Cereals/Céréales

CROP: Barley, *Hordeum vulgare* L.

LOCATION: Manitoba

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TITLE: BARLEY FOLIAR DISEASES IN MANITOBA IN 1993

METHODS: Surveys of southern Manitoba barley fields were done between July 20 and August 31, 1993 to assess foliar disease incidence and severity. The 78 fields (66 six-rowed, 12 two-rowed) were selected at random along the survey routes depending on crop frequency and availability. Symptoms of disease on at least 10 plants were examined at each site along a diamond-shaped transect 25m per side begun a few paces within the field margin. Disease levels were estimated visually in both the upper (flag and flag -1 leaves) and lower canopies using a four category scale: trace (<5% leaf area affected), slight (5-15%), moderate (16-40%) and severe (41-100%). Infected leaves were collected at all sites and stored in paper envelopes. Subsequently small leaf sections were surface-sterilized and placed in petri dish moist chambers to promote pathogen sporulation and thereby disease diagnosis.

RESULTS AND COMMENTS: The 1993 growing season in Manitoba was very moist and somewhat cooler than normal. Foliar disease was evident in all fields surveyed and one or more pathogenic fungi were isolated from the infected leaves collected at each location (Fig 1.). Despite frequent rains, disease appeared to be influenced by the previous crop, and severities were noticeably higher in fields where barley straw was evident on the soil surface. Leaf spot ratings were: on upper leaves, trace in 23% of fields, slight - 47%, moderate - 26%, severe - 1%, and senesced - 3%; on lower leaves, trace - 3%, slight - 18%, moderate - 41%, severe - 30%, and senesced - 9%. Fields with moderate levels of spotting on upper leaves and severe levels on the lower ones, when sampled (1/4 to 1/3 of the total), were expected to suffer yield losses of about 20%. As found in 1992, *Pyrenophora teres* (net blotch) was the predominant pathogen isolated and was found in 94% of fields; *Cochliobolus sativus* (spot blotch) was found in 62%, and *Rhynchosporium secalis* (scald) in one field near Wellwood. The severity of scald in this field of 6-row barley was striking, representing the most severe level of the disease seen in Manitoba in many years. *Septoria passerinii* was not isolated from any leaf samples in 1993, continuing a trend noted in 1992, also a cool year. Based on visual symptoms, the net form of net blotch was the most important foliar disease of barley in Manitoba in 1993.

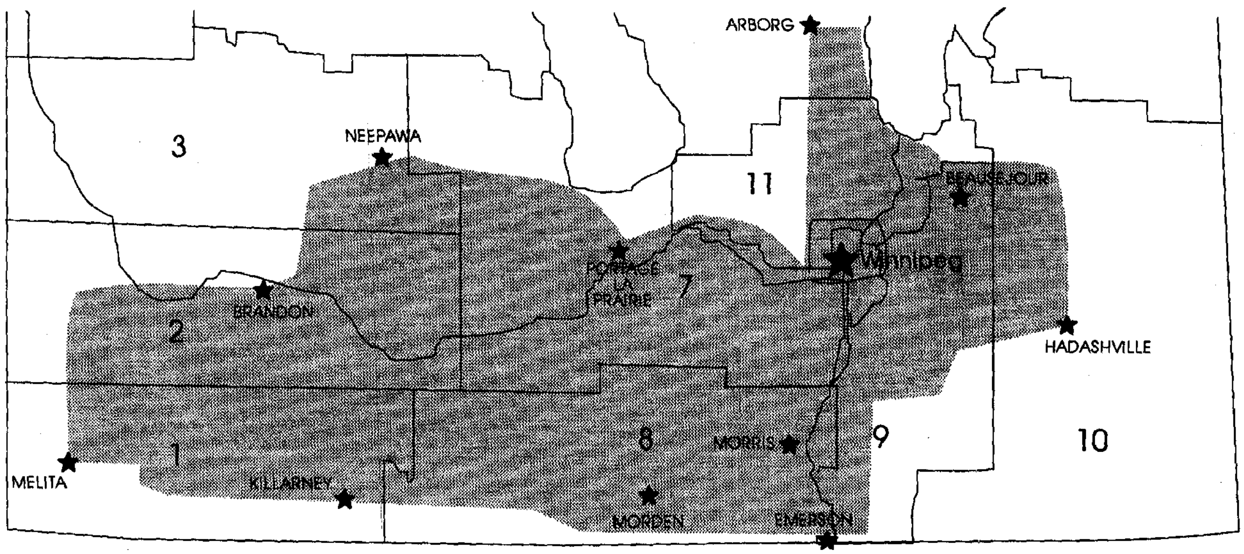

Figure 1. Area of southern Manitoba surveyed in 1993 for foliar diseases of barley.

CROP: Barley, *Hordeum vulgare* L.

LOCATION: Saskatchewan and Central Alberta

NAME AND AGENCY:

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TITLE: SASKATCHEWAN/CENTRAL ALBERTA BARLEY DISEASE SURVEY, 1993

METHODS: A barley disease survey was conducted in 90 fields in Saskatchewan and 43 fields in central Alberta between milk and hard dough growth stages. Random fields were assessed for the diseases present in a minimum sample of 10 plants taken at least 20 paces from the field edge. Diseases such as smut, ergot, take-all, and viruses were estimated for the percent incidence in either the plant sample or over the entire field. Common root rot was estimated by counting the number of plants in the sample that had lesions covering more than 50% of the sub-crown internode. Rust diseases were evaluated on the basis of both severity and infection type as described in the Cereal Methodology Manual (1986) published by CIMMYT. The remaining foliar and leaf spot diseases were assessed on a 0-11 scale (McFadden 1991). The scale was changed from the 0-9 range (Couture 1980) that was used in the previous four years to better reflect typical disease progression in the plant canopies of Saskatchewan.

Samples of diseased leaf tissue were plated to determine the causal agents of leaf spots. Dry leaves cut into 4 cm long segments were washed for one hour and disinfected for one minute with 0.5% Sodium hypochlorite. Three pieces were plated on water agar containing 100 mg/L streptomycin sulfate and 50 mg/L vancomycin hydrochloride. If enough leaf tissue was available, two petrie plates were prepared for each sample. The plates were incubated for one week under a mixture of black light, black-blue light, and cool white fluorescent light for 12 hours alternating light and dark at 20 C. The relative importance of causal agents was determined from their level of sporulation on infected leaf pieces.

Root tissues of 5-10 plants were sampled for the identification of *B. sorokiniana, Fusarium*, and *Gaeumannomyces graminis* var. *tritici* as root pathogens. The subcrown internodes and crowns were washed for one hour under running water, dried, disinfested with 0.5% sodium hypochlorite for 3 minutes, rinsed twice in sterile distilled water, and drained prior to plating on minimal medium containing 100 mg/L streptomycin sulfate and 50 mg/L vancomycin hydrochloride. The number of plants infected with red *Fusaria* and *B. sorokiniana* were recorded 7-9 days after plating. G. *graminis* var. *tritici* was isolated on semi-selective media (Juhnke *et al.* 1984) containing L-DOPA which produces a black pigmentation in the medium under the tissue that was infected. The lower one half inch of the main stem was washed for one hour under running water followed by surface sterilization with 1% silver nitrate for 30 seconds with two sterile water rinses and blotted dry before plating. The number of plants infected were recorded five days after plating. All plates were incubated at 20 C with 12 hours daylight.

