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Inventaire des maladies des plantes au Canada

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CONTENTS

The *Canadian Plant Disease Survey* is a periodical of information and record on the occurrence and severity of plant diseases in Canada and on the assessment of losses from disease Other original information such as the development of methods of investigation and control, including the evaluation of new materials, will also be accepted Review papers and compilations of practical value to plant pathologists will be included from time to time

L'inventaire des maladies des plantes au Canada est un périodique d'inforrnation sur la fréquence des maladies des plantes au Canada, leur gravité, et les pertes qu'elles occasionnent. La redaction accepte d'autres communications originales notamment sur la mise au point de nouvelles methodes d'enquête et de lutte ainsi que sur l'évaluation des nouveaux produits. De temps à autre. il inclut des revues et des syntheses de rapports d'intérêt imrnediat pour les phytopathologistes.

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FOREWORD

This issue of the Canadian Plant Disease Survey includes a compilation of plant disease survey results for the 1991 crop year. This is the fifth year the Canadian Phytopathological Society and Research Program Service, Research Branch, Agriculture Canada have undertaken this co-operative project.

The Society recognizes the continuing need for publication of plant disease surveys which benefit both Federal and Provincial agencies in planning appropriate research for the control of plant diseases. These surveys become an intrinsic part of the literature of plant pathology in Canada.

The publication of this report depends upon voluntary contributions by Canadian plant pathologists and the collation of the survey results by experts familiar with the diseases of the major crop categories. The survey is published annually in the spring issue of "Canadian Plant Disease Survey". To meet publication deadlines all the results are due to the collators by the first of December. Instructions for submissions and forms are available from the collators. The list of collators is appended.

We wish to thank the contributors and collators who devoted their time to the production of this publication, and look forward to future contributions.

L.W. Stobbs
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Canadian Plant Disease Survey Compilers

AVANT-PROPOS

Ce numero de I'lnventaire des maladies des plantes au Canada contient les resultats compiles d'etudes effectuees sur les maladies des plantes pour la campagne agricole de 1991. C'est la cinquieme annee d'un projet entrepris par la Societe canadienne de phytopathologie et le Service aux programmes de recherche de la Direction generale de la recherche d'Agriculture Canada.

La Societe reconnaît la necessite de publier ces resultats sur lesquels s'appuient les organismes federaux et provinciaux pour planifier les travaux de recherche qui s'imposent pour lutter contre les maladies des plantes. De plus, ces etudes viennent enrichir incontestablement la documentation sur la pathologie des plantes au Canada.

La publication de ces rapports est realisable grâce a la contribution benevole de phytopathologistes canadiens et au collationnement de leurs resultats par des specialistes des maladies des grandes cultures. On trouvera en annexe la liste des analystes faisant le collationnement. Comme la publication des resultats se fait chaque annee dans le numero du printemps de l'Inventaire des maladies des plantes au Canada, les rapports doivent être remis aux analystes avant le 1er decembre. On peut s'adresser a eux pour obtenir les formulaires et la marche a suivre pour presenter ces rapports.

Nous tenons a remercier tous les contributeurs et analystes, qui ont consacré une grande partie de leur temps a la production de cette publication annuelle des resultats des etudes sur les maladies des plantes et esperons vous compter de nouveau parmi nos collaborateurs.

L.W. Stobbs
Nationale Coordonnateur

H. Krehm
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Compilateurs

First report of halo spot of barley caused by *Pseudoseptoria stomaticola* in Alberta

S.W. Slopek[1] and T.J. Labun[2]

In 1987, halo spot caused by Pseudoseptoria stomaticola (syn. Selenophoma donacis var stomaticola) was found on barley, cv. Harrington, near Innisfail, Alberta. The disease has been found in the province every year since and appears to be increasing in prevalence. The disease, however, remains a minor pathogen of barley in Alberta.

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En 1987, la tache ocellee causee par *Pseudoseptoria* stomaticola (syn. Selenophoma donacis var Stomaticola a ete trouve sur un cultivar d'orge Harrington, pres d'lnnisfail, en Alberta. Depuis la maladie a ete observee dans la province a chaque année et semble être de plus en plus frequente. Quoi qu'il en soit, la maladie demeure un pathogene mineur de l'orge en Alberta.

Introduction

Halo spot of barley can be caused by either *Pseudoseptoria* donacis (Pass.) Sutton (syn. Selenophoma donacis (Pass.) Sprague and Johnson) or *Pseudoseptoria stomaticola* (Bauml.) Sutton (syn. Selenophoma donacis var stomaticola (Bauml.) Sprague and Johnson) (2,6). *P.* donacis has been reported on barley (*Hordeum* vulgare L.), in Australia (30,33), New Zealand (1), Europe (1) and South Africa (26). P. stomaticola has been found on barley in Canada (3,23,24), the United States (22), New Zealand (32), Italy (27) and Finland (31). In Canada, there have been no confirmed reports of P. donacis (3). P. stomaticola has been reported on *H.* vulgare in Prince Edward Island, Nova Scotia and Saskatchewan (4) as well as on Secale cereale L. in Manitoba, *Triticum aestivum* L. in Saskatchewan and a number of grasses throughout Canada (3), including Hordeum *jubatum* L. near Beaverlodge, Alberta (5). This is the first report of P. stomaticola on H. vulgare in Alberta.

P. stomaticola can be differentiated from P. donacis primarily by spore size. *P.* stomaticola spores are falcate, aseptate (1,25), variable, 10-20 x 1-3 µm (3,6,22,25), occasionally up to 25 µm long (22,251. P. donacis spores are stoutly falcate to boomerang-shaped, 18-35 x 2.0-4.5 µm (22,25). The fungus overwinters on crop residue and secondary spread is by rain-splashed spores that ooze out of pycnidia during wet periods (6).

Leaf spots caused by Pseudoseptoria are generally considered minor diseases of barley (6,7,8,14,15,16) although epidemics have been observed in south-west England (9) and Norway (10). Halo spot can cause yield losses of 0.6 t/ha and thousand kernel weight reductions of 2.9 g in a susceptible cultivar (28). The susceptibility of barley to halo spot depends on the growth stage of the plant. Brokenshire and Cooke (12) found that plants are susceptible at tillering, more resistant at stem elongation and highly susceptible at heading. Effective control of halo spot has been obtained with benomyl, thiophanate-methyl (13), carbendazim and propiconazole (28). Cultivars differ in resistance (29,33,34) and some are immune to some isolates of the pathogen (29).

Observations

In 1987, halo spot symptoms were observed on barley, cv. Harrington, near Innisfail, Alberta and subsequently identified as *P.* stomaticola (DAOM 210660) by Dr. J. Bissett of the Centre for Land and Biological Resources Research in Ottawa. The disease has been also found every year since and appears to be increasing in prevalence and intensity.

Observed halo spot symptoms have been consistent with previous reports. Lesions on leaves are square or rectangular with characteristic grey-white centres with purple margins with rows of pycnidia almost always observed within the lesions (Fig. 1). Lesions coalesce forming irregular shapes under high disease pressure (Fig. 2). Lesions on the awns (Fig. 3) are similar to those observed on the leaves and are occasionally abundant (Fig. 4). Cooke and Brokenshire (11) reported that typical halo spots were not observed on awns, only small necrotic areas. In Alberta, it has been observed that lesions on stems and awns of some cultivars, in particular the cv. Winchester, usually do not have grey-white centres.

In 1987, halo spot symptoms were observed at trace levels in a cultivar evaluation trial conducted at Olds, Alberta on cultivars Bonanza, Diamond, Harrington, Johnston, Klages, Otal and Samson but not on Empress, Leduc and Heartland. In 1988, halo spot was found in fungicide efficacy trials conducted near Crossfield (17) and Olds (18), Alberta. At growth stage (GS) 13 (21), at the Crossfield site, 48% of the leaves had halo spot. At GS 75 halo spot was present on the top two leaves in all of the treatments and

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was in fact the predominant disease on the flag leaves in some of the treatments. Halo spot was also found at Olds in 1989 (19,20).

In 1990, Ciba-Geigy Canada conducted a barley leaf disease monitoring program in the Parkland area of Alberta ranging from Crossfield in the south to Barrhead and Bonnyville in the north. Sixty fields were monitored. Halo spot was reported in three fields; one near Ponoka on cv. Noble and the other two near Penhold on cv. Harrington.

In addition to the monitoring program, two fields near Olds were examined. A survey of a field of Harrington barley near Olds was conducted at GS 55. The percent leaf area diseased was assessed using diagrams developed for assessing halo spot (11). A total of twenty-five stems were collected from five locations along an inverted "V" pattern through the field. Percentage leaf area diseased by halo spot and scald (*Rhynchosporium secalis* (Oud.) J.J.Davis), were assessed on the top three leaves. Disease levels on the flag-2, flag-I and flag leaves were 0.1, 1.1 and 0.6 for halo spot and 2.0, 0.9 and 0.2 for scald. These results are consistent with comments by Cooke and Brokenshire (11) that upper leaves appear to be more susceptible than lower leaves. At GS 87/92 a field of barley, cv. Winchester, was evaluated for awn damage resulting from halo spot infection. Ten heads were collected along a transect at ever twenty-five paces. The area of diseased awn averaged 8.8%.

Although the prevalence of this disease appears to be increasing it remains a minor pathogen of barley in Alberta. Epidemics of halo spot may occur in the future because inoculum levels appear to be increasing and many of the present cultivars are susceptible to the pathogen.

Acknowledgements

We thank Grace MacDonald, a summer employee with Ciba-Geigy, for her keen eye. The peculiar leaf disease symptoms which she observed and brought to my (SWS) attention were subsequently identified as halo spot infections. We also thank Dr. J. Bissett for identifying the fungus.

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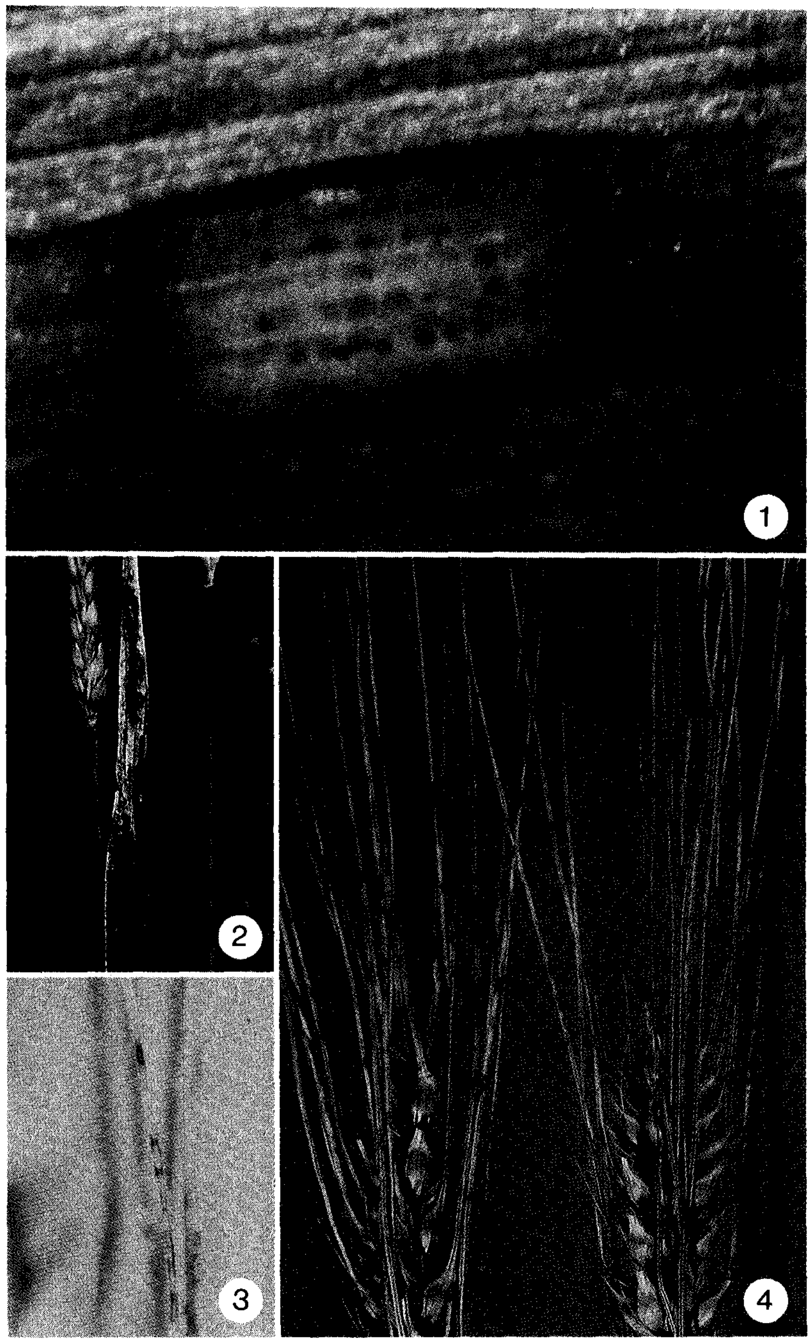

Fig. 1. Halo spot lesion on a barley leaf. Rows of pycnidia are visible within the lesion.

Fig. 2. Coalescing lesions of halo spot on flag leaf of barley, cv. Harrington at GS 73.

Fig. 3. Halo spot lesions on a barley awn.

Fig. 4. Severe infection of barley awns by halo spot.

Response of cultivars and breeding lines of *Phaseolus vulgaris* L. to the black pod fungus, *Alternaria alternata* in southwestern Ontario

J.C. Tu and S.J. Park[1]

From 1981 to 1983, seventy to eighty commercial cultivars, breeding lines, and plant introduction lines of beans were tested for resistance to black pod disease caused by *Alternaria alternata* (Fr.) Keissler. The different degrees of susceptibility and resistance of these cultivars and lines are reported in this paper.

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Depuis 1981 jusqu'à 1983, environ soixante-dix a quatre-vingt cultivars commerciaux, de lignees genealogiques et lignees genealogiques introduites de haricots furent evaluees pour leur resistance a la brûlure alternarienne causee par *Alternaria alternata* (Fr.) Keissler. Les differents degres de susceptibilite et de resistance de ces cultivars et de ces lignees sont discutes dans ce rapport.

Introduction

Black pod disease of common beans (*Phaseolus vulgaris* L.) was discovered by Tu (1982). The causal organism, *Alternaria alternata* (Fr.) Keissler, is a weak parasite which colonizes the cavities of stomata of the actively growing plants (Dickinson and O'Donnell, 1977; Dickinson and Bottomley, 1980). In the fall, when senescence of plants begins and leaves and pods turn yellow, the fungus starts to flourish and tissues show a black mouldy appearance. Severely infected pods turn black and seeds from diseased pods often show varying degrees of grey discoloration (Tu and Park, 1983). The disease is widespread in southwestern Ontario, and each year losses due to 'pickers' and seed discoloration are estimated at 2 to 3 million dollars (Tu *etal.*, 1988). Approximately 63% of Ontario-produced dry beans were infected and/or infested with *Alternaria* spp. of which 56% was *A. alternata* (Tu, 1989). Fall rains that delay the harvest exacerbate this disease (Tu *et al.*, 1988). Seed discoloration reduces quality and marketability of white beans.

The control of black pod disease by chemical spray has been investigated and the results indicated that the fungus was tolerant to benomyl, dichloran and chlorathalonil but was sensitive to iprodione (Tu, 1983). Unfortunately, application of iprodione to control this disease is costly and not economically feasible. Furthermore, it may have adverse environmental implications. Measures other than chemical means are being examined to manage this disease. Early seeding and use of early maturing cultivars were suggested to ensure that harvesting could be completed before the arrival of the rainy season in the fall (Tu *etal.*, 1988). Alternatively, the disease might be controlled or alleviated by using resistant cultivars, since there were indications that some cultivars tended to have less severe symptoms (Tu and Park 1983). A series of screening trials were conducted to evaluate the susceptibility of some cultivars and lines in an effort to identify plants which might be of value to develop resistant cultivars.

Materials and methods

The cultivars, breeding lines, and plant introduction lines, that were submitted to the Ontario Cooperative Bean Variety Trial, were seeded in experimental plots at the Harrow Research Station. The experiments were conducted in 1981, 1982, and 1983. Each year, between seventy to eighty cultivars and lines were tested in completely randomized block design in four replications, each with 2 row-plots. The beans were seeded in the last week of May or first week of June, depending on weather and soil conditions. The disease developed naturally in field plots every year, usually starting in mid-season (late July) and progressively worsened toward maturity. Disease severity was scored on a 0-9 scale which corresponded to percentages of total leaf area with disease symptoms (i.e. 0 = 0-10%, 1 = 11-20%). The disease severity readings for leaves and stems were made between August 31 and September 15, and between September 15 and 21 for pods.

Results and discussion

The results (Table 1 and 2) showed that fifty-five commercial cultivars, breeding lines, or plant introduction (P.I.) lines had a disease severity rating of 0 to 4 indicating a high to moderate resistance to this disease in southwestern Ontario. Many of the resistant cultivars (Table 1) are currently recommended cultivars and could be adopted readily into commercial production in Ontario while the others along with breeding lines and P.I. lines (Table 2) could be used by breeders in the development of resistance to this disease. Resistance to *A. alternata* infection would contribute to the reduction in incidence and

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severity of Alternaria black pods and consequently reduce the 'pickers' and seed discoloration.

The present results should be helpful to growers, breeders, seed companies, and the Ontario bean industry.

Acknowledgement

The authors wish to thank the individuals and companies for supplying the seed used for testing.

Table 1. Response of cultivars of common beans to *Alternaria alternata* infection in southwestern Ontario.†

Disease Severity Index‡ (0-9 scale)	Cultivar*
0.0 - 1.0	Rabia de Gato[1], A-553
1.1 - 2.0	Bunsi[6], C-202, Crestwood[5], ExRico 23[4], OAC Rico[4], Kaboon[9]
2.1 - 3.0	Duty[7], Fleetwood[9], Westland[6], Northland[6], Harofleet[8], Midnight[2], Stinger[6], Midland[6], Domino[2], Neptune[2], Swan Valley[2], OAC Gryphon[4], Black Magic[2], C-15[2]
3.1 - 4.0	OAC Seaforth[4], Harokent[9], Kentwood[9], Aurora[9], Admiral[8], Laureat[1], Flo[1], Mitchell[9], Dresden[9]
4.1 - 5.0	Seafarer[9], Steuben[9], Suncrest[5]
5.1 - 6.0	Sanilac[9]
6.1 - 7.0	-
7.1 - 8.0	Sacramento RK[8]

† This list may include some private cultivars. Interested parties wishing to obtain seeds should write directly to their respective sources.

‡ Based on a 0-9 scale, where 0 = <10%, 1 = 11-20% of pods with symptoms, 2 = 21-30%...and 9 = 91-100%. Thus, a score of 0 to 4.0 is considered to have high to moderate levels of resistance and a score of 4.0 to 9.0 to have moderate to high levels of susceptibility.

