont.	2	2	-	3	3	2	1	2	1	0	1	0	0	3
St. Catharines, Ont.	1	3	4	0	0	1	2	0	0	0	2	0	0	2
Guelph, Ont.	3	4	2	3	0*	4	4	2	1	4	4	1	1	4
Mindemoya, Ont.	3	4	0	0	0	3	4	2	1	2	3	0	2	3
Kemptville, Ont.	3	4	3	0	0	3	4	-	1	1	4	0	1	2
Ottawa, Ont.	4	4	-	2	2	-	4	-	-	4	-	-	0	2
Merrickville, Ont.	-	-	-	-	-	-	3	-	-	3	-	-	1	2
Appleton, Ont.	-	4	-	0	1	-	-	-	1	3	-	-	1	2
Williamstown, Ont.	-	4	-	-	-	-	-	-	-	3	-	-	-	3
Kapuskasing, Ont.	1	1	0	0	2	0	0	3	0	0	0	3	0	0
Macdonald College, Que.	4	4	2	2	0	2	3	0	2	4	4	-	1	4
Lennoxville, Que.	3	4	0	2	0	2	0	3	1	1	0	0	0	4
L'Assomption, Que.	4	4	-	0	1	2	1	3	1	0	1	3	0	2
Ste. Anne de la Poc., Que.	2	4	0	1	0	3	2	4	1	2	0	0	1	2
Normandin, Que.	0	3	-	0	2	0	0	4	0	2	0	4	0	2
Fredericton, N.B.	-	-	-	1	1	1	1	-	2	1	0	0	3	0
Kentville, N.S.	3	4	4	1	0	1	2	3	1	2	0	0	2	4
Pictou, N.S.	0	3	0	0	0	1	1	0	0	0	0	0	0	0
Nappan, N.S.	1	3	4	1	0	1	0	2	0	0	0	0	0	3
Charlottetown, P.E.I.	2	4	0	3	0	2	1	3	0	2	-	1	1	2
St. John's West, Nfld.	0	0	-	-	-	-	0	-	0	0	-	-	0	0

* Septoria tritici present on wheat.

Note: 1 = trace, 2 = light, 3 = moderate, 4 = heavy, - = no observations made
for the rusts 1 = tr - 1%. 2 = 2-20%, 3 = 25 - 50%, 4 = above 50%

Wheat Leaf Rust:

The considerable amount of leaf rust on susceptible varieties in the Western rust nurseries does not adequately reflect the fact that 1956 was a "light" rust year (Table 4). The rust nurseries were sown later than most farmers' fields and, consequently, leaf rust, despite its late arrival, had opportunities to develop considerably before wheat matured in the nurseries.

As pointed out in last year's report there was then evidence for an increase in Western Canada of races and biotypes capable of attacking Lee rather vigorously in the seedling stage. Despite the fact that such rust strains have shown further increase this year there was little leaf rust present on Lee in 1956 either in the rust nurseries or in farmers' fields. It seems likely, as stated elsewhere in the present report, that Lee has considerable mature-plant resistance which protects it, in the field, from severe rust infection.

A point of some interest is that Redman showed resistance at St. Catharines, Kemptville, and Appleton, Ontario; at Lennoxville, L'Assomption, Ste. Anne de la Pocatiere, and Normandin, Quebec; and at Pictou and Nappan, N.S., but was susceptible at certain other points in Eastern Canada, as at Guelph and Mindemoya, Ont., Macdonald College, Que., and Kentville, N.S. This variety has behaved similarly in past years. Presumably it is resistant where the rust is composed mainly of race 58 to which it is resistant.

The varieties Exchange and Frontana showed definite resistance at all stations.

Oat Stem Rust:

The distribution of rust races was definitely reflected in varietal reaction. Rather high percentages on Clinton were indicative of the high prevalence of race 7. That the race group 8-10-11 was much less common was indicated by the low percentages on Exeter. Race 7A, the only stem rust race to which Rodney is susceptible, was not sufficiently common to produce any appreciable amount of rust on it.

Crown Rust of Oats:

In the Western nurseries heavy infection occurred only in those at Brandon and Winnipeg, Man., and this rust was not found in nurseries west of Indian Head and Melfort, Sask. In Eastern Canada fairly heavy infection developed in the nurseries in eastern Ont., and at Macdonald College, Que., but elsewhere infection was light or absent.

Except at Mindemoya, Ont., there was little rust on Garry and Rodney and only a trace was found on the important breeding variety Landhafer. However, two races, 263 and 276, which attack Landhafer in the seedling stage were isolated from rust samples collected in the rust nurseries. Race 263 was found at Merrickville, Ont., and at Winnipeg whereas race 276 was found at Winnipeg only.

Rusts on Barley:

Stem rust caused severe infection on barley only at Creston, B.C. Although rye stem rust as well as wheat stem rust was heavy at this station it is clear, as a result of isolation studies, that the rust on barley was wheat stem rust, principally races 11 and 59. The only other stations at which appreciable stem rust infection occurred on barley were Macdonald College, Que. and Fredericton, N.B. At the latter place the infection was caused by rye stem rust as has been the case at this station in previous years.

Leaf rust of barley was seen at only 1 station in Western Canada but occurred at 14 stations in the Eastern provinces.

Infection by rye stem rust was absent or light except at Creston, B.C., and Fredericton, N.B.

Diseases Other Than Rusts

Powdery mildew (Erysiphe graminis) was seen on wheat in 9 out of the 23 nurseries on which observations were made for its presence (Table 4) but infection was severe only at 4 points: Dauphin, Man., St. Catharines, Ont., and Kentville and Nappan, N.S. Powdery mildew was observed on barley in 8 of 28 nurseries examined. Except for a trace infection at Creston, B.C., it was found only in the nurseries in Ont. and Que.

Speckled leaf blotch of barley (Septoria passerinii) was severe only in the nurseries in Man. and eastern Sask. and at Lacombe, Alta. It was less prevalent in Eastern Canada where it was found in only 5 of the 15 nurseries observed.

Speckled leaf blotch of oats (Septoria avenae f. sp. avenae) was found in 11 of the 14 Eastern Canada nurseries examined but in Western Canada it was found only at Winnipeg and Morden, Man., and at Agassiz, B.C.

In addition to the diseases recorded in Table 4 several others occurred in the rust nurseries but no systematic observations were made on them. Net blotch of barley (Helminthosporium teres) was found in only 2 stations in Eastern Canada (Fort William and Kemptville, Ont.) of 11 examined, but in Western Canada this disease was moderate or heavy in 4 stations (Creston, B.C., Melfort, Sask., and Brandon and Dauphin, Man.) out of 9 examined.