RESULTS AND COMMENTS: There were 74 two-row and 59 six-row barley fields surveyed. The distribution, severity, and prevalence of diseases by crop districts are shown in Table 1. Leaf spots and common root rot were the most prevalent diseases and were found in more than 70% of the fields. The most important foliar disease was net blotch which occurred in 91% of the fields at moderate to severe levels. Trace to severe levels of scald occurred in 70% of the fields. Scald was most severe in the northern crop districts of Saskatchewan and crop districts bordering on central Alberta and Saskatchewan. The severity of scald in Alberta was lower than typically observed. Septoria leaf blotch was found in 11% of the fields at low levels. Smuts were found at trace levels in 14% of the fields. There was no leaf rust or stem rust. Low levels of powdery mildew, barley yellow dwarf virus, and ergot were rarely found. Take-all was not noted in any fields. In Alberta, there were two cases of barley leaf stripe both occurring on Jackson barley.

A summary of some common diseases indicated that two-row barleys in Saskatchewan were more susceptible to net blotch, scald, common root rot, and smut infections than the six rows (Table 2). Also, two-row barleys were more common. In Alberta, six-row barleys were more common and were more resistant to net blotch but **less** resistant to scald and common root rot than the two-row types.

In Saskatchewan six-row barley, samples from 14 fields showed that the net form of net blotch *(Pyrenophora teres)* was the most important leaf spot disease occurring in 10 fields while the spot form was a causal agent in 5 fields. *B. sorokiniana* (spot blotch) was causal agent in 5 fields, *Septoria nodorum* was the causal agent of spots in 8, and *S. tritici* in one. Samples from 32 fields in Census District 8 in Alberta, showed that *P. teres,* (net form) was a causal agent in 30, *B. sorokiniana* in 2, and *S. nodorum* in 7 fields. Based on symptoms, scald was an important disease in 14 fields.

Leaf samples from 36 Saskatchewan fields of two-row barley indicated that the net form of net blotch *(P. teres)* was a casual agent in 31 fields, the spot form of net blotch in 4, and spot blotch *(B. sorokiniana)* in 9. *S. nodorum* was a causal agent in 16 fields and *P. tritici-repentis* originated from lesions in one field sample. There was one field of mixed two- and six-row barley where the major foliar disease was the net form of net blotch. In Census District 8 from Alberta samples from 11 fields showed that *P. teres,* (net form) was the causal agent in 10 fields and *B. sorokinana* in 2. Based on symptoms, scald was an important disease in 8 fields.

Root isolations indicated that *B. sorokiniana* was the most frequent species (67% in two-row, 48% in six-row), followed by red *Fusaria* (30% in two-row, 22% in six-row). *G. graminis* var. *tritici* was isolated from 11% of the plants in both types of barley. Although take-all was not identified by field symptoms, plating indicated take-all occurred in 39% of the barley fields surveyed. The same proportion of fields with take-all occurred in both two- and six-row barley. The highest frequency of take-all occurred in Saskatchewan crop districts 3 (57% of the fields), 4 (50% of fields), 7 (57% of fields), and 9 (63% of fields). Crop district 5 had the lowest proportion of fields with take-all in barley (17%) although take-all was found in 70% of the wheat fields surveyed in the same district. In Alberta, take-all was found in 35% of the fields.

Observations were recorded on previous cropping history in both the barley and wheat disease surveys in 1991-1993 for Saskatchewan and 1993 for Alberta (Table 3). The most common rotations in Saskatchewan were a cereal crop followed by a cereal (42%), summerfallow followed by a cereal (38%), and a non-cereal (such as canola, peas, flax, canary seed, alfalfa, sunflower, or grass) followed by a cereal (20%). In Alberta there was very little summerfallow (1%) and continuous cereals were more prevalent (67%) than diversified rotations (32%). Based on the average leaf spot ratings in barley over three years in Saskatchewan, leaf spot diseases increased under continuous cereal rotations (severity rating of 7.1) when compared with summerfallow or diversified rotations (both 6.7). Diversified rotations reduced the severity of root rots (22%) more so than the other traditional rotations (27% for summerfallow and 25% for continuous cereals). Leaf spot diseases and root rot severities did not decrease under the diversified rotations in Alberta but this interpretation is based on only one year of data.

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Table 1. Distribution, severity, and prevalence of barley diseases in Saskatchewan and Alberta fields surveyed between milk to hard dough stages in 1993.

CROP District	No. Fields	NET BLOTCH	SCALD	CCR %	SMUT %	LEAF RUST	STEM RUST	POWDERY MILDEW	BYDV %	ERGOT %	TAKE-ALL %	SEPTORIA
SASKATCHEWAN												
1A	1	10.0/*	011	3711	011	011	011	011	011	011	011	3.011
16	3	6.313	TR/1	3513	TRII	013	013	013	TR/1	013	013	011
2A	2	8.0/2	511	3012	TR/1	012	012	012	012	TRII	012	012
2B	2	7.0/2	012	1311	012	012	012	012	012	012	012	2.011
3AN	0											
3AS	2	9.5/2	012	012	012	012	012	012	012	0/2	0/2	012
36N	3	8.2/3	7.0/1	2013	013	013	013	013	013	013	013	TRII
3BS	2	8.312	7.012	1012	012	012	012	012	012	012	012	1.0/1
4A	0											
46	2	9.0/1	7.0/1	3012	TR/1	012	012	012	012	012	012	TR/1
5A	6	6.3/6	6.3/6	3115	016	016	016	016	TR/1	016	016	2.812
5B	6	7.9/6	7.916	2715	TR/1	016	016	016	016	016	016	016
6A	6	8.916	8.9/6	3713	0.512	016	016	016	016	016	016	016
6B	12	8.9/9	10.016	21/12	019	019	019	019	019	019	019	9.012
7A	0											
76	7	9.5/6	8.713	2017	017	0/7	017	0/7	0/7	0/7	0/7	0/7
8A	9	4.7/9	3.3/7	1717	019	019	019	1.012	019	019	019	0.2/1
86	19	6.5119	5.0/18	41/14	0119	0119	0119	0.2/1	0119	0119	0119	1.0/4
9A	5	10.015	10.015	6313	015	015	015	015	015	015	015	015
9B	3	9.013	9.0/3	5012	013	013	013	013	013	013	013	013
Average or total	90	8.1/85	7.5/68	30/72	TR/6	0190	0190	0.613	TR/2	TRII	0190	2.4/14
ALBERTA												
8	43	7.6136	5.2126	30.0143	TR/12	0143	0143	TRII	0143	TRII	0143	0143

* *Average disease rating (0-11 scale, McFadden 1991) / number of fields affected.*

Table 2. Distribution and severity **of** some common diseases **of** two and **six** row barleys in Saskatchewan and Alberta in 1993.

Crop District	Row Type	No. Fields	Net blotch	Scald	CRR %	Smut %
SASKATCHEWAN						
1	2	4	8.2/4*	TR/1	3614	TR/1
	6	0				
2	2	4	7.314	511	2113	TR/1
	6	0				
3	2	7	6.917	7.014	1515	017
	6	0				
4	2	2	9.011	7.011	3012	TR/1
	6	0				
5	2	7	6.517	6.517	2716	016
	6	5	8.715	8.715	3514	TR/1
6	2	12	9.4111	9.5/10	2719	111
	6	6	8.314	8.415	2016	016
7	2	7	9.5/6	8.713	2017	017
	6	0				
8	2	16	6.6116	5.6116	20112	0116
	6	13	5.1/13	3.9110	16/10	0113
9	2	5	10.515	10.515	5713	015
	6	3	8.513	8.513	2512	013
Average	2	64	8.2164	7.5151	28/51	0.314
or total	6	27	7.7126	7.4123	24122	TR/1
ALBERTA						
8	2	11	8.119	4.8110	20111	0111
	6	32	7.1/27	5.6116	40132	TR/12

* Average disease rating (0-11 scale, McFadden 1991)/number of fields affected.