* The superscripts following each cultivar indicate the suppliers of seeds:
1. Dr. M.H. Dickson, N.Y. State Agric. Exp. Station, Geneva, NY; 2. Dr. J.D. Kelly, Michigan State University, Lansing, Michigan; 3. CIAT, Cali, Colombia; 4. Dr. T.E. Michaels, University of Guelph, Guelph, Ontario; 5. Gen-Tec Seeds Ltd., Woodslee, Ontario; 6. G.W. Thompson & Sons Ltd., Blenheim, Ontario; 7. Wilbur Ellis Co., Spokane, Washington; 8. Idaho Seed Bean Co., Twin Falls, ID; and 9. Dr. S.J. Park, Harrow Research Station, Harrow, Ontario.

Table 2. Response of common bean lines to *Alternaria alternata* infection in southwestern Ontario.†

Disease Severity Index‡ (0–9 scale)	Line*
0.0 – 1.0	P.I. 167.399[a]
1.1 – 2.0	P.I. 169.828[a], P.I. 171.803[a], P.I. 174.317[a], T7901[d], T8102[d], T8201[d], T8203[d], PVH32[h], OAC-5[e]
2.1 – 3.0	P.I. 169.920[a], P.I. 171.761[a], P.I. 203.958[a], NY2558[b], OAC-3[e], OAC-4[e], T8204[d], GT-0182[g], 1225022[h]
3.1 – 4.0	ISB-513[f], T8103[d], MO3[h], MO8[h], P.I. 169.880[a]
4.1 – 5.0	P.I. 169.894[a], P.I. 203.958[a], P.I. 173.047[a], OAC-1[e], 8BP-266[b], NY2114-12[b]
5.1 – 6.0	T8104[d], MO162[b], MO1[h], MO2[h], MO3[h]
6.1 – 7.0	Wisconsin RRR46[e], P.I. 165.435[a], GY-273[h], 1455005[h]
7.1 – 8.0	P.I. 165.616"

† This list includes some numbered lines, breeding lines and P.I. accessions. Interested parties wishing to obtain seeds should write directly to their respective sources.

‡ Based on a 0–9 scale, where 0 = <10%, 1 = 11–20% of pods with symptoms, 2 = 21–30%...and 9 = 91–100%. Thus, a score of 0 to 4.0 is considered to have high to moderate levels of resistance and a score of 4.0 to 9.0 to have moderate to high levels of susceptibility.

* The superscripts following each line indicate the suppliers of seeds: a. Plant Introduction Station, U.S.D.A., Pullman, Washington; b. Dr. M.H. Dickson, N.Y. State Agric. Exp. Station, Geneva NY; c. Dr. D.J. Hagedorn, University of Wisconsin, Madison, WS; d. G.W. Thompson & Sons, Blenheim, Ontario; e. Dr. T.E. Michaels, University of Guelph, Guelph, Ontario; f. Idaho Seed Bean Co., Twin Falls, ID; g. Gen-Tec Seeds Ltd., Woodslee, Ontario; and h. Dr. S.J. Park, Harrow Research Station, Harrow, Ontario.

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Variability among cultivated sunflower genotypes to sclerotinia head rot

W. Dedio[1]

Sclerotinia head rot occurred in 1980 and was widespread in Manitoba sunflower in 1981. Agriculture Canada test plots at Thornhill and Holland, Manitoba, were almost 100% infected by the pathogen. In some tests, sclerotinia head rot was negatively correlated with height, days to bloom and days to maturity. Tests showed considerable variability in head rot intensity among the cultivars including those with closely related genotypes. Resistance to head rot appeared to be conditioned by additive genes derived from both parents. The head rot incidence in three-way crosses was similar to that predicted from single crosses.

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La pourriture sclerotique du capitule s'est declaree en 1980 et fut largement répandue dans les cultures de tournesol au Manitoba en 1981. A Thornhill et Holland au Manitoba, dans les parcelles experimentales d'Agriculture Canada presque 100% des plants furent infectes par le pathogen. Certains essais rapportes sur la pourriture sclerotique du capitule furent correles negativement avec la hauteur, les jours de floraison et les jours de maturite. Les essais ont demontre une variabilite considerable de l'intensite de la pourriture du capitule parrnis les cultivars incluant des genotypes relies de pres. La resistance a la pourriture du capitule semble être conditionnee par des genes additifs derives des deux parents. L'incidence de la pourriture du capitule avec le croisement triple a ete sirnilaire a celle prevu avec les croisements simples.

Introduction

Sclerotinia sclerotiorum (Lib.) de Bary is an important pathogen that can markedly reduce yields of sunflower (*Helianthus annuus* L.). The pathogen causes two sunflower diseases depending on the mode of sclerotial germination. In North America, hyphal outgrowths, during myceliogenic germination of soilborne sclerotinia, penetrate the plants and incite sudden wilt, considered to be the more serious disease of the two (Acimovic, 1984). Head rot, resulting from carpophoric sclerotial germination, has also resulted in serious crop losses in Manitoba and North Dakota (Hoes, 1969; Gulya *et al.,* 1989). In 1986, an estimated 10.2% of the crop in eastern North Dakota was affected by head rot (Gulya *et al.* 1989).

The development of head rot is dependent upon environmental conditions that favor production of apothecia and ascospores, ejection of ascospores, and spore germination at the time when the plants are most susceptible (Lamarque and Rapilly, 1981). Kondo *et al.* (1988) demonstrated that ascospores invaded the sunflower head mainly through florets. Head rot is probably a major disease in Argentina, France and Japan because of frequent rains during flowering (Acimovic, 1984; Kondo, 1988).

The effect of genotype on susceptibility to head rot is being studied to provide a basis for the development of resistant cultivars. In France, Leclerq, (1973) observed that shorter and earlier maturing cultivars were more susceptible to head rot. Kondo *et al.* (1988) tested eleven cultivars and reported that differences in head rot occurrences were accounted by differences in flowering time. Gulya *et al.* (1989) also reported considerable variation in head rot among 189 genotypes.

In 1980 and 1981, an unusually high natural incidence of head rot was observed in the sunflower test plots at Thornhill (8 kilometers west of Morden) and Holland, Manitoba. This provided an opportunity to evaluate the variation in susceptibility among our cultivated genotypes to head rot under natural infections.

Materials and methods

The incidence of head rot was scored from 0 to 10, with 0 assigned to uninfected sunflower and 10 to infection of all of the heads. In 1980, two trials were designed to evaluate the yield potential of new ,sunflower lines or cultivars. The first trial, part of the US. National Sunflower Performance Trial (US NSPT), contained thirty-one commercial hybrids grown in a randomized block design with four replicates. The second trial (1980 Prel) consisted of 230 entries from the Morden breeding program in ten preliminary yield tests, each with two replications. The incidence of head rot was determined one or two weeks prior to harvest in October. Data was also recorded for plant height, days to 80% bloom, days to maturity and yield. Correlation coefficients between head rot incidence and various agronomic characters were determined for the plants in both trials.

In 1981, data was collected from another US NSPT planted at Thornhill with forty-two entries. Head rot incidence and agronomic data also were collected from the Canadian Sunflower Co-operative Test (CSCT) at Thornhill with

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Table 1. Agronomic characteristics and head rot estimates of sunflower hybrids tested in 1980 and 1981.

Test	No. of hybrids	Yield, kg/ha Mean SO	Days to bloom Mean SD	Oays to maturity Mean SD	Height, cm Mean SD	Head rot score' Mean SO
1980 Prelim	230	1930 ± 352	66.1 ± 3.0	107.4 ± 3.4	160 ± 13	0.9 ± 1.0
1981 Prelim 1	184	2340 ± 383	80.3 ± 1.6	117.1 ± 1.8	153 ± 11	2.5 ± 1.0
1981 Prelim 2	40	1448 ± 340	79.4 ± 1.3	115.4 ± 1.2	153 ± 7	4.5 ± 2.1
1981 US NSPT	42	2233 ± 322	83.5 ± 1.9	121.0 ± 2.9	170 ± 10	1.6 ± 1.9
1981 CSTC, Holland	36	2340 ± 247			152 ± 8	2.2 ± 1.7
1981 CSTC, Thornhill	36	2293 ± 407	82.1 ± 2.1	119.2 ± 2.9	156 ± 9	2.8 ± 2.1
1981 CSTC, Combined	36	2316 ± 235			154 ± 6	2.5 ± 1.9

* Scored from 0 to 10 (0 = no infection, 10 = 100% infection).

Table 2. Correlation coefficients of head rot incidence with several agronomic characteristics in 1980 and 1981 tests.

Test	Correlation coefficient			
	Yield	Height	Days to bloom	Days to maturity
1980 Prelim	-.40**	-.03	-.45**	-.39**
1981 Prelim 1	-.44**	-.04	.06	-.10
1981 Prelim 2	-.75*	.08	.29	-.26
1981 US NSPT	-.58*	-.11	-.26	-.02
1981 CSTC, Holland	-.56*	-.30		
1981 CSTC, Thornhill	-.85**	-.39	-.47	-.53
1981 CSTC, Combined	-.82**	-.64*		

*,** Significant at the 0.05 and 0.01 levels of probability, respectively.

thirty-six entries. These thirty-six entries were planted at Holland, Manitoba, and data were recorded for plant height and head rot incidence. These two tests were replicated four times in a rectangular lattice design. Data was also collected from 184 experimental hybrids in eight preliminary yield tests in 1981 with two replications (1981 Prelim 1).

In another 1981 test (1981 Prelim 2), four female lines (CM 577, CM 588, CM 589 and HA 301) were used in single and three-way crosses. The four lines were used in all combinations to produce six initial crosses for use in the development of three-way hybrids. This resulted in a total of 10 cytoplasmic male sterile lines or single crosses that were used as females for production of hybrids. Four experimental restorer lines, numbers 22, 29, 33 and 55, were used to combine with each of the female parents. They consisted of two pairs of sister lines; one pair (22 and 29) was derived from a cross involving CM 469 while the other pair (33 and 55) was derived from two identical crosses involving CM 497. The line CM 497 was released earlier that shows partial tolerance to sclerotinia stem rot (Huang and Dedio, 1982). Both CM 469 and CM 497 were derived from a gene pool developed by allowing fifty inbred lines to interpollinate for three generations. The forty possible resulting hybrids from these crosses were planted at Thornhill in a randomized block design with three replicates.

The 1981 agronomic data and head rot scores are presented in Table 1. Correlation coefficients between head rot and days to bloom, days to maturity, height and yield were determined where data was available.

Table 3. Head rot score of single and three-way hybrids from four female and four male parent lines. Predicted values from single crosses are in brackets.

	Male parent				
Female parent	22	29	33	55	Mean
CM 589	8.2	9.3	6.0	4.3	7.0
CM 588	2.5	2.3	3.7	0.7	2.3
CM 577	4.3	7.3	6.3	3.5	5.4
HA 301	3.5	7.7	3.3	2.7	4.3
Single cross mean	4.6	6.7	4.8	2.8	4.7
CM 588 X CM 589	3.0(5.4)	7.3(5.8)	6.0(4.8)	2.5(2.5)	4.7(4.6)
CM 588 X CM 577	4.7(3.4)	3.7(4.8)	4.0(5.0)	0.3(2.1)	3.2(3.8)
CM 588 X HA 301	3.7(3.0)	5.7(5.0)	3.0(3.5)	3.0(1.7)	3.8(3.3)
CM 589 X CM 577	6.0(6.2)	5.0(8.3)	7.0(6.2)	3.0(3.9)	5.3(6.2)
CM 589 X HA 301	5.5(5.8)	8.0(8.5)	4.5(4.6)	2.0(3.5)	5.0(5.6)
CM 577 X HA 301	3.3(3.9)	7.3(7.5)	3.0(4.8)	2.8(3.1)	4.1(4.8)
3-way cross mean	4.4(4.6)	6.2(6.6)	4.6(4.8)	2.3(2.8)	4.4(4.7)

* Scored from 0 to 10; 0 = no infection, 10 = 100% infection.

Table 4. Regression equations relating yield with sclerotinial head rot at Thornhill and Holland, Manitoba Sunflower Committee Tests, 1981.

Thornhill	
$y = 2757 - 162.1x$	
Holland	
$y = 2518 - 82.3x$	
y = yield (kg ha-1); x = head rot score	

Results

Sclerotinia head rot was widespread in Manitoba in 1980 and was much more severe in 1981. The range of head rot scores among hybrids in the 1980 US NSPT was 0 to 0.7 in 1980, with an average of 0.3. Therefore data are not presented. On the site for the 1980 preliminary test, the mean head rot score was 0.9 and the range was 0 to 4.4 (Table 1). In the 1981 tests, head rot was much more severe with mean scores of 2.5 for Prelim 1, 4.5 for Prelim 2 and 1.6 for US NSPT (Table 1). The range of values for these three tests varied between 0 and 8.3.

In all of the 1980-81 tests, only the CSCT showed a significant negative correlation of height with head rot incidence. Days to bloom and maturity were negatively correlated with head rot incidence in the 1980 preliminary tests and 1981 CSCT at Thornhill, but not significantly in the latter test.

Considerable variation in susceptibility to head rot was found among hybrids from the four inbred lines used as females and four restorer lines (Table 3). The mean score of single cross hybrids with different females ranged from 2.3 for CM 588 crosses to 7.0 for CM 589 crosses. This was a significant difference as an LSD (.05) of 1.2 was obtained when groups of hybrids with different females were compared. When groups of hybrids with different restorers (males) were compared, the mean score ranged from 2.8 to 6.6 for single crosses and 2.3 to 6.2 for three-way crosses with an LSD (.05) of 0.8. The head rot incidence in the three-way crosses was close to the values predicted from single crosses (Table 3). The mean head rot score of the four female lines with each of the four males were 4.6, 6.7, 4.8, 2.8 compared to 4.4, 6.2, 4.6 and 2.3 for means of six single cross females with each of the four males, respectively.

Discussion

In 1981, sclerotinia head rot of sunflower was severe in Agriculture Canada test plots and other fields in Manitoba and Saskatchewan. The 1981 disease outbreak may have been related to the nine-day period of wetness that coincided with flowering periods of the different hybrids. Previous to this, the last outbreak of head rot in Manitoba occurred in 1968 (Hoes, 1969). In 1981, flowering was delayed and the disease outbreak coincided fairly closely with the wet period, 76 mm of rain in early August. Outbreaks of sclerotinia of lower intensity have appeared sporadically in Manitoba since 1981, but only the most susceptible hybrids were affected.

There was significant correlation between head rot and low yield. When plants became infected the achenes were released and the head appeared to disintegrate. From the regression equations it was estimated that when 50% of the plants were infected, a 29% yield reduction occurred at Thornhill and 16% reduction at Holland (Table 4).

The plant height, days to bloom and days to maturity were factors affecting the incidence of head rot in some tests. In this study plant height did not appear to be as important in disease incidence as postulated by Leclercq (1973). The incidence of head rot correlated significantly with days to bloom or maturity in some tests (Table 2).

The large range of head rot incidence in the various tests as indicated by the high standard deviation could not be accounted for by agronomic characteristics alone. Even within the same height or maturity requirement class, considerable variation in head rot was noted. Although considerable variation was observed among different genotypes by Kondo *et al.* (1988) and Gulya *et al.* (1989), most of the resistant lines used by the latter authors were either late flowering, very tall or susceptible to insects such as midge (*Contarinia schulzi* Gagne). In this investigation considerable variation in head rot incidence was found in agronomically desirable hybrids. Even in hybrids with related restorer lines, head rot incidence varied considerably (Table 3). The fact that the head rot incidence of three-way hybrids were close to the values predicted from single crosses would suggest additive effects of the genes are involved (Table 3).

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Screening of alfalfa cultivars for resistance to fusarium wilt in northeastern Alberta

S.F. Hwang[1]

Greenhouse and field tests were conducted to evaluate sixteen alfalfa cultivars for dry matter yields and resistance to fusarium wilt. All cultivars showed symptoms of fusarium wilt, but disease severity varied considerably among cultivars. Algonquin, Angus, Beaver, Drylander, Saranac, and Spredor were the cultivars least affected by ***Fusarium oxysporum*** f. sp. ***medicaginis;*** Anchor, Peace, Roamer, Rambler, and Trek were the most affected. Significant differences were found among cultivars for dry matter yields.

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Des essais au champs et en serre furent efectues pour evaluer les rendements en matière seche et la resistance à la fletrissure fusarienne de seize cultivars de luzerne. Tous les cultivars ont présenté des symptômes de fletrissure fusarienne mais avec une sévérité variant considérablement. Les cultivars Algonquin, Angus, Beaver, Drylander, Saranac'et Spredor furent les moins affectés par le ***Fusarium oxysporum*** f. sp. ***medicaginis.*** Les cultivars Anchor, Peace, Roamer, Rambler et Trek furent les plus affectes. Parmis les cultivars, on a trouve des differences significatives pour les rendements de la matiere seche.

Introduction

Fusarium wilt of alfalfa ***(Medicago sativa*** L.), caused by ***Fusarium oxysporum*** f. sp. ***medicaginis*** (Weimer) Snyd. and Hans., progresses slowly in natural alfalfa stands, but can cause considerable yield losses in a stand over a period of several years (2,3,4). In Alberta, winter survival is critical for successful production of alfalfa and survival depends largely on the storage of adequate food reserves in the roots and crowns during the fall (2,8,9). Fusarium wilt may predispose alfalfa to winterkill by affecting the accumulation of food reserves (12). The development of fusarium wilt-resistant alfalfa cultivars would offer the best possibility for the control of this disease, but more information on the responses of currently available cultivars to fusarium wilt is needed by plant breeders. The objective of this study was to evaluate alfalfa cultivars for resistance to fusarium wilt under greenhouse and field conditions.

Materials and methods

One single-spore isolate of ***Fusarium oxysporum*** f. sp. ***medicaginis*** was obtained from roots of symptomatic alfalfa seedlings collected in northeastern Alberta and identified based on descriptions by Booth (1) and Nelson ***et a/.*** (11). The fungus was maintained on potato dextrose agar plates at 5°C. Conidial inoculum was prepared by placing a 9 mm-diameter mycelial disk of *F. oxysporum* f. sp. ***medicaginis*** in 250 mL conical flasks containing 100 mL sterile Kerr's (7) solution, which was shaken continuously at 200 rpm for 5 days at room temperature in natural light. The cultures were filtered through two layers of cheesecloth to remove mycelium and the filtrate was centrifuged at 1000 rpm for 10 min. The pellets of conidia were resuspended and diluted with sterile water to a concentration of 1.5×10^6 conidia/mL.

Seeds of each alfalfa cultivar were surface-sterilized in 70% ethanol for 2 min, followed by 2 min in 0.6% sodium hypochlorite, then rinsed three times in sterile distilled water, and sown in fiber flats (50x 30 x 10 cm) containing sterilized vermiculite. The seedlings were inoculated with ***Rhizobium meliloti,*** fertilized with 20-20-20 (N-P-K), and placed on a greenhouse bench at 22-26°C. Three months after seeding, alfalfa plants were lifted, and the tops were trimmed to about 4 cm from the crown while the roots were trimmed to about 12 cm from the crown. The plants were inoculated by immersing the roots in the conidial suspension for 30 min. For the greenhouse test, the inoculated plants were planted in 13-cm-diameter plastic pots containing a steam-sterilized mixture of sand, loam and vermiculite (1:1:1, v/v). Ten replicate pots (5 plants/pot) were used for each cultivar and all pots were arranged randomly on the greenhouse bench. For the field test, one field plot was established in the spring of 1989 at the Alberta Environmental Centre, Vegreville. A' pre-emergence herbicide, Eptan EC, at a rate of 4.5 L/ha along with 90 kg/ha of monoammonium phosphate (11-51-0), 20 kg/ha of potash (0-0-60) and 19 kg/ha of elemental sulphur (0-0-0-90) were incorporated into the soil. Inoculated plants were planted in a randomized complete block design with four replications. Each single cultivar plot consisted of 50 plants spaced 20 cm apart in a 10-m-long row. There was 1 m between cultivars and 2.5 m between replicates. When necessary inoculated plants were stored at 3-5°C in a container with 1-2 cm water to keep the roots moist until transplanting.

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Table 1. Comparative forage yield of alfalfa cultivars and their resistance to fusarium wilt under greenhouse and field conditions.

	Dry weight (g)		Disease Severity[y]		
Cultivar	Greenhouse	Field	Greenhouse	Field	$\bar{x}$ Field & Greenhouse
Algonquin	3.22 a[x]	394 abc	1.1 b	2.0 cde	1.6
Anchor	2.75 abcd	327 abcd	1.9 ab	2.9 ab	2.4
Angus	3.05 ab	294 abcd	1.6 b	1.5 e	1.6
Anik	1.37 g	57 d	1.7 ab	2.0 cde	1.9
Beaver	2.75 abcd	480 ab	1.0 b	1.6 e	1.3
Drylander	2.97 abc	181 cd	1.7 b	1.7 de	1.7
Peace	2.29 def	270 abcd	2.7 a	3.0 a	2.9
Rambler	3.34 a	283 abcd	2.0 ab	2.4 abcd	2.2
Rangelander	3.14 ab	334 abcd	1.7 b	2.0 cde	1.9
Roamer	1.97 f	203 bcd	2.7 a	3.0 a	2.9
Saranac	2.84 abcd	554 a	1.3 b	2.1 bcde	1.7
Spredor	2.62 bcde	516 a	1.6 b	1.7 de	1.7
Thor	2.80 abcd	469 abc	1.5 b	2.4 abcd	2.0
Trek	2.14 ef	326 abcd	1.8 ab	2.5 abc	2.2
Trumpetor	1.45 g	376 abc	1.5 b	2.3 abcd	1.9
Vernal	2.39 cdef	551 a	1.8 ab	2.4 abcd	2.1

x Values in a column followed by the same letter are not significantly different using Duncan's Multiple Range test ($P=0.05$).

y Disease severity was based on a scale of 0-5 where 0 = no discoloration in the root; 1 = small dark strands in the inner stele; 2 = small dark-brown arcs in the inner stele; 3 = larger dark-brown areas in the inner stele or partial dark-brown rings in the outer stele; 4 = the entire outer stele dark brown, plant alive; 5 = plant dead.

The plants were harvested three months after transplanting, dried at 70°C for 24 hr, and weighed. Tap roots of surviving plants were dug up, cross-sectioned, and rated for disease severity based on a previously described 0 to 5 scale (14): 0 = no discoloration in the root; 1 = small dark strands in the inner stele (Fig. 1); 2 = small dark-brown arcs or rings in the inner stele (Fig. 2); 3 = larger dark-brown areas, arcs or rings in the inner stele, or partial dark-brown rings in the outer stele (Fig. 3); 4 = the entire outer stele dark brown, plant alive (Fig. 4); 5 = plant dead. Sections approximately 1 µm thick were cut from the infected tap roots, mounted on glass slides, stained with toluidine blue, and examined and photographed with a light microscope (10).

ANOVA and Duncan's Multiple Range tests were used to statistically analyze the data on dry matter yield and disease severity of fusarium wilt.

Results and discussion

The sixteen cultivars were affected to varying degrees by F. oxysporum f. sp. medicaginis in both greenhouse and field tests (Table 1). The highest disease ratings were recorded for cvs. Anchor, Peace, Roamer, Rambler, and Trek (x for field and greenhouse of 2.9 to 2.2, respectively), whereas lowest disease ratings were observed for cvs. Algonquin, Angus, Beaver, Drylander, Saranac, and Spredor (x for field and greenhouse of 1.3 to 1.7, respectively). Disease severity ratings of the remaining cultivars were intermediate (Table 1). In the greenhouse test, highest dry matter yields (3.05 to 3.34 g/pot) were observed for cvs. Algonquin, Angus, Rambler, and Rangelander compared with cvs. Anik, Peace, Roamer, Trek, Trumpetor, and Vernal, which yielded the least (1.37 to 2.39 g/pot). Yields of the remaining six cultivars were intermediate (2.62 to 2.97 g/pot) (Table 1). In the field test, highest yields (469 to 554 g/plot) were observed for cvs. Beaver, Saranac, Spredor, Thor, and Vernal compared with cvs. Anik, Drylander, and Roamer, which yielded the least (57 to 203 g/plot). Yields of the remaining eight cultivars were intermediate (270 to 376 g/plot) (Table 1).

Crown and root rot is a complex disease that has been considered a major limiting factor in the production of alfalfa for a number of years (2,5,6). Selection for resistance to crown and root rot has been difficult because of the large number of causal organisms (4,5,6,13). Fusarium wilt appears to be an important component of the crown and root rot disease complex; in some years, the damage of fusarium wilt alone may be lethal to alfalfa (3). Moreover, according to Richard *et al.* (12), cold resistance of alfalfa is affected more by fusarium wilt than by fusarium root rot, because infection 'with F. oxysporum f. sp. medicaginis affects physiological processes that normally lead to hardening (8,12).

A combination of fusarium wilt disease and winter stress factor is believed most likely to cause stand decline and yield reduction in Alberta. The results of this study clearly demonstrate that Algonquin and Beaver are the known winter-hardy cultivars within the group of lowest disease severity and the other two tested winter-hardy cultivars, Anik and Peace, belong to the intermediate and greatest disease severity groups, respectively. Beaver is the only promising cultivar with high dry matter yield; Anik had the least yield in both the greenhouse and field tests.

Disease severity ratings in this study were not related to yields, but did indicate comparative resistance to fusarium wilt of different cultivars. The very close agreement of field and greenhouse disease evaluations in this study suggests that greenhouse testing can be an important supplement to field testing for resistance to fusarium wilt. It offers breeders the advantage of rapid progress in developing fusarium wilt-resistant alfalfa cultivars.

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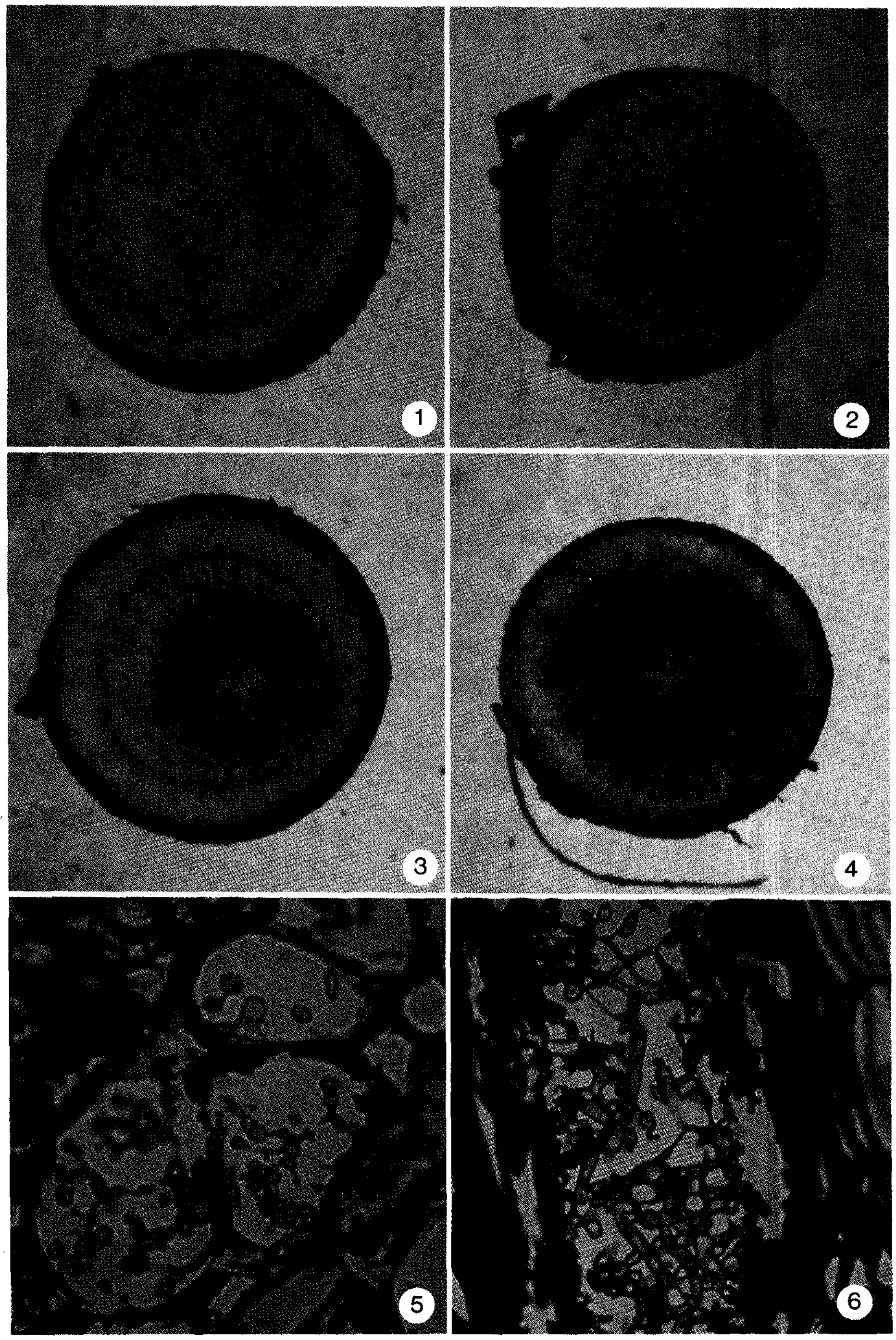

Figs. **1-4.** Cross section of alfalfa tap root infected with Fusariurn oxysporum f. sp. medicaginis.
Fig. 1. Small dark strands in the inner stele (disease severity= **1).**
Fig. 2. Small dark-brown arcs in the inner stele (disease severity = **2).**
Fig. **3.** Large dark-brown areas in the inner stele (disease severity = **3).**
Fig. **4.** Entire outer stele dark brown (disease severity = **4).**

Fig. 5. A portion of a cross section through an alfalfa tap root infected with Fusariurn oxysporurn f. sp. medicaginis. Note the conidia in the xylem vessel element.

Fig. **6.** A portion of a longitudinal section through an alfalfa tap root infected with *Fusarium* oxysporurn **f.sp.** rnedicaginis. Note the hyphae in the xylem vessel element.

Frequency and distribution of seedborne fungal pathogens in western Canadian canola-1989 and 1990

R.M. Clear[1]

In 1989 and 1990, composite samples of canola from crop districts in western Canada were tested for the presence of the seedborne pathogens Alternaria brassicae, A. raphani, and *Leptosphaeria* maculans. Each year, six hundred seeds from each crop district were surface disinfected before plating onto 20% V-88 agar. A. brassicae and A. raphani were more common in 1989 and were isolated most often from Alberta and the northern crop districts. The virulent form of L. maculans was found primarily in Saskatchewan, where it was recovered on average from 0.1% of seeds tested.

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En 1989 et 1990, les echantillons composes de canola provenant des districts agricoles de l'Ouest canadien furent etudies pour detecter la presence de pathogenes propagés par la semence, soit Alternaria brassicae, A. raphani, et Leptosphaeria maculans. Chaque année, six cent sernences de chaque district agricole furent desinfectees en surface avant l'ensemencement dans l'agar 20% V-88 agar. A. brassicae and A. raphani furent plus commun en 1989 et furent isolés plus souvent en Alberta et dans les districts agricoles nordiques. La forme virulente de L. *maculans* fut trouvee originairement en Saskatchewan, où elle fut recouverte a 0.1% en moyenne sur les semences evaluees.

Introduction

A number of seedborne fungal pathogens are present on canola seed harvested in western Canada (Martens ***et al.,*** 1984). Three of the more important ones are ***Alternaria brassicae*** (Berk.) Sacc. and ***A. raphani*** Groves & Skolko, the causal agents of alternaria blackspot, and ***Leptosphaeria maculans*** (Desm.) Ces. & de Not., the causal agent of blackleg. Field surveys for these pathogens and the diseases they cause have been reported over a number of years. The frequency of seed infestation by ***L. maculans*** has also been assessed (Petrie and Vanterpool, 1974), but recent information on average levels of seed infection is lacking. Although these pathogens are not found as frequently on the seeds as on the vegetative plant parts, their presence on the harvested seed coincides with their presence in the field. This survey examines their frequency and distribution on harvested seed.

Materials and methods

In 1989 and 1990, 2,123 and 2,992 samples respectively of canola (grades 1 and 2) were submitted in envelopes capable of holding 500g of seed to the Grain Research Laboratory (GRL) by primary elevator managers, oilseed crushing companies and canola producers. These samples were graded by the Inspection Division of the Canadian Grain Commission, composited at the GRL according to grade and crop districts, then subsampled for mycological tests. Seeds were surface disinfected by soaking in a 0.3% sodium hypochlorite solution for 1 min, then air dried under a laminar flow hood. Each year, 300 seeds of the No. 1 grade canola composite and an equal number of the No. 2 grade canola composite from each crop district were placed onto 20% V-8® agar in petri dishes, 15 seeds per plate, and incubated for 7 days at room temperature under a cycle of 12 hrs darkness and 12 hrs UV and fluorescent light. Although tested separately, results from the crop districts are reported as a compilation of both No. 1 and No. 2 grades. Too few samples of canola graded No. 3 were received to be composited by crop district and *so* have been left out of this report. The virulence of the ***L. maculans*** isolates was established by inoculating wounded cotyledons of 7-day old Westar canola seedlings with 10 µL of a 1×10^6 spore suspension. After growth for 10 days at 22°C, the cotyledons were examined for signs of necrosis. The cultural characteristics of ***L. maculans*** on V-8® agar were also examined according to the method of McGee and Petrie (1978).

Results and discussion

The number of samples within a composite ranged from 2 to 430 (Table 1). Less than twenty-two samples were received from Saskatchewan crop districts 2, and 4 and Alberta district 1 because little canola is grown in these areas (DeClercq ***et al.,*** 1989).

Alternaria brassicae and ***A. raphani*** were most frequently isolated from crop districts 1 to 7 in Alberta, 8 and 9 in Saskatchewan, and 5 and 12 in Manitoba (Figures 1 and 2). Both pathogens were recovered more often in 1989 than in 1990, with ***A. brassicae*** being the more common of the two. The abundance of these pathogens on seed from the more northern crop districts may be due not only to weather conditions, but also to the seeding of varieties

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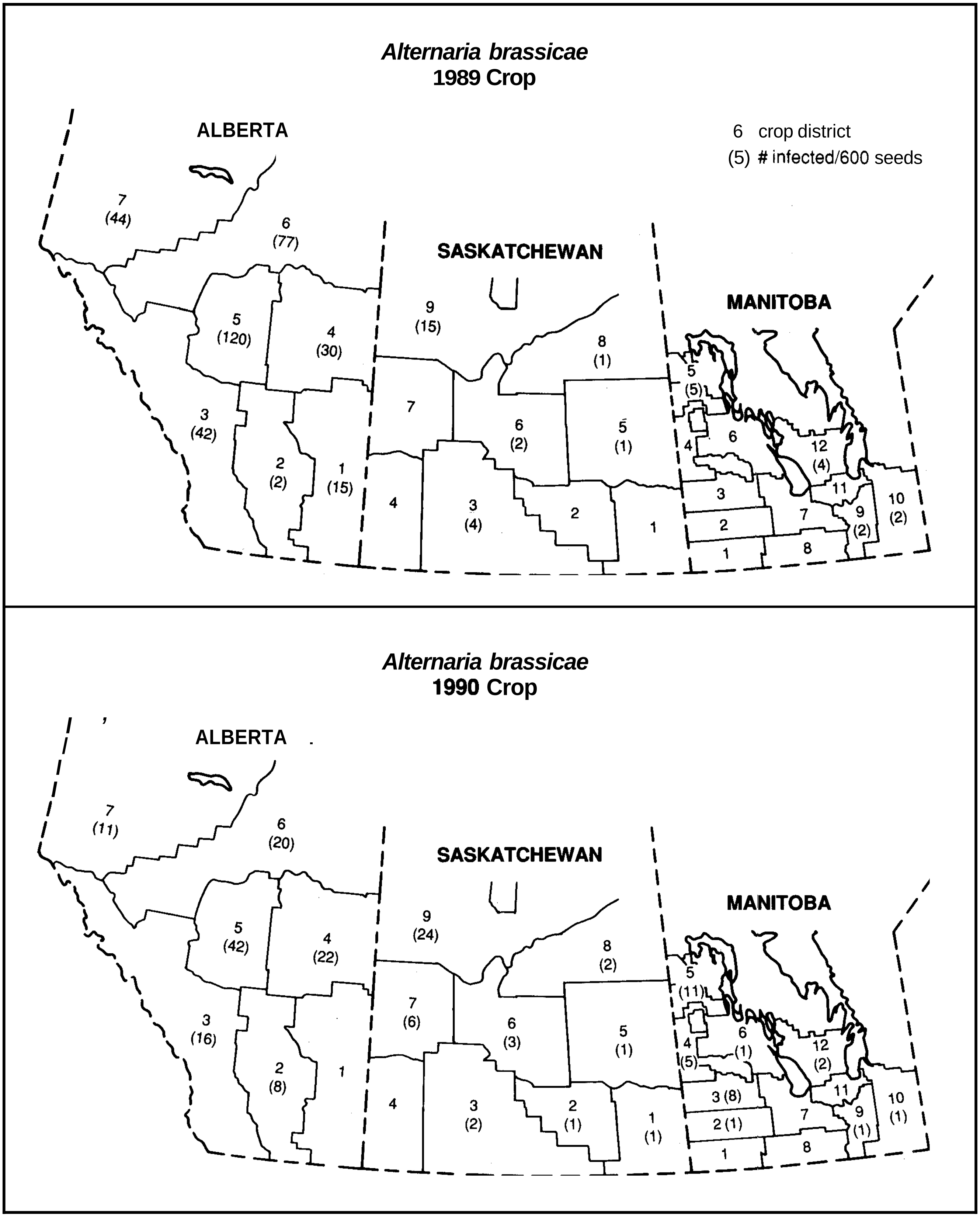

Alternaria brassicae
1989 Crop
ALBERTA
SASKATCHEWAN
MANITOBA
6 crop district
(5) # infected/600 seeds
7 (44)
6 (77)
5 (120)
4 (30)
3 (42)
2 (2)
1 (15)
9 (15)
8 (1)
7
6 (2)
5 (1)
4
3 (4)
2
1
5 (5)
4
6
12 (4)
11
10 (2)
9 (2)
3
2
1
7
8
Alternaria brassicae
1990 Crop
ALBERTA
SASKATCHEWAN
MANITOBA
7 (11)
6 (20)
5 (42)
4 (22)
3 (16)
2 (8)
1
9 (24)
8 (2)
7 (6)
6 (3)
5 (1)
4
3 (2)
2 (1)
1 (1)
5 (11)
4 (5)
6 (1)
12 (2)
11
10 (1)
9 (1)
3 (8)
2 (1)
1
7
8

Fig. 1.