Table 3. Effect of previous crop on leaf spot and common root rot severity ratings of wheat and barley grown in Saskatchewan from 1991-1993 and in Alberta in 1993.

Previous crop	Current crop	Number of fields				Leaf spot rating (0-11)				Common root rot (%)			
		A93	S93	S92	S91	A93	S93	S92	S91	A93	S93	S92	S91
Summer-fallow	Cereal	1	98	60	113	7.0	8.9	5.1	5.8	20	21	21	22
	Barley	1	20	25	47	7.0	8.9	4.7	5.7	20	26	25	30
	Wheat	0	78	35	66	0.0	8.9	5.5	5.9	0	16	16	15
Cereal	Cereal	42	83	84	131	8.1	9.0	5.3	5.9	4	25	18	19
	Barley	30	31	26	45	7.3	9.1	5.5	6.2	4	29	20	25
	Wheat	12	52	58	86	8.8	8.9	5.1	5.7	3	20	16	14
Other*	Cereal	20	38	41	56	8.7	7.9	4.3	5.8	5	20	23	24
	Barley	10	13	11	20	8.9	7.1	4.7	6.3	1	22	29	26
	Wheat	10	25	30	36	8.4	8.7	3.8	5.2	9	17	17	22

* includes canola, canary seed, alfalfa, peas, flax, sunflower, and grass.

CROP: Barley and Wheat

LOCATION: Manitoba

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TITLE: FLAME CHLOROSIS IN MANITOBA IN 1993

BACKGROUND: Surveys for flame chlorosis (FC), a soil-borne, virus-like disease of spring cereals (1,2,6) have documented its spread and apparent intensification since it was first observed in western Manitoba in 1985 (1). Although FC has been observed causing major crop losses only in barley, it has been confirmed in wheat and oat (2), triticale (3) and two grassy weed species (4). In 1993, unusually wet conditions throughout the growing season made it difficult for extension personnel (who assisted in earlier surveys) to examine a similar number and geographic extent of fields as included in the surveys conducted from 1990-1992. However, locally very high disease incidences in wheat and barley were observed near Niverville in the Red River Valley, and in barley near Shoal Lake in western Manitoba. We took advantage of this circumstance to sample soil and the roots of FC seedlings for putative soil-borne fungal vectors of the virus-like FC agent.

METHODS: Specimens of FC plants from fields where the disease was observed were forwarded promptly to the Plant Pathology Laboratory of Manitoba Agriculture to confirm the diagnosis (2). Some of the putative FC-positive specimens, and those specimens which could not be diagnosed with certainty as FC-positive on the basis of visual symptoms were tested by dot-blot assay for FC-specific RNA (5) to confirm the diagnosis independently.

Soil and seedling root tissue were sampled for putative fungal vectors as described previously (2,6). Isolates of *Pythium* spp. were cultured in artificial media and mycelial nucleic acid extracts analyzed by dot-blot hybridization with FC-RNA (5,6).

RESULTS AND COMMENTS: The smaller number of sites examined in 1993 did not allow us to develop an epidemiological map similar to those presented in this publication in 1992 and 1993 (7). Nonetheless, results from the sites that were examined and the specimens submitted fit the distribution of the disease noted since 1990: the Brandon-Neepawa-Shoal Lake triangle in western Manitoba, and the Red Riwer Valley south and east of Winnipeg are the principal FC areas. These are regions where the combined frequencies of barley and wheat cropping are such that there is little scope for fallowing or rotation to non-cereal crops (2).

Earlier observations suggesting that the FC agent might be soil-transmitted to leaf and root initials during early germination rather than to established root systems had prompted us to examine *Pythium* spp. (6). The preliminary analysis of isolates from sites with high disease levels (Table 1; Ref. 6), suggests *Pythium* spp. may play a role in transmitting the virus-like FC agent.

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Table 1. Association of *Pythium* spp. containing FC-RNA with sites having high levels of FC-diseased plants.

Isolate No.	Taxon	Plant host	Geographic origin	FC at site	Hybridization with FC-RNA **
BR 629	*P.irregulare*	cucumber	Edmonton, AB	(-)	(-)}abundant
BR 630	*P.irregulare*	cucumber	Edmonton, "	(-)	(-)}ds RNA
SH 1	*P.ultimum* G1*	barley	Foxwarren, MB	(+)	(++)
SH 5-C	*P.ultimum* G1	barley	Niverville "	(+)	(+)
SH 7	*P.ultimum* G1	barley	Niverville "	(+)	(+)
SH 9	*P.ultimum* G2	barley	Niverville "	(+)	(+)
SH 12	*P.arrhenomanes*	barley	Minnedosa "	(+)	(++++)
SH 14	*P.ultimum* G1	barley	Minnedosa "	(+)	(+/-)
SH 20	*P.ultimum* G1	wheat	Niverville "	(+)	(+)
SH 21	*P.ultimum* G1	barley	Niverville "	(+)	(+)

* G1 and G2 are morphologically different globose forms of vegetative mycelium and are designations that distinguish these asexual isolates.

** (-)...no detectable hybridization; (+/-)...borderline detection
(+)...faint signal; (++++)....very strong signal, ca. 1000x (+).

CROP: Barley, Oat, and Wheat

LOCATION: Maritime Provinces

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TITLE: DISEASES OF CEREALS IN THE MARITIME PROVINCES, 1993

METHODS: Disease severity of spring cereals was monitored in northwestern New Brunswick (St. John's River Valley), Nova Scotia, and Prince Edward Island. Winter cereals were observed in the Annapolis Valley of Nova Scotia and in Prince Edward Island.

RESULTS: **Barley:** Incidence of foliar diseases was variable with some fields exhibiting severe disease levels while other fields of the same cultivar exhibited low to moderate disease levels. Scald (*Rhynchosporium secalis*) was more severe than usual due to high rainfall and low temperatures during the early summer. At the higher disease severity levels, significant yield loss may be attributed to this disease. Net blotch (*Pyrenophora teres*) was of normal severity with moderate to severe infection levels in most fields. This disease appeared late in the growing season and yield losses recorded in fields with severe diseases. Trace amounts of stripe (*Pyrenphora graminea*) were found only in experimental barley plots.

Wheat: Septoria leaf and glume blotch (*Septoria nodorum*) were more severe than usual in 1993. Severe leaf infection was attributed to wet weather in the early summer. When the drier weather of late summer and maturity approached, poor root development associated with the wet weather of early summer, combined to incite a type of 'early dying syndrome' in which maturity was hastened and the crops exhibited a lowering of yield and quality. Fusarium head blight (*Fusarium graminearum*) resulted in downgrading of spring milling wheats to feed grades. This reduction in quality was more noticeable with the more susceptible cultivars, e.g., Roblin. Severity of powdery mildew (*Erysiphe graminis*) was cultivar dependent.

Winter wheats survived the winter better in 1992-1993 than in the previous year. Powdery mildew continues to be severe on the susceptible milling wheats produced with high nitrogen fertility. Some downgrading of milling wheat to feed wheat was also attributed to fusarium head blight.

Oats: Septoria speckled leaf blotch (*Septoria avenae*) was of normal severity. Crown rust was found more frequently than normal. BYDV was not found in field surveys in 1993.

CROP: Barley, Oat and Wheat

LOCATION: Manitoba and Saskatchewan

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TITLE: CEREAL SMUT SURVEY, 1993

METHODS: In July 1993, cereal crops were surveyed for *Ustilago hordei, U. nigra, U. nuda, U. tritici, U. avenae,* and *U. kolleri* in Manitoba and Saskatchewan. The area was covered by routes from Winnipeg-Swift Current-Kindersley-Yorkton-Winnipeg (thanks to N. Howes and G. Hamilton) and Winnipeg-Yorkton-Prince Albert-Swan River-Winnipeg, as well as one day trips north and south of Winnipeg. Fields were selected at random at approximately 15 km intervals, depending on the frequency of the crops in the area. An estimate of the percentage of infected plant (i.e. plants with sori) was made while walking on ovoid path of approximately 100 m in each field. Levels of smut greater than trace were estimated by counting plants in a 1 m^2 area at at least two sites on the path. *U. nuda* and *U. nigra* were differentiated by observing germinating teliospores with a microscope.

RESULTS: See Table 1. Smut was found in 62% of the fields of barley, 24% of the common wheat, 72% of the durum, and 3% of the oat. The average levels were 0.7% for barley, 0.3% for durum wheat, 0.1 for common wheat, trace for oat. The most smut observed at any one site was 3% loose smut, 2% false loose and 7% covered smut in one field of barley near Neepawa, Manitoba.

COMMENTS: The amount of smut in cereals remains relatively low, reflecting the low moisture levels of recent years. The increase of smut in common wheat is due to an increase in production of susceptible semi-dwarf cultivars.

Table 1. Incidence of smut in cereals in Manitoba and Saskatchewan in 1993.

CROP	NO. FIELDS	SMUT SPECIES	% FIELDS AFFECTED		MEAN % OF INFECTED PLANTS	
			MB	SK	MB	SK
Common wheat	233	*U. tritici*	29	19	0.1	0.1
Durum wheat	51	*U. tritici*	67	74	tr*	0.4
Oat	34	*U. avenae*	5	0	tr	0
		U. kolleri	0	0	0	0
Barley	186	*U. nuda*	74	48	0.6	0.3
		U. hordei	6	8	0.2	0.1
		U. nigra	5	2	0.1	tr

* tr = less than 0.1%

CROP: Barley, Oat and Wheat

LOCATION: Manitoba and Eastern Saskatchewan

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TITLE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 1993

METHODS: Surveys of fields and nurseries of barley, oat and wheat for incidence and severity of stem rust (*Puccinia graminis* Pers. f.sp. *tritici* Eriks. & E. Henn. and *P. graminis* f.sp. *avenae* Eriks. and E. Henn.) were conducted in Manitoba in July and August, 1993. Samples for race identification were obtained from fields and trap nurseries in the four western provinces.

RESULTS AND COMMENTS: The incidence of stem rust was very light on all three cereals in the prairie region in 1993. All oat and wheat cultivars recommended for the rust area are resistant to stem rust, and no losses were expected. Infections of susceptible lines in nurseries also were lower than normal, with maximum levels of 30% for wheat stem rust and 10% for oat stem rust. Infections of wild oat also were light. In commercial barley fields, maximum levels of infections were 1%, with no losses. About 30-40% infection levels developed on wild barley later in fall. A number of collections from wild barley were rye stem rust (*f. graminis* f.sp. *secalis* Eriks. & E. Henn.). Rye stem rust also is virulent to barley, but to date few collections from cultivated barley have been identified as rye stem rust.

There were no significant changes in virulence in oat or wheat stem rust in 1993. In oat stem rust, races NA27 and NA29 predominated. These races are differentiated only by virulence or avirulence to gene *Pg15*. For wheat stem rust, race TPM was the main race collected from lines of susceptible wheat in nurseries. Race QCC predominated in collections from cultivated barley, and from wild barley both races TPM and QCC were more equally represented.

CROP: Oat, ***Avena sativa*** L.

LOCATION: Quebec

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TITLE: AN OUTLINE OF DISEASES OF OATS IN QUEBEC IN 1993

METHODS: Most experimental sites of cereals and a number of fields in Quebec were visited at least once in the period from mid-July to mid-August. At each visited site, diseases were identified and their severity was assessed in all oat lines and cultivars grown there. Plant samples were also collected at random from field crops at various locations and were examined in the laboratory. Growth stages of plants at the times of assessment or sampling ranged from medium milk to medium dough.

RESULTS AND COMMENTS: The monthly average temperatures in May, June, July and August were about normal. But most drastic changes to the growth season occurred in the precipitation records: 40% above normal in June, 35% below normal in July and 35% above normal in August.

Moderate levels of speckled leaf blotch (***Stagonospora avenae***) were observed although its occurrence was general. In the Eastern Townships, infections reached severe levels and caused more damage than elsewhere, especially in late planted material.

Crown rust (*Puccinia coronata*) was found more consistently than usual, but small amounts were detected at most sites. The highest severity occurred as usual in the south-west part of the province and symptoms were such that it was the most important disease there and significant damage was caused.

Stem rust (*Puccinia graminis*) presence was not noticed at any site visited, as usual.

Foliage symptoms of yellow dwarf (Barley Yellow Dwarf Virus) were found throughout the province but were more or less limited in severity. They were up to moderate levels in the Saint-Hyacinthe region. Infection appeared to have come late in most areas and caused not much damage.

Oat blast (white empty florets) was noticeable at moderate levels in the Saint-Hyacinthe region. Its occurrence was not so important elsewhere.

No change in smut diseases (*Ustilago* spp.) was noticed in farmers fields as compared to last year. The lessening seed treatment quality and the general decrease of the seed treatment practice are a concern.

CROP: Oat, ***Avena sativa*** L.

LOCATION: Manitoba and Eastern Saskatchewan

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TITLE: CROWN RUST OF OAT IN WESTERN CANADA IN 1993

METHODS: Surveys for oat crown rust incidence and severity were conducted in Manitoba from mid-July to late August, 1993, and in eastern Saskatchewan in mid-August. Crown rust collections were obtained from wild oat (***Avena*** *fatua* L.) and commercially grown oat in field surveys, and from susceptible and resistant oat lines grown in uniform rust nurseries. Rust nurseries were composed of susceptible lines, single-gene lines with resistance gene *Pc48* or *Pc68*, and common cultivars Dumont and Robert, both having *Pc38* and *Pc39*. The nurseries were located near Arborg, Brandon, Emerson, and Morden, Manitoba, and Indian Head, Saskatchewan. For virulence phenotype (race) identification, rust collections were established on a susceptible cultivar, Makuru. Eighteen single-gene lines, carrying *Pc35*, *Pc38*, *Pc39*, *Pc40*, *Pc45*, *Pc46*, *Pc48*, *Pc50*, *Pc54*, *Pc56*, *Pc58*, *Pc59*, *Pc60*, *Pc61*, *Pc62*, *Pc63*, *Pc64*, and *Pc68* were used as differentials.

RESULTS AND COMMENTS: The outbreak of oat crown rust in Manitoba in 1993 was the most severe in the last ten years. Significant levels of crown rust infections were observed in susceptible oat in mid-July, indicating that the inoculum was present early. Despite cool weather conditions during most of the growning season, crown rust was widespread throughout southern Manitoba, and traces of crown rust were found as far west as Indian Head, Saskatchewan. By mid-August, crown rust severities of 70-100% were commonly found in susceptible oat in uniform rust nurseries and in wild oat, and severities of 20-80% in commercial farm fields. Most of the oat cultivars grown likely had both resistant genes *Pc38* and *Pc39*. The heaviest crown rust infections were observed in the Red River Valley, and late-sown fields likely suffered significant losses to crown rust in 1993.