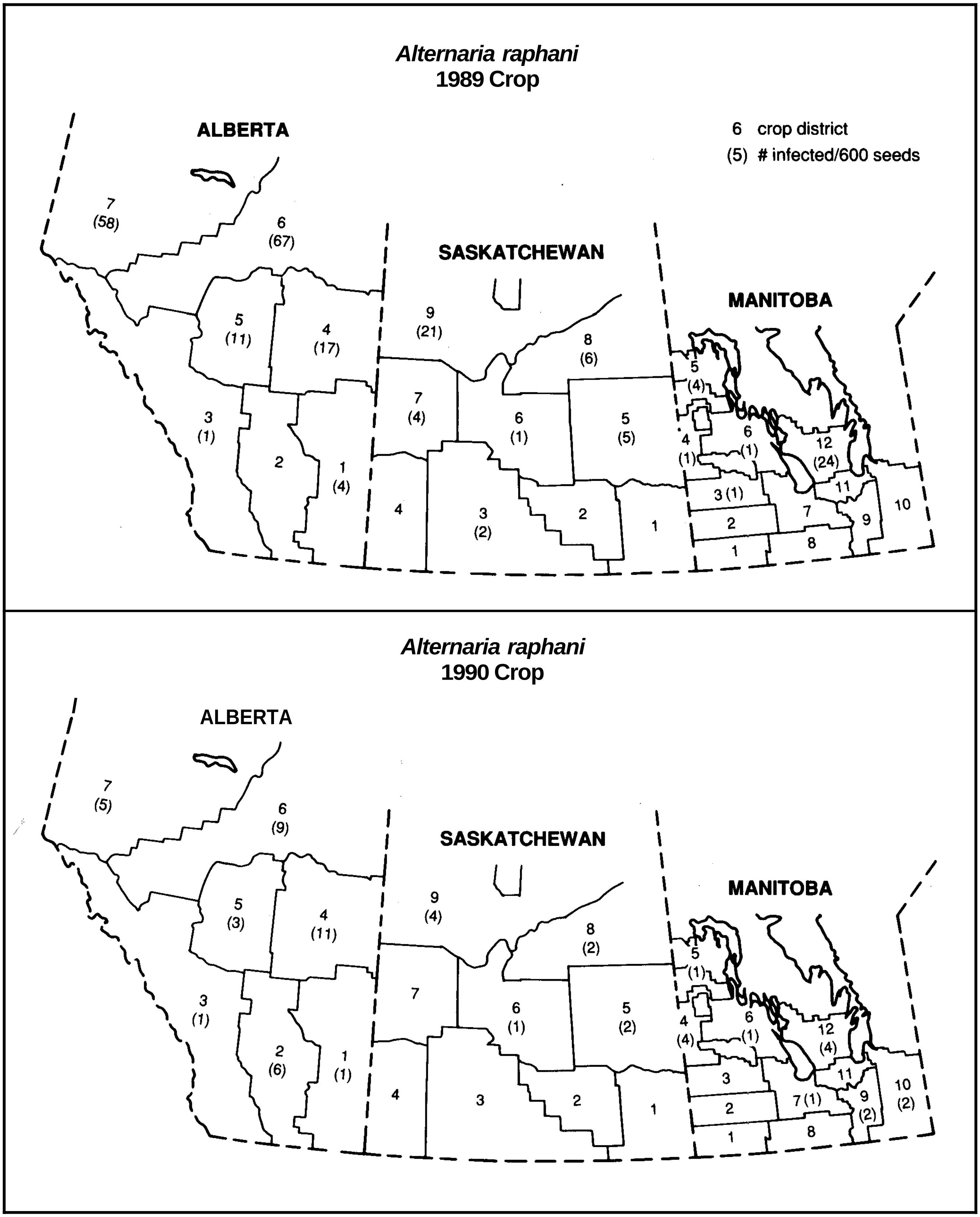

Alternaria raphani
1989 Crop
ALBERTA
6 crop district
(5) # infected/600 seeds
7 (58)
6 (67)
SASKATCHEWAN
MANITOBA
5 (11)
4 (17)
9 (21)
8 (6)
5 (4)
3 (1)
7 (4)
6 (1)
5 (5)
4 (1)
6 (1)
12 (24)
2
1 (4)
4
3 (2)
2
1
3 (1)
11
10
7
9
2
1
8
Alternaria raphani
1990 Crop
ALBERTA
7 (5)
6 (9)
SASKATCHEWAN
MANITOBA
5 (3)
4 (11)
9 (4)
8 (2)
5 (1)
3 (1)
7
6 (1)
5 (2)
4 (4)
6 (1)
12 (4)
2 (6)
1 (1)
4
3
2
1
3
11
10 (2)
7 (1)
9 (2)
2
1
8

Fig. 2.

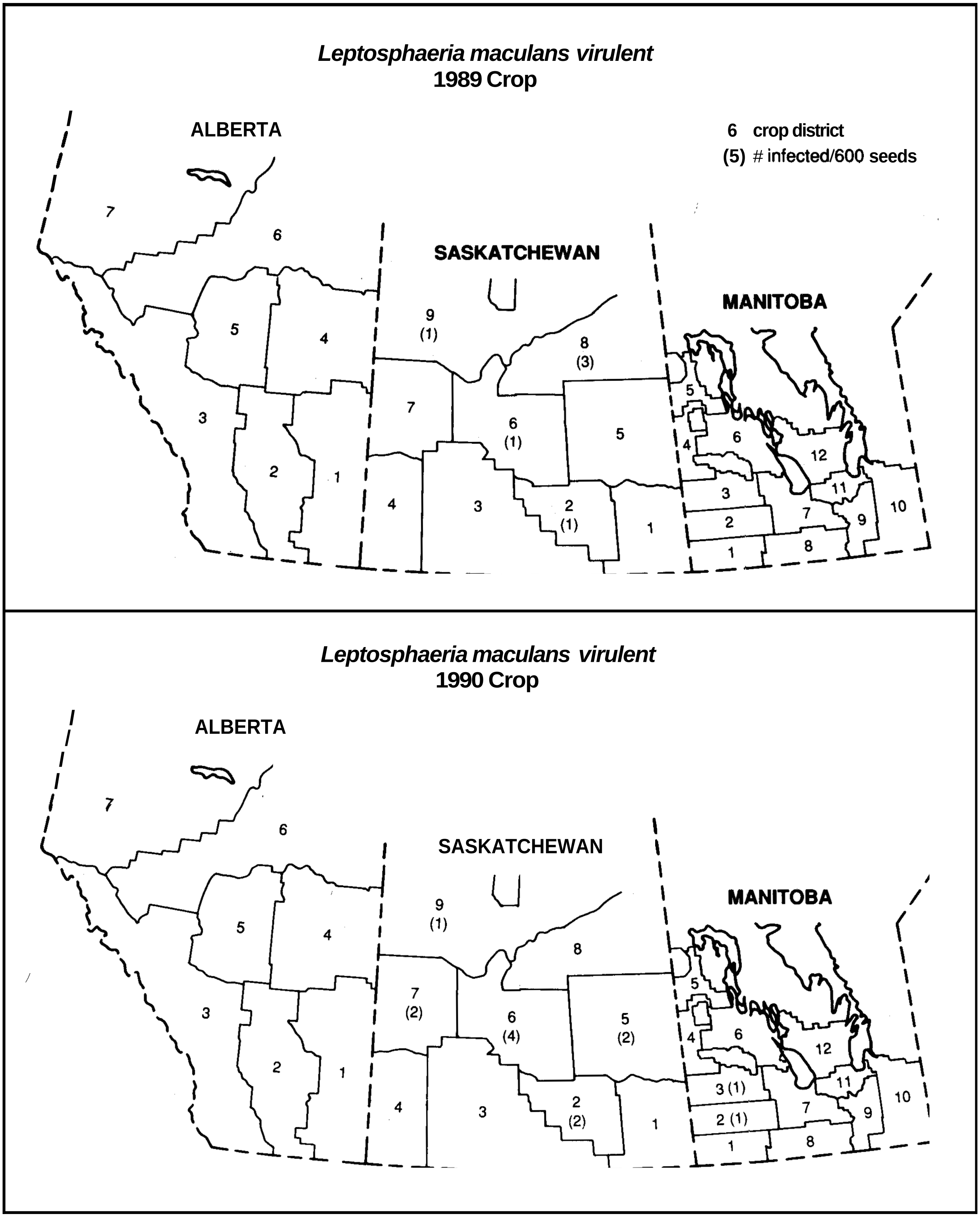
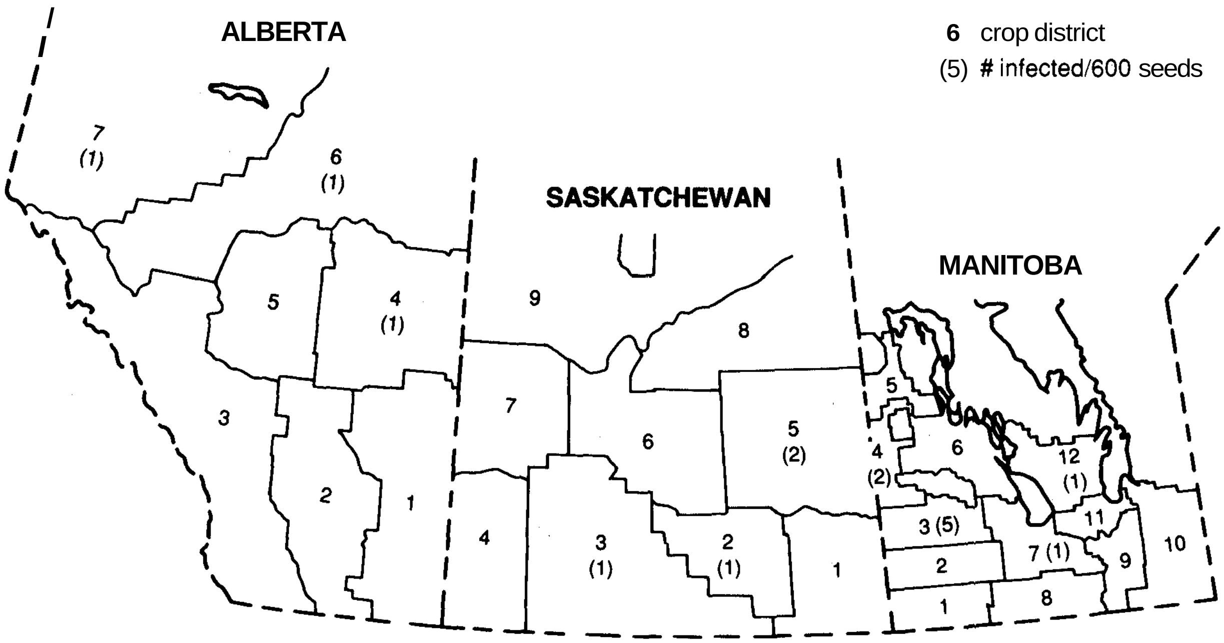

Leptosphaeria maculans virulent
1989 Crop
ALBERTA
SASKATCHEWAN
MANITOBA
6 crop district
(5) # infected/600 seeds
9
(1)
8
(3)
6
(1)
2
(1)
Leptosphaeria maculans virulent
1990 Crop
ALBERTA
SASKATCHEWAN
MANITOBA
9
(1)
7
(2)
6
(4)
5
(2)
2
(2)
3 (1)
2 (1)

Fig. 3.

Leptosphaeria maculans avirulent
1989 Crop



Leptosphaeria maculans avirulent
1990 Crop

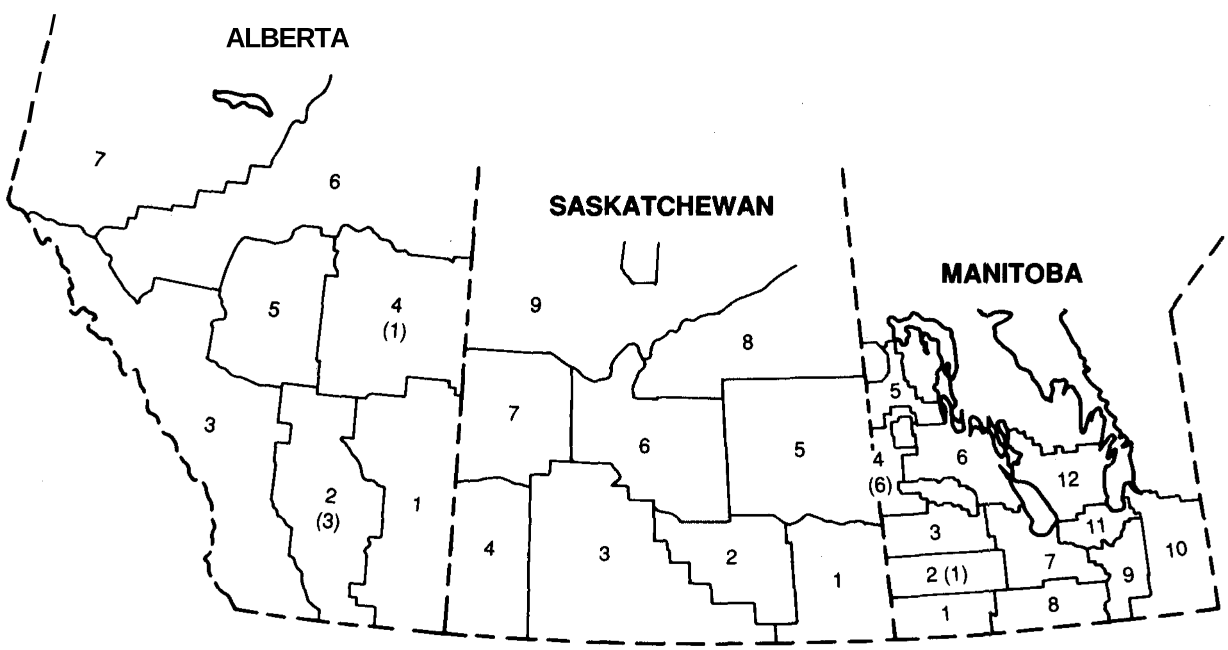


Fig. 4.

of the earlier maturing Brassica campesfris L., which are more susceptible to blackspot than are the B. *napus* L. varieties (Skoropad and Tewari, 1977; Conn and Tewari, 1989). In 1989 and 1990, *B.* campesfris varieties accounted for 67.9% and 63.8%, respectively, of the canola acreage in Alberta, with only districts 1 and 2 having more acres of B. napus than B. campestris. In Saskatchewan in 1989, 35% and in 1990, 29.8% of the canola acreage was sown to B. campesfris, notably in districts 7 and 9, and for the same years in Manitoba only 8.7% and 15.4% of the canola acreage was B. campesfris (Anonymous, 1989; Anonymous, 1990). The higher occurrence of the blackspot fungi in the 1989 composite samples coincides with the observation that alternaria blackspot was the most economically important disease of canola in central Alberta in 1989 (Conn and Tewari, 1990). In 1990 in central Alberta, the percent areas of siliqua covered with lesions were much less than in 1989 (Conn and Tewari, 1991). They attributed the difference to the wet weather at the end of July and early August of 1989. However, the Peace River of Alberta was surveyed for blackspot in 1989 (Harrison, 1990) and 1990 (Harrison and Loland, 1991) and they found blackspot to be more common in 1990 than 1989. Perhaps environmental conditions in the Peace River area were more advantageous for seed infection in 1989 than in 1990. Blackspot also was reported at higher levels in northeast Saskatchewan in 1990 than 1989 (Kirkham and Berkenkamp, 1990; Berkenkamp and Kirkham, 1991), whereas this disease was found in more Manitoba fields in 1989 than 1990. The severity in Manitoba was low (Van Den Berg and Platford, 1990; Van Den Berg and Platford, 1991).

Lepfosphaeria maculans is not readily seedborne but it was recovered from some seed samples. Almost all of the seedborne virulent forms were recovered from the Saskatchewan samples, where it was isolated from 0.1% of the seeds, and was more common than the avirulent form (Figures 3 and 4). A few virulent isolates were found in the Manitoba seed samples whereas none were detected in the Alberta samples. Recent reports of the field incidences of the virulent blackleg indicate it is more common in Saskatchewan (Berkenkamp and Kirkham, 1991), than in Manitoba (Van Den Berg and Platford, 1991). There has also been a recent report of the presence at low levels of the virulent blackleg in certain areas of Alberta (Evans *et al.*, 1991). In only one instance did the cultural characteristics and the pathogenicity tests on seedlings fail to agree. An isolate from Saskatchewan appeared to be virulent culturally, but in the seedling test it was avirulent.

The frequency and distribution pattern of these pathogens on seed is in agreement with the field disease survey results in some crop production areas, but they differ slightly from the results in other areas. Differences in the frequency and distribution of these pathogens between growing areas probably involves a number of factors, of which weather is certainly a major one. Spread of the virulent form of *L.* maculans, even when 0.1% of the seed is infected, is a real threat to crop production. Based on estimates by Humpherson-Jones (1985), a seeding rate of 3-4 kg/ha and 0.1% seed infection would result in the sowing of 750 infected seeds/ha. To limit disease spread it is important to ensure that only pathogen-free seed or

Table 1. Number of canola samples in each crop district composite for 1989 and 1990.

	Manitoba		Saskatchewan		Alberta	
Crop District	1989	1990	1989	1990	1989	1990
1	60	54	142	102	16	14
2	60	117	22	16	102	114
3	60	119	106	24	56	55
4	33	53	6	2	135	249
5	51	69	147	328	91	100
6	32	43	171	145	79	67
7	60	105	82	66	136	168
8	60	116	167	346	--	--
9	--	--	128	430	--	--
9 & 10	54	38	--	--	--	--
11	46	37	--	--	--	--
12	21	25	--	--	--	--

fungicide treated seed is used in areas free of the pathogen. Since most districts had detectable levels of the alternaria blackspot pathogens, use of seed free of these pathogens would not imply freedom from the disease during the growing season. However, it would be especially beneficial if resistance to these pathogens was incorporated into varieties agronomically suitable to the areas where alternaria blackspot is most important.

Acknowledgements

The assistance of the producers and the grain industry in supplying samples is gratefully acknowledged. Thank you as well to the staff of the Oilseeds section of the GRL for sample collection and preparation and to the grain inspectors of the Canadian Grain Commission for grading the samples. The expert technical assistance of S. Patrick is also appreciated.

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Tomato spotted wilt virus, a problem on grass pea and field pea in the greenhouse in 1990 and 1991

R.C. Zimmer[1], K. Myers[2], S. Haber[3], C.G. Campbell[1] and G.H. Gubbels[1]

Tomato spotted wilt virus severely affected grass pea, ***Lathyrus sativus,*** and field pea, ***Pisum*** sativumvar. ***arvense,*** in the greenhouse during the winters of 1989-90 and 1990-91. On grass pea, symptoms varied from loss of chlorophyll and wilting and drying up of the foliage of the entire plant to those where stem segments at one or more nodes became bleached and dried up. On field pea, leaf symptoms were light brown often with a purplish tinge and occurred randomly on the plant. Also on field pea, purplish or purplish brown streaking of the stem and petiole was prominent. On both hosts, purplish circular lesions or diffuse purplish areas were characteristic on the pods. Flower and pod abortion occurred on severely affected plants. Symptoms of this virus also were observed on potato, tomato, Nicotinia and petunia. The western flower thrip, ***Frankliniella occidentalis,*** vector of this virus, was abundant throughout the greenhouse area.

Can. Plant Dis. Surv. 72:1, 29-31, 1992.

Le virus de la maladie des taches bronzees de la tomate a sévèrement affecte la gesse cultivee, ***Lathyrus sativus,*** et le pois de grande culture ***Pisum sativum*** var. ***arvense,*** en serre durant les hivers 1989-90 et 1990-91. Sur les gesses cultivees, les symptômes furent variés. Certains plants ont montre une perte de chlorophylle, un fletrissement et un dessechement du feuillage de la plante entière. D'autres plants ont montre un blanchiement et un dessechement des segments pres de un ou de plusieurs noeuds. Sur les pois de grande culture, les symptômes foliaires ont montre un brun pâle accompagnes souvent d'une teinte violacee, et ce changement de couleur fut present au hasard sur les plants. De plus, dans les champs de pois, des necroses violacees ou brune violacees sur les tiges et les petioles furent proeminent. Sur les gousses des deux hôtes, des lesions circulaires violacees ou des regions violacees diffuses furent caracteristiques. L'avortement des fleurs et des gousses s'est produit sur des plants severement affectes. Les symptômes de ce virus ont ete observes aussi sur la pomme de terre, la tomate, la nicotine et le petunia. Le thrip des petits fruits, ***Frankliniella occidentalis,*** vecteur de ce virus, fut abondant partout a l'interieur de la serre.

Introduction

During the winters of 1989-90 and 1990-91, at the Agriculture Canada Research Station, Morden, Manitoba, greenhouse-grown plants of grass pea, ***Lathyrus sativus*** L., and field pea, ***Pisum sativum*** var. ***arvense*** L., produced atypical growth.

Symptoms on ***L. sativus*** plants varied from progressive loss of chlorophyll and drying of foliage from the base to the top of the plant, to plants on which leaf and stem segments at one or more nodes became bleached and dried up (Fig. 1). Leaf symptoms on field pea often were a light brown accompanied with a purplish tinge (Fig. 2). On ***L. sativus,*** but more ***so*** on field pea, purplish or purplish brown discoloration of the stem and petioles was prominent. Circular purplish lesions or diffuse purplish discolored areas were characteristic of this disease on the pods (Figs. 3,4). Flower and pod abortion occurred on severely affected plants.

The cause of this problem was not evident; therefore, a series of tests were carried out to implicate or eliminate variables such as: planting medium, water source, nutrition, lighting and soil-borne diseases as possible causes. In all test treatments some plants developed lesions, but no trend was evident. Plants with similar treatments grown in a growth cabinet did not develop symptoms, indicating that the probable cause was common only to the greenhouse area.

Since a bacterium or fungus was not implicated, a virus was considered to be the cause. The symptoms were similar to those caused by the pea streak virus or by several other viruses known to cause streak type symptoms. However, two factors did not support such a premise. Firstly, the symptoms on peas varied somewhat from those reported and, secondly, aphids are known to transmit pea streak, but there was no aphid problem in the greenhouses during 1990 and 1991. There were, however, significant populations of whitefly and thrips in the greenhouses.

The cause of the problem at Morden was confirmed by enzyme-linked immunosorbent assay as due to the

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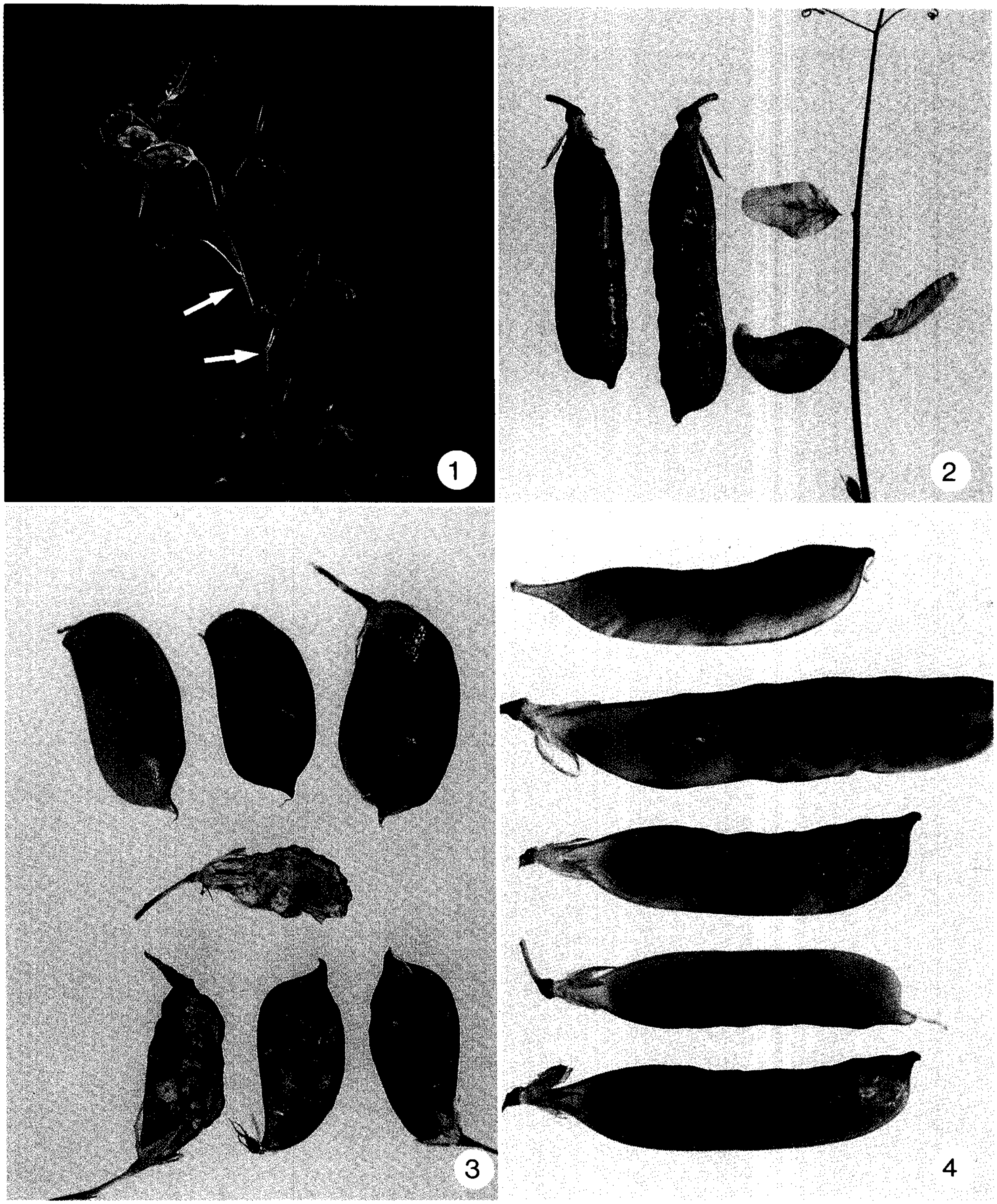

Fig. 1. Stem of grass pea, ***Lathyrus sativus,*** with tan areas at two nodes (arrows); nodes above and below the arrows appear healthy.

Fig. 2. Leaf symptoms on field pea, ***Pisum sativum*** var. ***arvense,*** tan with purplish veination.

Fig. 3. Pods of grass pea with a range of symptoms.

Fig. 4. Pods of field pea with a range of symptoms.

Impatiens strain of tomato spotted wilt virus (TSWV-I). It also was found in 1991 on Impatiens in the conservatory greenhouse at Assiniboine Park, Winnipeg, Manitoba. This is the first report of this virus in Manitoba and a first report of ***Lathyrus sativus*** as a host.

Why this virus appeared suddenly in Manitoba and how it was introduced probably will never be known. TSWV has a wide host range (1,4,5). The possibility of seed transmission of this virus has not been answered satisfactorily. Seed transmission has been reported only in the compositae, Cineraria. Jones (3) obtained seed transmission of up to 96% in Cineraria. However, Crowley (2) examined 5000 seeds from infected Cineraria plants and found no infected seedlings. In addition to ***L. sativus*** and field pea at Morden, symptoms of TSWV were apparent on potato, tomato, Nicotiana and petunia. Once introduced, TSWV was spread efficiently throughout the greenhouse cells at Morden by the western flower thrip, ***Frankliniella occidentalis*** Pergande. Control of this virus is hard to obtain because of its wide host range and because of the difficulty in obtaining efficacy by chemical means.

Acknowledgements

We thank Dr. R.O. Hampton, Oregon State University, Corvallis, Oregon, for his helpful suggestion as to the cause of our problem and the Centre for Land and Biological Resources Research, Agriculture Canada, Ottawa, Ontario, for the thrip identification.

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SOCIETE CANADIENNE DE PHYTOPATHOLOGIE / INVENTAIRE DES MALADIES DES PLANTES AU CANADA - APERCU DES MALADIES

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Diagnostic laboratories / Laboratoires diagnostiques

Crop / Culture: Diagnostic Laboratory Report

Location / Emplacement: Manitoba

Title / Titre: Diseases diagnosed on alfalfa samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991

Name and Agency / Nom et Organisation:

Platford, R. G.
Manitoba Agriculture
Agricultural Services Complex
201-545 University Crescent
Winnipeg, Manitoba
R3T 5S6

<u>Methods</u>: The Manitoba Agriculture Plant Pathology Laboratory provides diagnoses and control recommendations for disease problems of crops and ornamentals. Samples are submitted by Manitoba Agriculture extension staff, farmers, agri business and the general public. Diagnoses are based on visual examination for symptoms and culturing on artificial media.

<u>Results</u>: The Manitoba Agriculture Plant Pathology Laboratory received 45 samples of alfalfa. Diagnostic results are presented in Table 1. Dry weather in early spring delayed growth of alfalfa. Common leaf spot was the most common problem isolated from alfalfa. Crown rot continued to be a major problem in stands over 4 years old. There appears to be a relationship between winter injury, snow mould and invasion of damaged crowns by Fusarium spp. There were no surveys conducted in 1991 for verticillium wilt and none of the samples submitted were found to be infected with verticillium. One field of alfalfa was found to be heavily infected by rust (Uromyces striatus).

Table 1: Summary of diagnoses on alfalfa samples submitted to the Manitoba Agriculture Plant Pathology Laboratory.

DISEASE	PATHOGEN	NUMBER OF SAMPLES
Common leaf spot	Pseudopeziza medicaginis	14
Black stem	Phoma medicaginis	5
Crown rot	Fusarium spp.	4
Yellow leaf blotch	Leptotrochila medicaginis	4
Rust	Uromyces striatus	1
Nutrient deficiency	undetermined	11
Physiological stress	winter injury, white spot	4
Herbicide injury		2
	Total	45

Crop / Culture: Diagnostic Laboratory Report

Location / Emplacement: Manitoba

Title / Titre: Diseases diagnosed on cereal crops submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991

Name and Agency / Nom et Organisation:

Platford, R. G.
Manitoba Agriculture
Agricultural Services Complex
201-545 University Crescent
Winnipeg, Manitoba
R3T 5S6

Methods: The Manitoba Agriculture Plant Pathology Laboratory provides diagnoses and control recommendations for disease problems of crops and ornamentals. Samples are submitted by Manitoba Agriculture extension staff, farmers, agri-business and the general public. Diagnoses are based on visual examination for symptoms and culturing on artificial media.

Results: The Manitoba Agriculture Plant Pathology Laboratory received 489 submissions of cereal samples in 1991. Results are presented in Table 1.

Wheat Tan spot was present at very high levels when wheat was in the seedling stage in all regions. The highest incidence of tan spot occurred in fields of wheat planted into wheat stubble in the central region. Wet weather in July favoured further development of leaf diseases resulting in severe yield losses. Wheat streak mosaic was prominent in 8 fields of spring wheat in the southwest regions of Killarney and Melita. Leaf rust was very severe on Biggar wheat throughout most of southern Manitoba. Head blight occurred at high levels in the Red River Valley. A combination of fungal leaf diseases, root rot and head blight resulted in below average yields for wheat in Manitoba.

Barley Wet weather in June favoured the development of high levels of net blotch in the central, interlake and eastern regions. Continued wet weather in July favoured further development of the leaf diseases and resulted in severe yield losses. Barley yellow dwarf virus was quite prevalent particularly in the central and southwest regions, but losses due to barley yellow dwarf virus were low. Stem rust was prominent in late planted fields of barley in the central, eastern and interlake regions.

oats The most prominent disease of oats in 1991 was barley yellow dwarf virus. Severely infected fields were reported in the interlake, southwest and eastern region but barley yellow dwarf virus was found in almost all fields of oats in southern Manitoba at levels from trace to severe. The most heavily infected were late planted fields.

Table 1: Summary of diagnoses on cereal samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991.

CROP	DISEASE	NUMBER OF SAMPLES
Wheat	Tan spot (Pyrenophora *triciti-repentis*)	51
	Septoria leaf blotch (Septoria spp.)	50
	Leaf rust (Puccinia *recondita*)	36
	Glume blotch (Septoria spp.)	27
	Common root rot (Cochliobolus *sativus*, Fusarium spp.)	17
	Head blight (Fusarium *graminearum*)	12
	Barley yellow dwarf virus	11
	Wheat streak mosaic virus	8
	Herbicide injury	30
	Environmental stress	26
	Nutrient deficiency	1
	Total	269
Barley	Net blotch (Pyrenophora *teres*)	78
	Stem rust (Puccinia *graminus*)	34
	Barley yellow dwarf virus	31
	Leaf rust (Puccinia horedii)	24
	Common root rot (Cochiobolus sativus, Fusarium spp.)	9
	Loose smut (*Ustilago nuda*)	1
	Herbicide injury	15
	Environmental stress (seeding problems)	9
	Total	201
Oats	Barley yellov dwarf virus	14
	Crown rust (Puccinia *coronata*)	2
	Septoria blotch (Septoria spp.	1
	Environmental stress	1
	Herbicide injury	1
	Total	19

Crop / Culture: Diagnostic Laboratory Report

Location/Emplacement: Manitoba

Title / Titre: Diseases diagnosed on samples of ornamental trees and shrubs submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991.

Name and Agency / Nom et Organisation:

Platford, R. G.
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R3T 5S6

Methods: The Manitoba Agriculture Plant Pathology Laboratory provides diagnoses and control recommendations for disease problems of crops and ornamentals. Samples are submitted by Manitoba Agriculture extension staff, farmers, agri-business and the general public. Diagnoses are based on visual examination for symptoms and culturing on artificial media.

Results: Results of 385 submissions of ornamental trees and shrubs are presented in Table 1.

Table 1: Summary of diagnoses on ornamental tree and shrub samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991.

CROP	DISEASE	NUMBER OF SAMPLES
Spruce	Cytospora canker (Leucostoma *kunzei*)	5
	Needle cast (Rhizosphaera *kalkhoffii*)	5
	Seedling damping off (*Fusarium* spp, Botrytis *cinerea*)	1
	Environmental stress (winter injury, drought)	30
	Nutrient deficiency	9
	Herbicide injury	1
	Total	51
Pine	Needle cast (*Cyclaneusma niveum*)	5
	Canker (Leucostoma spp.)	3
	Gall rust (Endocronartium *harknessii*)	2
	Environmental stress (winter injury)	4
	Herbicide injury	2
	Total	16
Elm	Dutch elm disease (*Ophiostoma ulmi*)	42
	Canker (*Botryodiplodia* spp.)	I
	Black spot (*Gnomonia ulmea*)	1
	Dothiorella wilt (Dothiorella *ulmi*)	1
	Slime flux (*Erwinia* cloacae)	1
	Verticillium wilt (Verticillium sp.)	1
	Environmental stress (drought)	10
	Herbicide injury	8
	Total	71

Willow	Cytospora canker (Cytospora *spp.*)	2
	Leaf rust	1
	Herbicide injury	14
	Nutrient deficiency	11
	Environmental stress	6
	Total	34
Poplar	Canker (Cytospora *chrysosperma*)	9
	Septoria canker & leaf spot (Septoria *musiva*)	9
	Shoot blight (*Pollacia* spp.)	7
	Leaf rust (*Melampsora* medusae)	2
	Herbicide injury	8
	Environmental stress (winter injury)	7
	Nutrient deficiency	6
	Total	48
Birch	Birch decline (environmental stress)	5
	Cytospora canker (Cytospora *spp.*)	2
	Herbicide injury	4
	Nutrient deficiency	3
	Total	14
Ash	Anthracnose (*Gloeosporium spp.*)	2
	Canker (unidentified cause)	2
	Rust (*Puccinia sparaganioides*)	1
	Herbicide injury	16
	Environmental stress (drought, winter injury)	
	Total	21
Maple	Canker (Cytospora *spp.*)	3
	Anthracnose (*Gloeosporium spp.*)	3
	Tar spot (*Rhytisma acerinum*)	1
	Herbicide injury	13
	Nutrient deficiency	9
	Environmental stress	3
	Total	32

Oak	Oak decline (environmental stress)	2
	Leaf blister (*Taphrina* caerulescens)	2
	Anthracnose	1
	Herbicide injury	1
	Total	6
Basswood	Canker (unidentified cause)	1
	Leaf spot (unidentified)	1
	Environmental stress	6
	Herbicide injury	1
	Total	9
Caragana	Crown rot (*Fusarium* spp.)	4
	Canker (unidentified)	1
	Septoria leaf spot (Septoria *caraganae*)	1
	Herbicide injury	8
	Environmental stress	2
	Total	16
Mountain Ash	Canker (Cytospora spp.)	12
	Fireblight (*Erwinia* arnylovora)	10
	Leaf spot (unidentified cause)	3
	Nutrient deficiency (iron chlorosis)	7
	Environmental stress (drought, winter injury)	2
	Total	34
Cotoneaster	Fireblight (*Erwinia amylovora*)	7
	Canker (*Cytospora* spp.)	4
	Nutrient deficiency (iron deficiency)	4
	Environmental stress	2
	Total	17
Rose	Botrytis bud blast (*Botrytis cinerea*)	3
	Black spot (*Diplocarpon rosae*)	3
	Rust (*Phragmidium* spp.)	3
	Powdery mildew (*Sphaerotheca macularis*)	1
	Nutrient deficiency (iron chlorosis)	4
	Herbicide injury	2
	Total	16

Crop / Culture: Diagnostic Laboratory Report

Location / Emplacement: Manitoba

Title / Titre: Diseases diagnosed on fruit crops submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991.