To date, 125 single-pustule isolates, comprising 77 virulence phenotypes, have been established from collections of susceptible oat and wild oat. Fifty of the isolates, in 31 virulence phenotypes, were virulent to the currently recommended cultivars Dumont, Riel, Robert, AC Marie, and **AC** Belmont, all having crown rust resistance based mainly on the gene combination *Pc38* and *Pc39*. Genes *Pc48* or *Pc68* are individually being incorporated into common cultivars which have both genes *Pc38* and *Pc39*, i.e. to develop cultivars with reistance that is enhanced with *Pc48* and/or *Pc68*. In 1993, several isolates were obtained that were virulent to the gene combination *Pc38*, *Pc39* and *Pc48*, but none of the isolates analysed were virulent to the gene combination *Pc38*, *Pc39*, and *Pc68*, and combination *Pc38*, *Pc39*, *Pc48*, and *Pc68*.

CROP: Wheat

LOCATION: Quebec

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TITLE: DISEASES OF WHEAT IN QUEBEC IN 1993

METHODS: The incidence of major diseases of wheat was recorded on different lines and cultivars of spring wheat grown at 12 localities within the regions of Montreal, Saint-Hyacinthe, Lennoxville, Deschambault, Quebec, La Pocatiere and Lake St-John. Winter wheat was observed in the Montreal, Saint-Hyacinthe and Quebec regions. Disease severity assessment was made during the late milk to soft dough stages. Fusarium head blight was also assessed in 11 farmers' fields distributed throughout the county of Saint-Hyacinthe by counting the percentage of heads and spikelets infected by the pathogen.

RESULTS AND COMMENTS: Incidence of powdery mildew (*Erisiphe graminis)* was very low this year. Only very light infections were recorded on very susceptible cultivars in the Saint-Hyacinths and Lennoxville areas.

Leaf spots *(Pyrenophora tritici-repentis*), mixed later in the season with *(Phaeospharia nodorum),* were widespread in all regions but were most severe at the Deschambault and Lennoxville regions.

Glume blotch *(Phaeospharia nodorum)* was observed at low intensities only at the Lennoxville, Quebec and Lake St-John regions.

Leaf rust *(Puccinia recondita*) was widespread this year towards the end of the season. Infections were serious on the very susceptible cultivars Algot, Mondor and Opal. An outbreak of stem rust (*Puccinia graminis)* occured for the first time since many years in all the regions except at Lennoxville. Pustules on the leaves were mixed with those of leaf rust.

Fusarium head blight (*Fusarium graminearum*) was widespread but the intensity of infections varied greatly not only from one region to another but from one locality to another in the same region depending on weather conditions during the flowering periods. The most severe infection recorded was at St-Cesaire, in the Saint-Hyacinthe region, where more than 50% heads were counted in the very susceptible lines. Serious infections also occured in the Lake St-John's region where, in certain localities, farmers' fields were not harvested since levels of vomitoxine measured before harvest were higher than 7 p.p.m. Less than 1% infected heads were observed in the plots at Saint-Hyacinthe, Macdonald College, Deschambault and Pintendre. Infection levels in the 11 farmers' fields surveyed in the county of Saint-Hyacinthe were as follows: 0.1% infected spikelets (1% heads) in fields of Aquino and Max, 1.4% spikelets (11% heads) in a field of Messier, 0.4% spikelets (4% heads) in a field of the winter wheat Augusta, 16.5% spikelets (24% heads) in a field of Roblin and 7.8% spikelets (70% heads) in a field of winter wheat Clara.

Loose smut (*Ustilago tritici*) was at very low levels on certain lines in all regions.

Take-all *(Gaeumannomyces graminis)* and ergot (*Claviceps purpurea*) were again restricted to the northern region at very low intensities.

Winter survival in winter wheat was good this year in south western Quebec.

CROP: Wheat, *Triticum aestivum* L.

LOCATION: Manitoba

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TITLE: FOLIAR DISEASES OF SPRING WHEAT IN MANITOBA IN 1993

METHODS: Surveys for diseases of spring wheats were conducted in southern Manitoba between 16 July and 23 August 1993. Leaves were collected from 160 fields (112 common, 19 durum, 29 semi-dwarf) between heading and soft dough stages of development. Severity of disease on upper and lower leaves was categorized as 0, TR, 1, 2, 3 or 4, with 4 describing dead leaves and 1 lightly affected. Samples of diseased leaf tissue were surface sterilized and placed in moisture chambers for 5-7 days to promote pathogen sporulation and disease identification.

RESULTS AND COMMENTS: Abundant rain throughout the growing season promoted leaf-spotting diseases in fields across the surveyed area in 1993 (Fig. 1). One or more pathogens were isolated from most fields. Disease severity levels were moderate (2) on upper leaves and moderate to severe (2-3) on lower leaves. The pathogens, *Septoria nodorum,* S. *tritici,* and S. avenae f.sp. *triticea* (septoria leaf blotch complex), *Pyrenophora tritici-repentis* (tan spot), and *Cochliobolus sativus* (spot blotch) were isolated from 97.5%, 53.8, and 47.5% of fields, respectively (Table 1). High levels of rainfall favored development of *S. tritici* for a second year while incidence of C. *sativus* remained at lower levels compared to 1989-1991. Incidence of septoria leaf blotch was more than 90% in 1993, accounting for 68% of the pathogenic fungi isolated (Table 1). The increase is most likely due to higher rainfall in the past few years in combination with conservation tillage practices. Tan spot was found at lower levels than in 1992.

Some 36% of Manitoba wheat graded feed in 1993 due to shrivelling caused by *S. nodorum* and to presence of tombstone kernels caused by fusarium head blight. Losses due to S. *nodorum* are estimated to approach 30 million dollars.

Table 1. Frequency of diseases identified in 160 wheat fields in Manitoba in 1993.

	DISEASE				
	SEPTORIA LEAF BLOTCH				
WHEAT TYPE	*NODORUM*	AVENAE	*TRITICI*	TAN SPOT	SPOT BLOTCH
Common	90.2	19.6	63.4	50.1	44.6
Semi-dwarf	89.7	6.9	51.7	65.5	44.8
Durum	63.2	5.3	26.3	52.6	52.6
Total Fields	139	8	91	86	76
Fields(%)	86.9	5.0	56.9	53.8	47.5
Isolations(%)	41.1	3.5	23.4	18.7	13.3