Name and Agency / Nom et Organisation:

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R3T 5S6

Methods: The Manitoba Agriculture Plant Pathology Laboratory provides diagnoses and control recommendations for disease problems of crops and ornamentals. Samples are submitted by Manitoba Agriculture extension staff, farmers, agri-business and the general public. Diagnoses are based on visual examination for symptoms and culturing on artificial media.

Results: The Manitoba Agriculture Plant Pathology Laboratory received 298 submissions of fruit crops. Results are presented in Table 1.

Table 1: Summary of diagnoses on fruit crop samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991.

CROP	DISEASE	NUMBER OF SAMPLES
Apple	Fireblight (*Erwinia* amylovora)	45
	Cankers (*Cytospora* spp.)	6
	Frogeye leaf spot (Botryosphaeria *obtusa*)	4
	Scab (*Venturia* inaequalis)	1
	Silverleaf (*Chondrostereum purpureum*)	1
	White rust (Botryosphaeria *dothidea*)	1
	Environmental damage (winter injury, water core)	45
	Nutrient deficiency (iron chlorosis)	22
	Herbicide injury	10
	Total	135
Strawberry	Crown rot, root rot (*Fusarium* spp.)	9
	Leaf spot (*Mycosphaerella* fragariae)	4
	Gray mold (Botrytis *cinerea*)	3
	Virus	2
	Nutrient deficiency	9
	Herbicide injury	4
	Total	31

Raspberry	Cane blight (Leptosphaeria coniothyrium)	10
	Fireblight (*Erwinia* amylovora)	6
	Anthracnose (*Elsinoe veneta*)	5
	Powdery mildew (*Oidium* sp.)	2
	Nutrient deficiency (iron chlorosis)	8
	Herbicide injury	4
	Environmental stress	3
	Total	38
Pear	Canker (Cytospora sp.)	3
	Fireblight (*Erwinia amylovora*)	2
	Environmental stress	5
	Total	10
Saskatoon	Cankers (*Valsa* spp.)	2
	Black leaf spot(*Entomosporium* maculatum	1
	Rust (Gymnosporangium spp.)	1
	Environmental stress (winter injury)	3
	Total	7
Currant	Powdery mildew (*Sphaerotheca mors-uvae*)	6
	Canker (unidentified)	2
	Anthracnose (Drepanopeziza spp.)	1
	Environmental damage	1
	Nutrient deficiency	1
	Total	11
Chokecherry	Cankers (Cytospora sp.)	2
	Bacterial blight	1
	Black knot (*Dibotryon* morbosa)	1
	Shot hole (*Blumeriella jaapii*)	1
	Herbicide injury	4
	Nutrient deficiency	1
	Total	10

Plum	Plum pockets (*Taphrina communis*)	6
	Bacterial blight (Pseudomonas sp.)	2
	Canker (Cytospora spp.)	1
	Shot hole (*Coccomyces* spp.)	1
	Environmental damage	7
	Nutrient deficiency	2
	Herbicide injury	1
	Total	20
Crabapple	Fireblight (*Erwinia* amylovora)	8
	Canker (Cytospora sp.)	6
	Black rot (*Botryosphaeria obtusa*)	2
	Environmental stress	13
	Nutrient deficiency	7
	Total	36

Crop/Culture: Diagnostic Laboratory Report

Location/Emplacement: Manitoba

Title/Titre: Diseases diagnosed on potatoes submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991

Name and Agency/ Nom et Organisation:

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Methods: The Manitoba Agriculture Plant Pathology Laboratory provides diagnoses and control recommendations for disease problems of crops and ornamentals. Samples are submitted by Manitoba Agriculture extension staff, farmers, agri-business and the general public. Diagnoses are based on visual examination for symptoms and culturing on artificial media.

Results: The Manitoba Agriculture Plant Pathology Laboratory received 35 samples of potatoes. The diagnoses are presented in Table 1. Tuber diseases including fusarium dry rot, scab, rhizoctonia black scurf and ring rot were the most frequently submitted problems. One non-commerical sample of potatoes from Thompson in northern Manitoba was found to have a tuber rot diagnosed as being caused by Armillaria mellea. There was only 1 sample submitted with verticillium wilt but this was not a true representation of the problem in Manitoba potato fields. There were many fields in southern Manitoba especially in the Winkler potato growing area that had a severe problem with wilt caused by Verticillium dahliae alone or in combination vith black dot (Colletotrichum *coccodes*) and fusarium root rot. Drought conditions in August reduced yields in the Carberry and Portage la Prairie areas.

Table 1: Summary of diagnoses on potato samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991

DISEASE	PATHOGEN	NUMBER OF SAMPLES
Fusarium dry rot	Fusarium spp.	6
Fusarium wilt	Fusarium spp.	5
Bacterial ring rot	*Clavibacter* michiganensis subsp. sepedonicus	4
Common scab	Streptomyces scabies	4
Fusarium root rot	Fusarium spp.	3
Early blight	*Alternaria* solani	2
Rhizoctonia	Rhizoctonia solani	2
Black dot	Colletotrichum coccodes	2
Armillaria tuber rot	Armillaria mellea	1
Verticillium wilt	Verticillium dahliae	1
Environmental stress	drought	3
	Total	33

Crop/Culture: Diagnostic Laboratory Report

Location/Emplacement: Manitoba

Title/Titre: Diseases diagnosed on turf samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991

Name and Agency/ Nomet Organisation:

Platford, R. G.
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Methods: The Manitoba Agriculture Plant Pathology Laboratory provides diagnoses and control recommendations for disease problems of crops and ornamentals. Samples are submitted by Manitoba Agriculture extension staff, farmers, agri-business and the general public. Diagnoses are based on visual examination for symptoms and culturing on artificial media.

Results: The Manitoba Agriculture Plant Pathology Laboratory received 87 samples of turf (Table 1). The most frequently submitted problem was melting out diagnosed on 36 samples followed by anthracnose (19), ascochyta leaf spot (12), fusarium patch (6) and septoria leaf spot (5). In addition to infectious diseases, browning of grass in 7 samples was caused by drought. Herbicide injury was found to affect 2 samples.

Leaf diseases were very prominent in Manitoba in 1991 due to high levels of moisture particularly in June and July. Anthracnose, melting out and ascochyta leaf spot were the most frequently observed leaf diseases. Snow mould was not a major problem in 1991. Decline of lawns, attributed to Fusarium patch and late season drought, was a frequent problem in Winnipeg.

Table 1: Summary of diagnoses on turf samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991

DISEASE	PATHOGEN	NUMBER OF SAMPLES
Melting out	Drechslera poae	36
Anthracnose	*Colletotrichum* graminicola	19
Ascochyta leaf spot	Ascochyta spp.	12
Fusarium patch	Fusarium spp.	6
Septoria leaf spot	Septoria spp.	5
Environmental stress	drought	7
Herbicide Injury		2
	Total	87

Crop/Culture: Diagnostic Laboratory Report

Location/Emplacement: Manitoba

Title/Titre: Diseases diagnosed on vegetable crops submitted to the Manitoba Agriculture Plant Pathology Laboratory in Manitoba in 1991.

Name and Agency / Nom et Organisation:

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Methods: The Manitoba Agriculture Plant Pathology Laboratory provides diagnoses and control recommendations for disease problems of crops and ornamentals. Samples are submitted by Manitoba Agriculture extension staff, farmers, agri-business and the general public. Diagnoses are based on visual examination for symptoms and culturing on artificial media.

Results: The Manitoba Agriculture Plant Pathology Laboratory received 74 submissions of vegetable crops in 1991. Results are presented in Table 1.

Table 1: Summary of diagnoses on vegetable samples submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991.

CROP	DISEASE	NUMBER OF SAMPLES
Tomato	Septoria leaf spot (*Septoria lycopersici*)	11
	Root rot (*Fusarium* spp.)	4
	Herbicide injury	13
	Nutrient deficiency	4
	Environmental stress	1
	Total	33
Broccoli	Downy mildew (Peronospora parasitical	1
	Black rot (Xanthomonas *campestris*)	2
	Total	3
Cauliflower	Downy mildew (Peronospora parasitica)	1
Cabbage	Black rot (Xanthomonas campestris)	1
	Root rot and wilt (Fusarium spp.)	1
	Phoma leaf spot (Leptosphaeria maculans)	1
	Total	3

Cucumber	Scab (*Cladosporium* cucumberinum)	4
	Angular leaf spot (*Pseudomonas lachrymans*)	2
	Root rot (*Fusarium* spp., Pythium spp.)	1
	Environmental stress	2
	Herbicide injury	1
	Nutrient deficiency	1
	Total	11
Garlic	Bulb rot (*Penicillium* spp.)	2
Lettuce	Aster yellows (Aster Yellow MLO)	2
	Herbicide injury	1
	Nutrient deficiency	1
	Total	4
Onion	Basal rot (*Fusarium* sp.)	5
	Blast (*Botrytis* sp.)	1
	Smut (*Urocystis cepulae*)	1
	Herbicide injury	2
	Environmental stress	1
	Total	10
Radish	White rust (*Albugo candida*)	1
Green Beans	Halo blight (Pseudomonas phaseolicola)	1
Carrots	Aster yellows (Aster Yellows MLO)	4
	Black rot (*Thielaviopsis basicola*)	1
	Total	5

Forage legumes / Legumineuses fourrageres

Crop / Culture: Alfalfa

Location/ Emplacement: Saskatchewan

Title / Titre: Occurrence of Alfalfa mosaic virus on alfalfa in Saskatchewan, 1990.

Name and Agency / Nom et Organisation:

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METHODS: Samples were collected from 61 alfalfa fields in central Saskatchewan in September, 1990. Samples were collected in a tear-drop pattern, with a single alfalfa stem sampled at each 4-m interval. Thirty stems per field were collected and stored on ice, then frozen. Alfalfa mosaic virus (AMV) symptoms are not distinctive in the fall, and there was no attempt to select plants with symptoms. ELISA, using the monoclonal antibody PVAS-92 from the American Type Culture Collection, was used to examine a 2 gm sample of bulked material from each site.

RESULTS & COMMENTS: There were large differences in the incidence of AMV among locations (Table 1). In the Melfort and Saskatoon regions, only 2 of 30 fields were positive for AMV, while 19 of 31 fields near Outlook and North Battleford were positive for the virus. The reason for this difference is not apparent. There were substantial differences in virus incidence between the irrigated and dryland sites at Outlook, but similar differences was not observed at the other locations. In 1991, samples were collected from the same fields, together with agronomic information and cropping history, but testing of these samples is not complete.

Table 1. Presence or absence (incidence) of AMV in alfalfa fields in four regions of central Saskatchewan, 1990.

Location	No. sites	No. with AMV	Incidence (%)
Melfort			
- dryland	14	1	6%
Saskatoon			
- dryland	6	0	0%
- irrigated	10	1	10%
North Battleford			
- dryland	13	a	61%
- irrigated	3	2	67%
Outlook			
- dryland	4	1	25%
- irrigated	11	8	73%

Acknowledgement: This study was funded in part by the Irrigation Based Economic Development fund of Saskatchewan. We thank D. Regnier for his assistance in the study.

Cereals / Cereales

Crop / Culture: Barley

Location / Emplacement: Manitoba

Title / Titre: 1991 SURVEY FOR FOLIAR DISEASES OF BARLEY IN MANITOBA

Name and Agency / Nom et Organisation:

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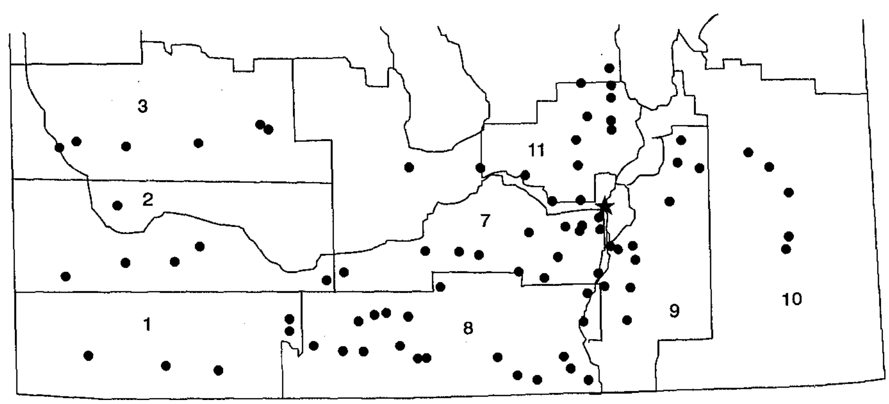
R. Michelutti, Agriculture Canada, Research Station, Harrow, Ontario, NOR 1GO

METHODS: Between 23 July and 2 August, 81 barley fields in Manitoba were sampled for foliar disease incidence and severity. Fields were selected at random every 10-20 km along the survey routes, depending on availability and crop frequency. At each site, about 10 plants were examined along a diamond-shaped transect 25 m long per side. Disease levels were estimated visually in both the upper (top two leaves) and lower canopies using a four-point scale: trace (<5% leaf area affected); slight (5-15%); moderate (16-40%); and severe (41-100%). Leaves with symptoms were collected and kept in paper envelopes for subsequent pathogen identification and disease confirmation. Infected leaf pieces were surface sterilized and placed in petri dish moist chambers to promote pathogen sporulation.

RESULTS AND COMMENTS: Leaf spotting was evident in all 73, six-rowed and 8, two-rowed fields examined (Fig. 1). Disease severity levels were higher than found in 1988-90, due to abundant rain in May, June and July. In most fields upper leaves were rated slight, but in 29% levels were moderate or severe; lower leaves in 80% of fields were moderately or severely infected. More fields with higher levels of disease were found in the eastern half of the surveyed area, but sampling was also more intense here. Lower rainfall in the south-western region in the previous few years, compared to other regions, likely depressed inoculum levels and contributed to reduced disease development. Pyrenophora teres (net blotch) and Cochiobolus sativus (spot blotch) were each isolated from >95% of fields. Occasionally, one or the other predominated, but in most instances both were common. Septoria passerinii (speckled leaf blotch) was found in 37% of fields, a higher proportion than normal, while Rhynchosporium secalis (scald) was detected in one field. Powdery mildew was observed in many fields but was not rated. Yield losses in some fields were estimated at 30-40%; average losses due to leaf spots were likely 15%.

Figure 1. Location of barley fields sampled for foliar disease in Manitoba in 1991.



Crop / Culture: Barley

Location/ Emplacement: Saskatchewan

Title / Titre: Saskatchewan Barley Disease Survey, 1991

Name and Agency / Nom et Organisation:

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D. Kaminski, Soils and Crops Branch, Saskatchewan Agriculture and Food, Room 133, Walter Scott Building, Regina, Saskatchewan S4S 0B1
C. Kirkham, Agriculture Canada Research Station, P.O. Box 1240, Melfort, Saskatchewan S0E 1A0
K. Mortensen and S. Boyetchko, Agriculture Canada Research Station, P.O. Box 400, Regina, Saskatchewan S4P 3A2

METHODS: A province wide survey was conducted in 134 barley fields between late milk and early dough growth stages. Random fields were surveyed by assessing disease on a sample of 10 plants 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 0-9 scale described by Saari and Prescott (1975), and modified by Couture (1980). 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. These were plated on water agar containing 100 mg/L streptomycin sulfate and 50 mg/L vancomycin hydrochloride and 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.

RESULTS AND COMMENTS: There were 87 two-row and 47 six-row barley fields surveyed. The distribution by crop districts, severity, and prevalence of the diseases are shown in Table 1. The netted-form of net blotch was the most prevalent disease being observed in 90% of the fields at severe levels. The spot-form of net blotch was found in 8% of the fields and it occurred at trace to moderate levels and only in central Saskatchewan. Scald occurred in the northern and eastern crop districts in 20% of the fields and ranged from light to moderately severe. Spot blotch was identifed as a minor leaf disease. Severe common root rot was found in 87% of the fields. The north-east and east-central regions had high levels of powdery mildew being observed in 20% of the fields. Barley stem rust was only found in trace levels in 14% of the fields and only in the eastern areas of the province. Other diseases present were loose and covered smut, leaf rust, take-all, BYDV, bacterial blight, and ergot.

Four oats fields were also examined. The average disease rating for leaf spots was 3.3 and these were caused by Septoria avenae and Pyrenophora avenae. Ten percent of the plants sampled were infected with severe symptoms of common root rot and 10-15% of the plants had crown rust.

Observations were recorded on previous crop in 117 fields in both the barley and wheat disease surveys in 1991 (Table 2). The two most common rotations were summerfallow followed by a cereal and cereal followed by a cereal. Only 13% of the fields had cereals following an oilseed crop. Thirteen of the 15 fields using a cereal-oilseed rotation were located in crop districts 5A, 5B, 6A, 8B, and 9A which are located in east-central and northern growing areas of Saskatchewan. There were no clear associations between previous crop, current crop, and the average leaf spot or common root rot ratings.

REFERENCE:

Couture, L. 1980. Assessment of severity of foliage diseases of cereals in cooperative evaluation tests. Can. Plant Dis. Surv. 1:8-10.

Saari, E.E., and J.M. Prescott. 1975. A scale for appraising the foliar intensity of wheat diseases. Plant Dis. Reptr. 59:377-380.