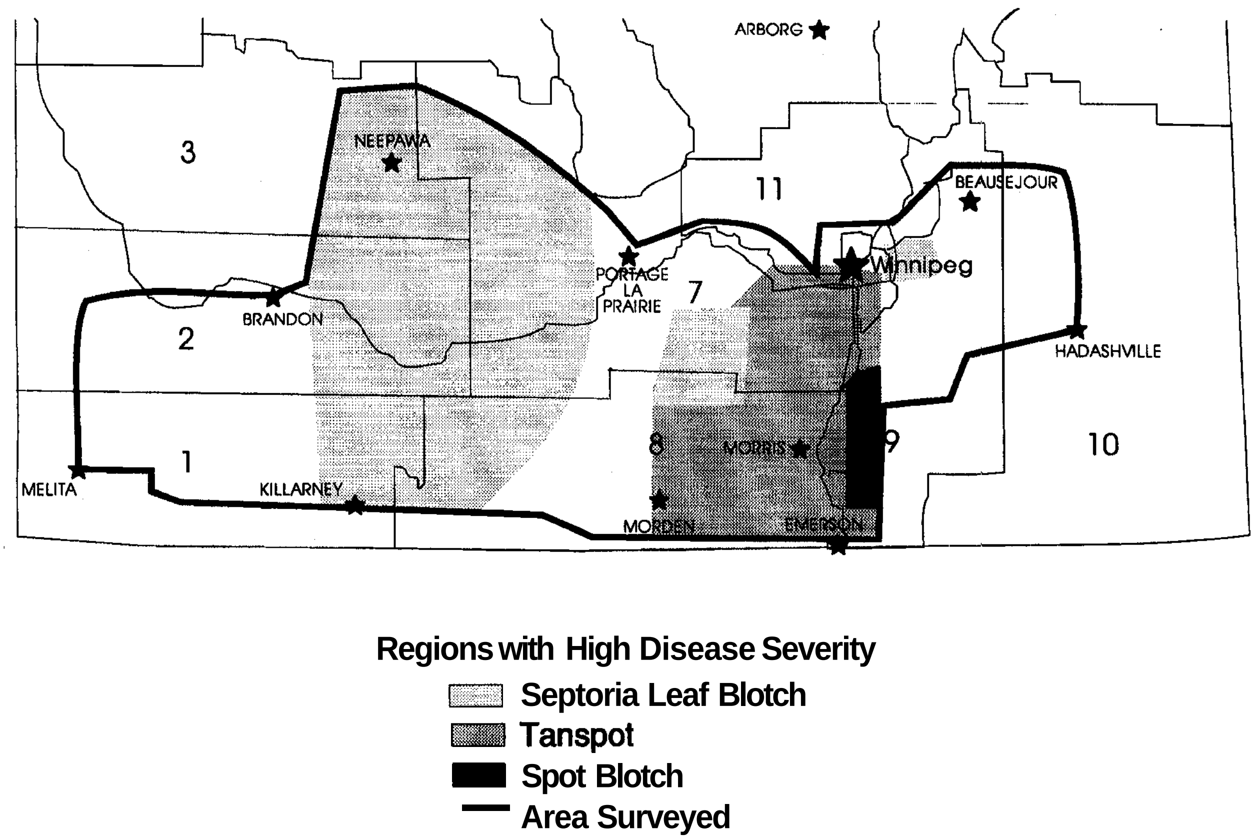

Figure 1. Crop districts surveyed and distribution of foliar pathogens in 1993.

CROP: Wheat, *Triticum aestivum* L.

LOCATION: Manitoba

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TITLE: OCCURRENCE OF FUSARIUM HEAD BLIGHT IN MANITOBA IN 1993

METHODS: A survey for fusarium head blight (FHB) in spring wheat fields was conducted in southern Manitoba between 20 July and 31 August 1993. Heads were examined in 129 fields (94 common, 8 durum, 27 semi-dwarf) between watery-ripe and medium dough stages of development. The percentage of heads affected with blight was estimated in each field. Kernels from sampled heads were surface sterilized and incubated on potato dextrose agar under continuous cool white light for 5-7 days to promote pathogen sporulation to confirm diagnosis and to aid in species identification.

RESULTS AND COMMENTS: Southern Manitoba experienced the most severe epidemic of FHB on record in 1993. This likely resulted from the above normal levels of precipitation throughout the growing season. Blighted heads were found in 96.1% of wheat fields examined and occurred throughout the surveyed area (Fig. 1). FHB was found in 97.9% of common, 88.9% of semi-dwarf, and 100.0% of durum wheat fields. Severity ranged from trace to 5% of heads infected west *of* Portage la Prairie and east of Beausejour. The more severely infested fields (20 to 80 % heads affected) were found in the Red River Valley and adjacent regions in crop districts 7 and 8 (Fig. 1). Severity levels in all wheat classes were similar. *Fusarium graminearum* was the principal causal species accounting for 88.2% of isolations (Table 1).

According to the Canadian Grain Commission, 7% of Manitoba wheat graded sample account tombstone; 36% graded feed. Assuming that 50% of wheat graded feed resulted from FHB it is estimated that the cost of the epidemic was approximately 75 million dollars.

Table 1. Fusarium species isolated from spring wheat in southern Manitoba in 1993.

FUSARIUM SPP.	ISOLATIONS (%)
F. graminearum	88.2
F. culmorum	0.1
F. avenaceum	6.3
F. poae	1.2
F. sporotrichioides	2.3
Related species	
Pseudomicrodochium	1.8

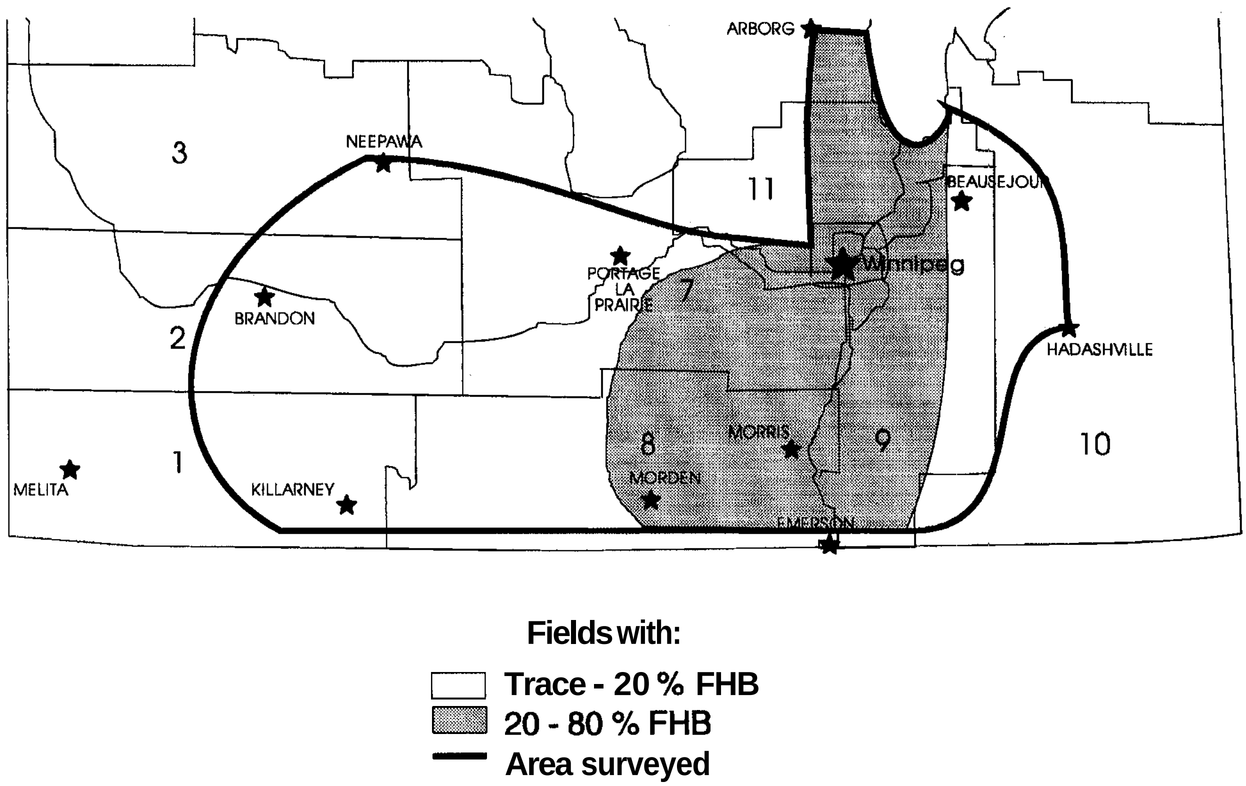

Figure 1. Crop districts surveyed for fusarium head blight in 1993.