Table 1 Distribution, severity, *and* prevalence of barley diseases in Saskatchewan fields surveyed **between** late **milk** to early dough stages in *1991.*

Crop District	No. Fields	Net blotch (net)	Net blotch (spot)	Spot blotch	Scald	Common root rot %	Smut %	Leaf rust	Stem rust	Powdery mildew	BYDV %	Ergot %	Take all %	Bacterial blight
LA	3	6.5/2*	-	2.011	-	24/3	-	-	5 MS/1	TR/3	-	-	-	-
1B	4	7.514	-	1.012	-	27/4	-	-	TR/3	-	-	-	5.0/2	-
2A	1	-	-	-	-	20/1	-	-	-	-	-	-	-	-
2B	7	7.1/7	-	-	7.0/1	3915	TR/2	-	TR/1	-	2.0/1	-	TR/1	-
3AN	0	- **												
	-	-	-	-	-	-	-	-	-	-	-	-		
3As	3	5.8/2	-	-	4.011	20/3	-	-	-	-	-	-	-	-
3BN	3	8.313	-	-	-	35/2	-	-	-	-	-	-	-	-
38S	1	7.0/1	-	-	-	1011	-	-	-	-	0.1/1	-	-	-
4A	0	-	-	-	-	-	-	-	-	-	-	-	-	-
4B	1	6.011	-	-	-	40/1	-	-	-	-	-	-	-	-
5A	9	6.216	3.512	2.8/3	7.511	30/9	0.5/2	TR/7	TR/6	5.9/3	-	TR/2	9.0/1	TR/2
5B	17	5.6115	TR/1	-	2.5/7	29/17	10.0/1	TR/7	TR/3	4.8/10	-	-	-	-
6A	9	6.718	TR/1	6.0/1	-	6519	-	-	TR/2	TR/2	-	-	-	-
6B	7	7.316	6.313	-	-	40/7	1.3/3	-	-	TR/1	1.0/1	-	-	-
7A	4	7.012	3.0/2	-	-	20/3	-	-	-	-	1.5/2	-	-	-
7B	4	7.7/3	5.012	-	-	38/4	-	-	-	-	-	-	-	-
8A	11	6.4111	-	-	0.414	17/7	-	-	-	0.812	-	-	-	-
8B	27	7.1127	-	-	0.414	37/26	-	-	TR/3	1.6/6	-	-	-	1.0/2
9A	23	6.0123	-	-	2.419	24/15	-	-	TR/2	W 3	-	-	-	-
9B	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Average or total	134	6.7/121	3.0111	3.0/7	3.5127	301117	2.4/10	TR/14	TR/19	1.7130	1.215	TR/2	4.7/4	1.0/2

* average disease rating (0-9 scale after Couture *1980)* / number of fields affected
** not observed or not recorded

Table 2 Effect previous crop on the average leaf spot **and** common root rot ratings of wheat and barley grown in Saskatchewan in *1991.*

Previous crop	Current crop	No. of fields	Leaf spot rating (0-9 scale)	Common root rot (%)
Summerfallow	@real	53	6.5	22
	Barley	22	6.7	34
	meat	31	6.3	14
Cereal	Cereal	48	6.4	20
	Barley	19	6.9	30
	wheat	28	6.3	12
Oilseed	@real	15	7.3	24
	Barley	9	7.8	23
	meat	6	6.5	26
Alfalfa	Barley	1	0.0	0

Crop/Culture: Wheat and Barley

Location/Emplacement: Manitoba and eastern Saskatchewan

Title/Titre: 1991 SURVEY OF FLAME CHLOROSIS IN MANITOBA AND EASTERN SASKATCHEWAN

Name and Agency/ Nom et Organisation:

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BACKGROUND: Surveys for flame chlorosis (FC), a soil-borne, virus-like disease of spring cereals (1), have documented its spread and apparent intensification since it was first observed in western Manitoba in 1985 (1-3). Until 1988 FC was observed only in barley, but has since been confirmed in wheat and oat (3). However, up to 1990, levels of infection sufficient to cause crop losses were observed only in barley. Starting from the base established with the 1990 survey, the annual FC surveys monitor the epidemiological trend of the disease. The 1991 survey also examined areas of Manitoba and eastern Saskatchewan not covered in earlier surveys.

METHODS: As noted in earlier reports (1,2), FC is readily diagnosed between the seedling and 4-node stages of growth on the basis of striking and characteristic symptoms. In field workshops held 1991-06-11 and -12 near Minnedosa and Winnipeg, respectively, agricultural survey personnel were shown how to diagnose FC and record survey data using the surveying method described in last year's report (2).

Specimens of FC plants from each field where the disease was observed were forwarded promptly to the Plant Pathology Laboratory of Manitoba Agriculture to confirm the diagnosis (2). Specimens which could not be diagnosed with certainty as FC-positive based on visual symptoms were tested for FC-specific RNA using a dot-blot assay developed at Agriculture Canada, Winnipeg Research Station (4). In addition, approximately one tenth of all specimens diagnosed as FC-positive on the basis of visual symptoms was also tested by the dot-blot assay to confirm reliability.

RESULTS AND COMMENTS: The region roughly bounded by Brandon, Neepawa, and Shoal Lake continues to be the area where FC is most prevalent and most likely to occur at levels sufficient to cause crop losses (Fig. 1). The results of the 1991 survey also reinforce earlier observations that the eastern Red River Valley constitutes a second region with relatively high FC levels. No FC was found at any of the sites examined in south-central Manitoba, the region that lies between the two principal FC areas. The 1990 survey identified several new FC locations (Dauphin, south of Brandon, south Interlake), and FC was observed at more sites and at higher levels in these areas in 1991. The area around Beausejour in eastern Manitoba recorded FC for the first time in 1991.

The 1991 FC survey in eastern Saskatchewan was the first systematic effort to monitor the disease beyond the borders of Manitoba, and followed from the 1990 discovery of FC in western Manitoba within a few km of the Saskatchewan border. No FC was observed at 50 sites (3 barley, 47 wheat fields) in eastern Saskatchewan within a 60 km-wide strip bordering Manitoba from approximately 49°30' to 51°15' N.

As recently as 1990, FC was principally a disease of barley. In the 1990 survey (2,3), FC was found at only trace levels in the small number of wheat fields where it was detected at all. In 1991, by contrast, several fields in both eastern and western Manitoba were observed where FC was at levels sufficient to cause crop losses. A trend to higher FC levels in wheat, if it continued, would raise considerably the threat posed by FC to cereal grain cultivation in Manitoba. In 1991, specimens of green foxtail (*Setaria viridis* L.) with FC-like symptoms and FC-specific RNA were found near Winnipeg (Haber and Harder, unpublished). This raises an additional concern that grassy weeds are FC hosts and thus might constitute reservoirs of inoculum.

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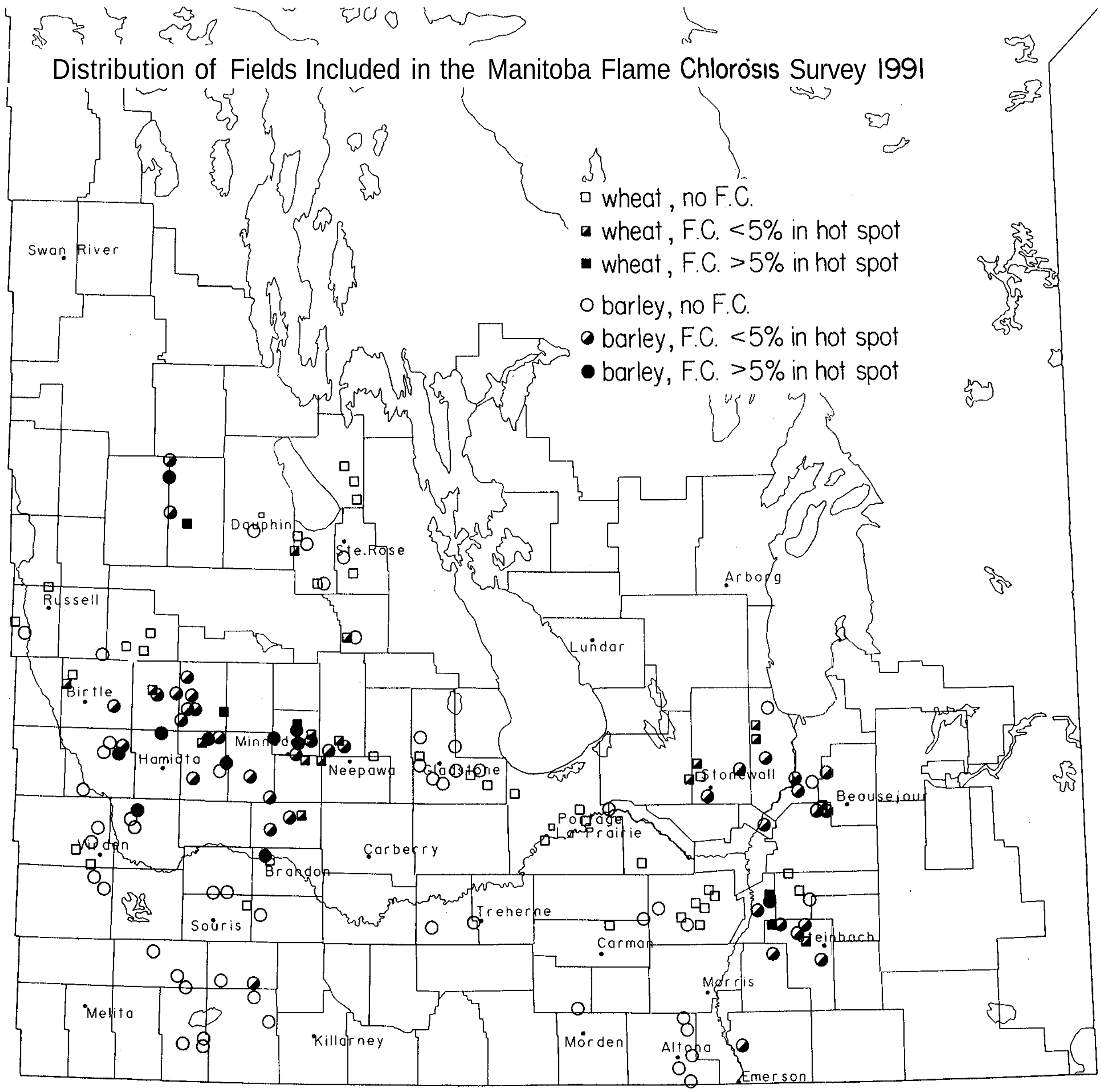
2. Haber, S. and R. G. Platford. 1991. 1990 survey of flame chlorosis in Manitoba. Can. Plant Dis. Surv. 71(1):79-80.
3. Haber, S., D. J. S. Barr and R. G. Platford. 1991. Observations on the distribution of flame chlorosis in Manitoba and its association with certain zoosporic fungi and the intense cultivation of cereals. Can. J. Plant Pathol. 13(3): (in press).
4. Haber, S., D. A. Wakarchuk, S. E. Cvitkovitch and G. Murray. 1991. Diagnosis of flame chlorosis, a novel, virus-like disease of cereals by detection of disease-specific double-stranded RNA with digoxigenin-labelled RNA probes. Plant Dis. (submitted).


Distribution of Fields Included in the Manitoba Flame Chlorosis Survey 1991
wheat, no F.C.
wheat, F.C. <5% in hot spot
wheat, F.C. >5% in hot spot
barley, no F.C.
barley, F.C. <5% in hot spot
barley, F.C. >5% in hot spot
Swan River
Dauphin
Ste.Rose
Russell
Arborg
Lundar
Birtle
Minnedosa
Hamiota
Neepawa
Gladstone
Stonewall
Beausejour
Portage la Prairie
Virden
Carberry
Brandon
Treherne
Souris
Carman
Steinbach
Morris
Melita
Killarney
Morden
Altona
Emerson

Crop / Culture: Barley, Oat, and Wheat

Location / Emplacement: Manitoba and Saskatchewan

Title / Titre: CEREAL SMUT SURVEY, 1991

Name and Agency / Nomet Organisation:

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METHODS: In July 1991, cereal crops were surveyed for *Ustilago hordei*, *U. nigra*, *U. nuda*, *U. tritici*, *U. avenae*, and *U. kolleri* in Manitoba and Saskatchewan. The northern area was covered by a route from Winnipeg-Saskatoon-Prince Albert-Swan River-Winnipeg and the southern area by trips north and south of Winnipeg and a route (thanks to G. Hamilton and N. Howes) from Winnipeg-Swift Current-Kindersley-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 plants (*i.e.* plants with sori) was made while walking an 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 52% of the fields of barley, 11% of the common wheat, 61% of the durum and 10% of the oat. The average levels were 0.2% for barley, 0.1% for durum wheat and trace for common wheat and oat. The highest incidence of smut observed was 5% loose smut of barley in one field near Gronlid, Saskatchewan.

COMMENTS: The incidence of smut in cereals continues to decline, reflecting the drought of recent years. The relatively moist conditions in 1991 will not have an impact until the seed infected in that year is grown out. It will be interesting to see how fast the levels of smut rebound in cultivars with fair or poor resistance, *e.g.* in barley and durum wheat.

Table 1. Incidence of smut in cereals in Manitoba and Saskatchewan in 1991.

Crop	No. fields	Smut species	% Fields affected MB	% Fields affected SK	Mean % infected plants MB	Mean % infected plants SK
Common wheat	212	*U. tritici*	13	9	tr*	tr
Durum wheat	72	*U. tritici*	64	61	0.1	0.1
Oat	29	*U. avenae*, *U. kolleri*	10	10	tr	tr
Barley	148	*U. nuda*	49	44	0.1	0.2
		U. hordei	7	13	tr	0.1
		U. nigra				

*tr = less than 0.1%

Crop / Culture: Barley, Oats and Wheat

Location / Emplacement: Central Alberta

Title / Titre: CEREAL DISEASE SURVEY IN CENTRAL ALBERTA, 1991

Name and Agency / Nom et Organisation:

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METHODS: Disease incidence and severity levels were sampled in 40 cereal fields in central Alberta (CD 8) in early August. Fields were selected randomly at intervals of approximately 10 km and plants were examined every 10 paces in an inverted "V". Leaf diseases were rated on the percent leaf area affected. Head and systemic diseases were rated as a percent of plants affected in square meter samples. Root diseases were rated as the average severity of the disease in 10 plant samples.

RESULTS:

Weather: Central Alberta began the crop year with good soil moisture reserves but spring rains delayed seeding in May and rains in June delayed spraying of herbicides. In July there were severe hail-storms, and a short dry spell stressed crops that were shallow rooted as a result of the early rains. Crops also suffered from competition by weeds as control was very poor, especially for wild oats. Consequently, barley yields and quality were poor. Wheat yields were generally good.

Barley: All seven 2-row barley fields examined had net blotch (*Pyrenophora teres*) and in five of these there was more than 10% disease on the flag leaf and more than 50% disease on the penultimate leaf. Scald (*Rhynchosporium secalis*) occurred in four fields but in low amounts. Common root rot (*Cochliobolus sativus* and *Fusarium* spp.) was also present in four fields, but only one was rated moderately diseased. Loose smut (*Ustilago nuda*) was present in very low amounts in two fields and ergot (*Claviceps purpurea*) was present in one field.

All but one of the 17, 6-row barley fields examined had net blotch but at levels of $\leq$10% disease on the top two leaves. Scald was found in 65% of the fields but again at low levels except for two fields with 25-75% disease on the penultimate leaf. Common root rot was present in 65% of the fields but at very low levels. Loose smut was present at trace levels in four fields and at 1% in one field. Bacterial blight (*Xanthomonas campestris*) was present in three fields in the centre of the surveyed area.

Oats: Blast was present in each of the seven oat fields examined, generally at levels > 10%. Barley yellow dwarf virus was present in four fields at low levels. Septoria leaf blotch (*Septoria* spp.) occurred at low levels in four fields but at 50% damage on the penultimate leaf of one field.

Wheat: Septoria leaf blotch was present in all nine wheat fields examined. Disease levels were generally $\leq$5% on the flag leaf, and $\geq$10% on the penultimate leaf. Stem melanosis (*Pseudomonas cichorii*) and ergot were present in one field each and common root rot in six. Root rot levels were low except for one field which was rated moderately diseased. Take all (*Gauemannomyces graminis*) was present in five fields, three of these with 5-10% of the plants diseased.

Crop / Culture: Oat

Location/Emplacement: Manitoba and eastern Saskatchewan

Title/Titre: OCCURRENCE OF OAT RUSTS IN WESTERN CANADA IN 1991

Name and Agency/ Nomet Organisation:

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METHODS: The occurrence of oat crown rust (causal agent Puccinia coronata Cda. f. sp. avenae Eriks.) and oat stem rust (causal agent P. graminis Pers. f. sp. tritici Eriks.) in Manitoba and eastern Saskatchewan was determined by frequent examination of farm fields or stands of wild oat (Avena fatua L.) from late June to mid-August. Rust samples were collected from wild oat, cultivated oat, and uniform rust nurseries located near Beausejour, Brandon, Morden, Shoal Lake, and Woodmore, in Manitoba, and near Indian Head in Saskatchewan.

RESULTS AND COMMENTS: Crown rust was first observed in trace amounts in susceptible oat on June 28 in southern Manitoba. Conditions were favourable for the development of the disease due to the abundance of moisture in July. By early August, crown rust was widespread in southern Manitoba; 100% severity levels were commonly observed in wild oat, while in commercial fields severities ranged from 10-40%. This indicates that the resistance gene combination Pc38 and Pc39 in the currently recommended cvs. Dumont, Riel, and Robert, still offered some protection to the crown rust population, but is becoming less effective. Crown rust was light in eastern Saskatchewan in 1991.

To date, 29 of the 59 isolates identified from the rust collections in 1991 were races with virulences to both genes Pc38 and Pc39. However, the most significant finding of the 1991 Manitoba survey was the detection of virulence to Pc68, a gene that has been immune to all Canadian crown rust isolates since its isolation from an Avena sterilis accession in 1982; several isolates with virulences to both Pc68 and Pc38 were obtained from a resistant trap nursery located near Beausejour, Manitoba. This is of concern because gene Pc68 is at advanced stages of incorporation into cvs. Dumont and Robert in the Winnipeg breeding program. The detection of virulence to both Pc38 and Pc68 would necessitate that other resistance gene(s) be used in combination with Pc68 to provide longer term effectiveness.

In contrast to crown rust, oat stem rust was light in the eastern prairies in 1991 and all the oat cultivars currently recommended for the region remained resistant to the predominant races of the stem rust population.

Crop / Culture: Wheat

Location/ Emplacement: Manitoba

Title / Titre: OCCURRENCE OF FUSARIUM HEAD BLIGHT IN MANITOBA IN 1991

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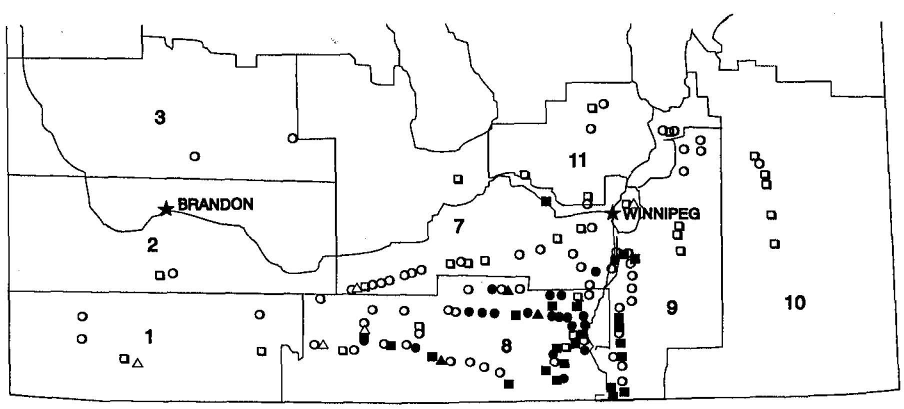
METHODS: One hundred and eighty-five wheat fields throughout Manitoba were surveyed for Fusarium head blight between July 23 and August 2, 1991 by sampling an area about 20 x 20 m at the edge of each field. Ten heads were collected at each site to confirm and identify the Fusarium species present.