CROP: Wheat, *Triticum aestivum* L.

LOCATION: Eastern Prairies

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TITLE: WHEAT LEAF RUST IN MANITOBA AND EASTERN SASKATCHEWAN IN 1993

METHODS: Trap nurseries and commercial farm fields in southern Manitoba and eastern Saskatchewan were surveyed for leaf rust incidence and severity from June to August, 1993.

RESULTS AND COMMENTS: Wheat leaf rust was first detected in 1993 during the second week of June, in winter wheat plots at Portage la Prairie, Manitoba. However, the lack of southerly winds in June and July reduced the initial amount of inoculum and slowed the general rate of leaf rust increase. By the first week of July, leaf rust was present only in trace amounts at scattered locations throughout southern Manitoba. By the first week of August, leaf rust had increased to light to moderate severity levels in fields of Katepwa, Neepawa, and Biggar in Southern Manitoba. Leaf rust levels were very low in fields of the resistant cultivars Roblin, Columbus, Pasqua, and Grandin. The severity of leaf rust infection on susceptible cultivars was significantly lower in eastern Saskatchewan. Only trace levels of rust could be found in Saskatchewan. Losses were not expected in this area.

CROP: Wheat, *Triticum aestivum* L.

LOCATION: Saskatchewan and Central Alberta

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TITLE: SASKATCHEWAN/CENTRAL ALBERTA WHEAT DISEASE SURVEY, 1993

METHODS: A province wide survey for wheat diseases in Saskatchewan was conducted by sampling 190 wheat fields between milk and hard dough growth stages. Twenty-two wheat fields were surveyed in the region around Lacombe, Alberta (Census District 8). Disease was assessed in random fields on a sample of 10 plants taken at least 20 paces from the field edge. Diseases such as smut, ergot, take-all, and viruses were estimated for percent incidence in either the plant sample or over the entire field. Common root rot was estimated by counting the number of plants in the sample that had lesions covering more than 50% of the sub-crown internode. Rust diseases were evaluated on the basis of both severity and infection type as described in the Cereal Methodology Manual (1986) published by CIMMYT. The remaining foliar and leaf spot diseases were assessed on a 0-11 scale (McFadden 1991). The scale was changed from the 0-9 range (Couture 1980) that was used in the previous four years to better reflect typical progression of disease in the plant canopies of Saskatchewan.

Samples of diseased leaf tissue were plated to determine the causal agents of leaf spots. Dry leaves cut into 4 cm long segments were washed for one hour and disinfected for one minute with 0.5% sodium hypochlorite. Three pieces were plated on water agar containing 100 mg/L streptomycin sulfate and 50 mg/L vancomycin hydrochloride. If enough leaf tissue was available, two petrie plates were prepared for each sample. The plates were incubated for one week under a mixture of black light, black-blue light, and cool white fluorescent light for 12 hours alternating light and dark at 20 C. On the basis of sporulation on the leaf surface, estimates were made on the importance of the following causal agents: *Septoria nodorum*, *S. tritici*, *S. avenae* f. sp. *triticea*, and *Pyrenophora tritici-repentis*. *Bipolaris sorokiniana* was noted on some leaf samples but was rarely a pathogen.

Root tissues of 5-10 plants were sampled for identification of *B. sorokiniana*, *Fusarium*, and *Gaeumannomyces graminis* var. *tritici* as root pathogens. The subcrown internodes and crowns were washed for one hour under running water, dried, disinfested with 0.5% sodium hypochlorite for 3 minutes, rinsed twice in sterile distilled water, and drained for plating on minimal medium containing 100 mg/L streptomycin sulfate and 50 mg/L vancomycin hydrochloride. The number of plants infected with red *Fusaria* and *B. sorokiniana* were recorded 7-9 days after plating. *G. graminis* var. *tritici* was isolated on semi-selective media (Juhnke *et al.* 1984) containing L-DOPA which produces a black pigmentation in the medium under the tissue that was infected. The lower one half inch of the main stem was washed for one hour under running water followed by surface sterilization with 1% silver nitrate for 30 seconds with two sterile water rinses and blotted dry before plating. The number of plants infected were recorded five days after plating. All plates were incubated at 20 C with 12 hours of daylight.

RESULTS AND COMMENTS: There were **181** hexaploid and **31** durum wheat fields surveyed. Their distribution by crop districts, and severity and prevalence of the diseases are shown in Table **1.** The most prevalent diseases were leaf spots **(92 %** of fields moderately to severely infected), common root rot **(69%** of fields with some severely infected plants), glume blotch (trace levels in **54%** of fields), and leaf rust (light infections in 30% of fields). Take-all symptoms occurred in **17%** of fields, mostly in the central districts of Saskatchewan and Alberta. The incidence of take-all in these fields ranged from less than **1%** up to **75%.** Low levels of powdery mildew were observed in 5% of the fields surveyed and of smuts in **7%.** Fusarium head blight was only observed in **3** fields. Other head discolorations caused by prematurity blight, *Alternaria*, and *Cladosporium* were also noted but were not estimated.

In Saskatchewan, the order of importance of the major leaf spotting pathogens on wheat from highest to lowest was *fyrenophora tritici-repentis* (tan spot), *Septoria tritici,* and *S. nodorum* (Table **2).** In Census District **8** of Alberta, **S.** *tritici* was the most important pathogen. Hard Red Spring (HRS) wheat and Canadian Prairie Spring (CPS) wheat were identified in samples from Crop Distrists 5A, 5B, and **6A.** For the **23** HRS samples the importance of *S. nodorum, S. tritici,* and *P. tritici-repentis* was **20%, 40%,** and **40%,** respectively, while for the **9** CPS samples the importance of the three pathogens was **19%, 32%,** and **49%,** respectively. *fyrenophora tritici-repentis* was the most important leaf spotting pathogen on durum wheat (Table **3).**

The pathogen most frequently isolated from roots was *B. sorokiniana* **(58%** in hexaploids, **62%** in durums), followed by red *Fusaria* **(30%** in hexaploids, **35%** in durums), and take-all **(9%** in hexaploids, **13%** in durums). White *Fusaria* were observed more frequently in hexaploids **(12%)** than in durums **(3%).** Take-all was confirmed in **33%** of the fields surveyed and occurred in equal proportions in the durum and hexaploid fields sampled. In Saskatchewan, the crop districts with the highest frequency of fields with take-all were C.D. **1 (64%)**, 5 **(70%),** and **9 (55%).** In Alberta, only **27%** of fields had take-all confirmed by plating. On average, take-all was confirmed in about twice the number of fields than were identified by field symptoms.

In Saskatchewan in **1993,** 50% of the wheat fields surveyed that followed summerfallow, **34%** followed another cereal crop, and **16%** followed a diversified rotation with the previous crop being either canola, peas, flax, canary seed, alfalfa, sunflower, or grass. The severity of leaf spots for each type of rotation was **8.9, 8.9,** and **8.7,** respectively. The tendency for leaf spots to decrease under diversified rotations is more apparent when three year averages from **1991-1993** are compared (see Table **3** in Bailey *et a/.* **1994.** Saskatchewan/Central Alberta Barley Disease Survey, **1993. Can** *Plant Dis. Surv.* **Vol. 74).** During the three years, **38%** of wheat crops followed summerfallow, **42%** followed cereals, and **20%** followed a diversified rotation. The average leaf spot ratings for these same rotations were **6.8, 6.6,** and **5.9.** In Alberta in **1993,** cropping histories differed and no previous summerfallowing was observed in the **22** fields surveyed. However, similar trends in leaf spot diseases were noted for the cereal and diversified types of rotations. The leaf spot ratings of wheat following a cereal **(55%** of the fields) was **8.8** and wheat following a non-cereal crop **(45%** of the fields) was **8.4.** Root rot severity was unaffected by the type of rotation in either province.

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Table 1. Distribution, severity, and prevalence of wheat diseases in Saskatchewan and Alberta fields surveyed between milk and hard dough stages in 1993.

Crop District	No. Fields	Leaf spot	Leaf rust	CRR %	Powdery mildew	Glume blotch	Ergot %	Smut yo	Take-all %	BYDV %	Head blight%	WSMV (%)
SASKATCHEWAN												
1A	4	5.8/4	5MR/3	2514	014	TR-214	1.0/1	014	TR/1	014	014	TR/2
1B	7	5.7/7	2MR/2	2717	0/7	CR	0/7	TR/2	TR/5	0/7	Off	TR/1
2A	10	7.0/9	2MR-5MS/8	2715	0110	1014	TR/1	TW2	TR/1	0110	TR/2	0110
2B	11	7.7/9	0111	3613	0111	TR/5	0111	TR/2	1-7512	0/11	211	0111
3A	3	6.4/3	15M/1	013	013	013	013	111	013	013	013	013
3B	36	9.7136	1MR-5MS/6	17/28	0136	1.2131	TR/1	TR/1	0136	0136	0136	0136
4A	0											
4B	7	8.5/7	Off	2714	0/7	1.2/4	an	an	0/7	0/7	0/7	0/7
5A	18	6.4118	1MR/5	31/14	0118	TR/8	TR/1	TR/2	TR-8111	0118	0118	TR/1
5B	10	8.7/10	TR/2	1714	0110	0.9/8	0110	0110	0110	0110	0110	0110
6A	10	9.1110	0110	1715	0110	4.413	0110	0110	0110	0110	0110	0110
6B	13	10.0113	TR/1	19113	0113	TR/9	0113	0113	0113	0113	0113	0113
7A	0											
7B	11	9.4/11	3MR/2	2019	0111	TR/5	0111	0111	6011	0111	0111	0111
8A	17	5.1/17	1MR-R/1	719	0.812	1.4/11	0117	TR/1	0117	0117	0117	0117
8B	22	7.419	5MR-R/4	21111	0.3/2	1.5115	0122	TR/1	0122	0122	0122	0/22
9A	8	10.018	1MS/1	2918	018	TR/3	018	018	018	018	018	018
9B	3	10.713	TR/2	6013	TR/1	TR/3	013	013	013	013	013	013
Average or total	190	8.0/174	1MR-5MS /56	251127	0.615	1.7 /113	TR/4	TR/12	TR-75 /21	01190	1.1/3	TR/4
ALBERTA												
8	22	8.8122	4MR/2	60119	2615	1.0/1	TR/1	TR/2	TR/14	0122	0122	0122

* average disease rating (0-11 scale, McFadden 1991) / number of fields affected

Table 2. Estimation of the percentage of leaf-spotting fungi on leaf samples of hexaploid wheat collected in Saskatchewan and in Census District 8 in Alberta in 1993.

CROP DISTRICT	NO. OF FIELDS	% OF LEAF-SPOT FUNGI / # OF FIELDS WHERE OCCURRED			
		SEPTORIA NODORUM	*S. TRITICI*	*PYRENOPHQRA TRITICI-REPENTIS*	*BIPOLARIS SOROKINIANA*
Saskatchewan					
1A	3	0/3	72/3	28/3	0/1
1B	5	6/3	65/5	27/5	2/4
2A	3	0/1	50/3	42/4	0/0
3BS	8	30/7	35/8	69/8	0/1
4B	5	22/5	5/3	73/5	0/3
5A	17	13/16	45/17	42/17	0/8
5B	10	26/1	38/10	36/10	0/6
6A	10	23/10	36/10	41/10	0/4
6B	13	17/12	33/11	40/12	10/6
7B	11	20/11	42/11	38/11	0/4
8A	1	50/1	0/0	10/1	40/1
8B	9	39/7	22/6	39/7	0/1
9A	8	21/8	46/8	33/7	0/4
9B	3	23/3	23/2	54/3	0/1
Alberta	22	29/21	68/20	3/2	0/3

Table 3. Estimation of the percentage of leaf-spotting fungi on leaf samples of durum wheat collected in Saskatchewan in 1993.

CROP DISTRICT	NO. OF FIELDS	% OF LEAF-SPOT FUNGI / # OF FIELDS WHERE OCCURRED		
		SEPTORIA NODORUM	*S. TRITICI*	*PYRENOPHORA TRITICI-REPENTIS*
1A	1	60/1	30/1	10/1
1B	2	0/2	0/0	100/2
2A	2	5/1	2/1	93/2
3BS	8	11/4	2/4	87/8
3BN	9	7/4	1/1	92/9
4B	3	0/1	0/0	100/3
5A	1	15/1	0/0	85/1

CROP: Winter Wheat

LOCATION: British Columbia

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TITLE: NORTH OKANAGAN/SHUSWAP WINTER WHEAT DISEASE SURVEY, 1993

METHODS: Twenty fields of winter wheat (including 3 variety or registration trials) in the north Okanagan and Shuswap areas of British Columbia were surveyed from July 12 to 15, 1993 for dwarf bunt (*Tilletia controvers*). Incidence of bunt was estimated where necessary by counting at least 200 heads along a row in two locations per field. Leaf samples were also collected for diagnosis of foliar diseases based on observation of sporulation. Samples of bunt from each field were sent to the Agriculture Canada Central Plant Health Laboratory in Nepean, Ontario, for confirmation of the bunt species involved.

RESULTS AND COMMENTS: Dwarf bunt was detected in 18/20 fields (90%) at some level (Table 1). Eight fields had estimated bunt levels of 10% or higher, including two fields in which bunt levels were at least 50%. Twelve fields (60%) had estimated bunt levels of 1% or higher. Dwarf bunt was previously known to occur in the Armstrong-Enderby area, however the extent of the infested area has never been determined. In this survey the disease was also found north of Salmon Arm near Tappen and in the area north of Vernon, although at less damaging levels. Dwarf bunt levels in individual fields are influenced by the level of soil infestation, planting date, and cultivar of wheat.

Tan spot (*Pyrenophora tritici-repentis*) was the predominant foliar disease. It was found in all fields surveyed, generally at low to moderate levels of severity. Leaf blotch (S. *nodorum*) was detected in only 3/20 fields. Stem rust (*Puccinia graminis* f.sp. *tritici*) was detected in 12/20 fields, generally at trace to low levels. Two fields of later maturing wheat had moderate to severe levels of stem rust. Minor Hessian fly damage was noted in 2 fields near Enderby.

Table 1. Dwarf bunt infested fields by location.

LOCATION OF FIELDS	NUMBER OF FIELDS SURVEYED	NUMBER OF FIELDS WITH DWARF BUNT	NUMBER OF FIELDS WITH >10% INCIDENCE OF DWARF BUNT
Vernon	2	1	0
Larkin	4	4	1
Armstrong	9	8	5
Enderby	3	3	2
Tappen	2	2	0
Totals	20	18	8