RESULTS AND COMMENTS: At sampling, the crop developmental stage ranged from medium milk to hard dough. Fusarium head blight was found in 78% of wheat fields examined and occurred throughout Manitoba (Fig. 1). It was found in 75% (83 of 111) of common, 67% (8 of 12) of durum and 85% (53 of 62) of semi-dwarf wheat fields. The severity ranged from trace (47 fields) to 50% heads infected. There were more common wheat fields having high severity levels in 1991 than in previous years. Generally, severity levels in common wheat were similar to those for the other two wheat types. The severely infected wheat fields were found primarily in crop district 8 (south-central Manitoba). F. graminearum was the pathogen species isolated most frequently (Table 1).

Table 1. Distribution of Fusarium species in common, durum and semi-dwarf wheat fields in Manitoba in 1991.

Fusarium spp.	No. wheat fields: Common	Durum	Semi-dwarf	Total
F. graminearum	80	6	50	136
F. culmorum	9	1	5	15
F. acuminatum	2	4	1	7
F. [illegible]	1	0	3	4
F. qorotrichioides	0	1	3	4
F. avenaceum	1	0	3	4
F. equiseti	0	0	2	2

Fig. 1. Occurrence of Fusarium head blight in fields of common (o), durum (△) and semi-dwarf (□) wheats in eight Manitoba crop districts in 1991. Open symbols = less than 10% severity. Filled symbols = 10-15% severity.



Crop / Culture: Wheat

Location / Emplacement: Manitoba

Title / Titre: FOLIAR PATHOGENS OF SPRING WHEAT IN MANITOBA IN 1991

Name and Agency / Nom et Organisation:

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METHODS: One hundred and ninety-one fields of wheat (113 common, 16 durum, 61 semi-dwarf, and 1 utility) in southern Manitoba were surveyed for foliar pathogens from 10 July to 2 August 1991. Crop developmental stages were recorded at time of sampling and 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. Infected leaf samples were collected at each site for subsequent pathogen/disease identification. Lesions from leaf tissue were surface sterilized and placed in moisture chambers for 5-7 days to induce sporulation to facilitate pathogen identification.

RESULTS AND COMMENTS: The locations of fields surveyed is shown in Fig. 1. Plant maturity for samples collected 10-16 July ranged from GS 57-73 (Zadoks et al. scale). Plants of later collected samples ranged from GS 75-85. Abundant rain in late spring and early summer caused widespread leaf-spotting in 1991 in Manitoba. Disease severity levels ranged from Tr-4 on flag leaves with the majority in the light or moderate (1 or 2) category. Most lower leaves had moderate to severe (2-3) levels, or, in later collected samples were already dead. Cochliobolus sativus (spot blotch), Septoria nodorum and S. avenae f. sp. triticea (Septoria leaf blotch) were isolated from 88.5%, 62.8%, and 60.7%, respectively, of fields across the surveyed area (Table 1), but disease levels were most severe in crop reporting districts 7-11 in the Red River Valley. C. sativus was isolated from a high percentage of fields in 1989, 1990, and 1991, but the incidence and severity of S. nodorum, and in particular S. avenae f. sp. triticea, increased substantially over the same time period. S. tritici was isolated from eight fields, four of which were in the Miniota region. Pyrenophora tritici-repentis (tan spot) was isolated from 50.8% of fields which represents a lower percentage than in 1989 or 1990. Fields with the most severe levels of tan spot were distributed uniformly across the surveyed area, in contrast to the distribution of spot blotch and Septoria leaf blotch. Disease severity caused by S. nodorum, S. avenae f. sp. triticea and C. sativus was highest on HRS and CPS wheats, whereas durum wheats were more severely affected by P. tritici-repentis.

Table 1. Frequency of diseases identified in 191 wheat fields in Manitoba in 1991.

Wheat class	Disease: Septoria leaf blotch 'nodorum'	Septoria leaf blotch 'avenae'	Septoria leaf blotch 'tritici'	Tan spot	spot blotch
Common	71	67	6	62	102
Semi-dwarf	43	36	1	20	53
Durum	6	12	1	14	13
Utility	0	1	0	1	1
Total	120	116	8	97	169
Fields (%)	62.8	60.7	4.2	50.8	88.5

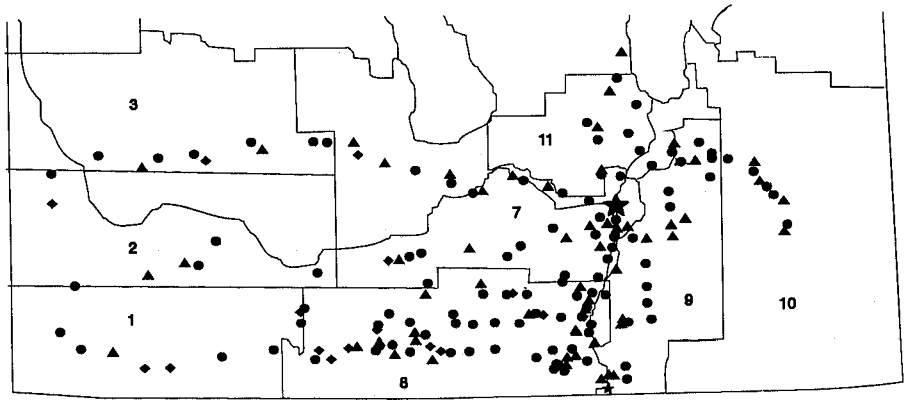

Fig. 1. Crop districts and locations of common (●), durum (◆), semi-dwarf **(A)**, and utility (★) wheat fields surveyed for foliar pathogens in 1991.

Crop / Culture: Wheat

Location / Emplacement: Manitoba, Saskatchewan

Title / Titre: LEAF RUST ON WHEAT IN THE EASTERN PRAIRIES IN 1991

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METHODS: Fields of cultivated wheat were examined throughout the growing season in Manitoba and eastern Saskatchewan for leaf rust.

RESULTS AND COMMENTS: Leaf rust was first observed on June 11 in spring wheat fields in southeastern Manitoba. By the last week in June leaf rust was present in light to trace amounts in spring wheat fields throughout southern Manitoba. Leaf rust severities were very high by the end of July throughout Manitoba due to the early arrival of rust, and the abundant rainfall in the previous two months that provided excellent conditions for rust to increase. In Manitoba and eastern Saskatchewan fields of the cultivars Katepwa, Neepawa, and Biggar had leaf rust severities from 50-100%, resulting in the loss of flag leaves before the heads had completed grain filling. An average yield loss of 10% in these cultivars was expected due to leaf rust. The cultivars Roblin, Laura, Columbus, Pasqua, and the American semi-dwarf Marshall were resistant to leaf rust, although these cultivars also had higher leaf rust severities than in past years due to the high inoculum pressure.

Crop / Culture: Wheat

Location / Emplacement: Saskatchewan

Title / Titre: Saskatchewan Wheat Disease Survey, 1991

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M.R. Fernandez, Agriculture Canada Research Station, P.O. Box 1030, Swift Current, Saskatchewan S9H 3X2
G.R. Hughes, Dept. of Crop Science and Plant Ecology, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0
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C. Kirkham, Agriculture Canada Research Station, P.O. Box 1240, Melfort, Saskatchewan S0E 1A0
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METHODS: A province wide survey was conducted in 254 wheat fields between late milk and early dough growth stages. Random fields were surveyed by assessing disease on a sample of 10 plants 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 0-9 scale described by Saari and Prescott (1975), and modified by Couture (1980). 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. These were plated on water agar containing 100 mg/L streptomycin sulfate and 50 mg/L vancomycin hydrochloride and 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 estimates were made on the importance of each fungal species.

RESULTS AND COMMENTS: There were 215 hexaploid and 39 durum wheat fields surveyed. The distribution by crop districts, severity, and prevalence of the diseases are shown in Table 1. The most prevalent diseases were leaf spots (92% of the fields moderately infected), common root rot (75% severely infected), and leaf rust (52% ranging from trace to severe). Leaf rust caused moderate levels of infection in 29 fields of hexaploid wheat in crop districts 3 and 4 but was not observed at all in 28 durum fields. Take-all occurred in 19% of the fields which were all in the southern crop districts. The incidence of take-all in the fields ranged from less than 1% up to 20%. Other diseases observed at low levels in less than 10% of the fields were powdery mildew, glume blotch, smut, ergot, BYDV, and bacterial blight. In the south-east corner of the province, seven cases of wheat streak mosaic virus was noted in trace amounts. Drought stress was evident in crop district 9. Also, it was observed that the awned hexaploid wheat cv. Laura was more resistant to leaf spotting (disease rating=6.0 in 3 fields) than the non-awned cultivars (disease rating=7.2 in 6 fields).

Pyrenophora tritici-repentis and Septoria nodorum were the predominant fungal species causing leaf spots (Table 2). S. tritici was present in signficant proportions in some crop districts (5 and 6) whereas S. avenae f. sp. triticea was rarely observed. In durum wheats, P. tritici-repentis was responsible for more than 90% of leaf spotting. In hexaploid wheats, the distribution of fungi was variable with crop districts and regions in the province. S. nodorum and P. tritici-repentis were observed in equal proportions in the south-east corner of the province (crop districts 1 and 2) and less than 10% of the lesions involved other pathogens. In the south-western and west-central crop districts (3, 4, and 7), there was a higher proportion of P. tritici-repentis as compared to S. nodorum. Crop districts 5 and 6 in central-east Saskatchewan had leaf spots caused by P. tritici-repentis (48%), S. nodorum (25%). and S. tritici (27%). S. nodorum was the most prevalent pathogen in the north.

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Couture, L. 1980. Assessment of severity of foliage diseases of cereals in cooperative evaluation tests. Can. Plant Dis. Surv. 1:8-10.

Saari, E.E., and J.M. Prescott. 1975. A scale for appraising the foliar intensity of wheat diseases. Plant Dis. Reptr. 59:377-380.

Table 1. Distribution, severity, and prevalence of wheat diseases in Saskatchewan fields surveyed between flowering and early dough stages in 1991.

Crop District	No. Fields	Leaf spot	Leaf rust	Common root rot%	Powdery mildew	Glume blotch	Ergot %	Smut %	Take all%	BYDV %	Bacterial blight
1A	8	3.2/8*	1-60 MS/6	15/7	-	Iw4	Iw3	1.011	6.916	-	-
1B	7	2.6/7	1-60 MS/5	19/5	-	TR/2	TR/2	-	3.514	-	1.7/3
2A	7	2.2/5	10-20 MR/6	17/4	-	4.0/2	TR/2	-	21.2/5	-	-
2B	9	3.8/9	1-10 MR/4	14/8	-	4.0/1	-	3.0/2	4.6/3	-	-
3AN	1	3.0/1	-	-	-	-	-	-	-	-	-
3As	0	- **	-	-	-	-	-	-	-	-	-
3BN	22	4.4/22	10-40 MR/3	17/17	-	0.1/1	-	0.3/8	0.6/11	0.1/2	-
3BS	19	4.6/17	5-40 MS/2	29/15	-	0.1/2	-	1.0/2	1.0/8	-	-
4A	5	3.013	1-40 M/5	15/4	0.1/1	-	-	-	0.4/4	-	-
4B	11	3.7110	-	28/4	3.5/1	-	-	1.0/1	0.1/3	-	-
5A	34	2.6/25	TR/25	14/31	0.1/2	TR/3	TR/2	-	9.9/4	-	-
5B	6	7.4/6	-	23/6	-	-	-	-	-	-	-
6A	8	6.2/7	2 S/6	33/6	-	-	-	1.0/1	-	-	-
6B	13	5.6113	5R -10M/5	10/6	-	TR/1	-	-	-	-	-
7A	7	5.1/7	TR/7	0/7	-	TR/1	-	1.0/1	-	-	-
7B	3	8.3/3	-	20/3	-	-	-	-	-	-	-
8A	22	3.1/21	TR/8	11/15	0.6/6	-	-	-	-	-	-
8B	38	4.9/38	TR/33	21/28	TR/12	TR/4	-	-	-	-	-
9A	34	4.6/34	1 MS/18	15/24	TR/5	-	-	-	-	-	-
9B	0	-	-	-	-	-	-	-	-	-	-
Average or total	254	4.61236	1MR-60MS /133	18/190	0.8/27	0.9121	TR/9	1.2116	5.4/48	0.1/2	1.7/3

* average disease rating (0-9 scale after Couture 1980) / number of fields affected

** not observed or not recorded

Table 2. Estimation of the percentage of leaf-spot fungi on leaf samples of hexaploid heat collected in Saskatchewan in 1991.

Crop district	No. of samples	% of leaf—potfungi			
		Septoria nodorum	S. tritici	S. avenae f. sp. triticea	Pyrenophora tritici-repentis
1A	8	50	4	0	46
1B	6	47	8	0	45
2A	4	60	0	2	38
2B	5	28	1	0	71
3B	22	24	1	0	75
4A	1	1	0	0	99
4B	3	63	0	0	37
5A	13	22	32	0	46
5B	6	9	25	0	66
6A	7	24	10	0	66
6B	6	45	42	0	13
7A	1	1	10	0	89
7B	1	0	0	0	100

Table 3. Estimation of the percentage of leaf-spot fungi on leaf samples of durum wheat collected in Saskatchewan in 1991.

Crop district	No. of samples	% of leaf-spot fungi			
		Septoria nodorum	S. tritici	S. avenae f. sp. triticea	Pyrenophora tritici-repentis
1B	1	10	0	0	90
2B	1	20	0	0	80
3B	17	7	0	0	93
4A	1	0	0	0	100
4B	5	1	0	0	99
7A	2	2	0	0	98

Crop / Culture: Cereals

Location / Emplacement: Maritime Provinces

Title / Titre: OCCURRENCE AND SEVERITY OF CEREAL DISEASES IN THE MARITIME PROVINCES - 1991

Name and Agency / Nom et Organisation:

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METHODS: Cereal fields and experimental plots in the cereal production districts of New Brunswick, Nova Scotia, and Prince Edward Island were examined for foliar disease during July and August for plantings conducted during the normal planting period in early-mid May. Diseases also were recorded in September and October for fields planted in late May and June.

RESULTS: Weather Conditions: Spring arrived early in the Maritimes in 1991 and the first part of the seeding period in early May was suitable for field work and most cereals were planted earlier than normal. This early planting, coupled with warmer and drier weather than usual in June and July resulted in very little foliar disease on spring cereals in all three Maritime Provinces. Survival of fall seeded cereals was good in New Brunswick and Prince Edward Island but Nova Scotia crops experienced more winter kill than normal. Yields of winter cereals were higher than normal where survival was good.

Disease observations: Disease severities on early planted crops did not warrant use of foliar fungicides as a general rule with the exception of milling wheats where high nitrogen levels were utilized on mildew susceptible cultivars. While diseases were severe in late planted crops, when the diseases did occur, it was too late to spray as crops were approaching maturity and beyond the recommended time for fungicide applications. Commencing in early September, weather conditions deteriorated and the Maritimes experienced rains with a frequency which did not permit grains to dry in the field. Late seeded barley, oats, and wheat crops in many instances were not harvested until late October when quality of the harvest had been lost.

Harvest of soybeans and lupins also experienced delays and in many instances seed harvested had moisture levels too high for safe storage. Most late harvested soybean and lupin seed was systematically infected with field fungi and once in storage, quickly degenerated if not immediately dried to a safe moisture level.

This period of wet harvest weather emphasized the importance of early seeding to ensure the crops mature in August. and early September when drying conditions tend to be superior to those of late September and October. It also emphasized the value of grain driers and of grain producers having such facilities available to them in wet harvest seasons.

Diseases occurring in the experimental cereal plots or fields throughout the Maritimes tended to be those characteristic of the region, i.e. mildews, *Septoria* incited leaf and glume blotches, smuts, scald, and the Pyrenophora-Bioplaris complex on barley crops. In most instances, foliar disease ratings were less than 5% of the leaf area observed and did not show a sufficient range of severities to identify lines with superior disease resistance, Very little head blight incited by *Fusarium* spp. were observed in either experimental plots or fields. Diseases were severe in experimental plots only when artificial moisture regimes were utilized.

Crop / Culture: Oat

Location / Emplacement: Province of Quebec

Title / Titre: DISEASES OF OAT CROPS IN QUEBEC IN 1991

Name and Agency / Nom et Organisation:

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METHODS: Most experimental sites of cereals in Quebec were visited from mid-July to mid-August for disease severity assessments. At each visited site, diseases were identified and assessed in a number of oat lines and cultivars. Growth stages of plants at time of assessments ranged from medium milk to soft dough.

RESULTS: Speckled leaf blotch (**Stagonospora** avenae) was widespread through crop districts in the province and was the most severe disease this year. Its overall severity was intermediate. Severity was more in the east than in the west and reached its highest level in the Lake Saint-Jean area. Infection in the Eastern Townships was lower than usual.

Crown rust (Puccinia **coronata**) did not occur extensively and was more or less restricted to the southwest part of the Province. There it was the most important disease on susceptible cultivars that were moderately infected. Traces of the disease were found elsewhere.

As usual, stem rust (——— **graminis**) was apparently not present this year.

Severity of yellow dwarf (Barley Yellow Dwarf Virus) was moderate in the various regions evaluated. Virus symptoms were not always conspicuous because of an unusual soil drought which confused the disease picture.

Crop / Culture: Wheat

Location / Emplacement: Province of Quebec

Title / Titre: OCCURRENCE OF WHEAT DISEASES IN QUEBEC IN 1991

Name and Agency / Nom et Organisation:

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METHODS: The incidence of wheat diseases was recorded on many different cultivars of spring wheat at ten locations in the six regions surveyed in Quebec in 1991. **Fusarium** head blight (F. graminearum) was seen only in trace amounts at all locations except in the Lake St. John's region. Leaf rust (**Puccinia** recondita) was severe on susceptible cultivars in all locations except at La Pocatiere and St. Eugene where it was moderately severe. Mixed leaf spot infections of Pyrenophora **tritici-repentis** and **Septoria** nodorum were widespread as usual in all regions but varied from low to moderate infections except at Deschambault where it was severe on susceptible cultivars like Laura, Mondor, and Norseman. Powdery mildew (**Erysiphe** graminis) was seen only in trace amounts at St. Hyacinthe and low amounts at Lennoxville on susceptible cultivars like Columbus, Norseman, Kennyon, and Lancer. Glume blotch (Septoria **nodorum**) was noted on spikes in low amounts only at Deschambault. Loose smut was observed in low quantities in the Montreal and Quebec City regions. Ergot (Claviceps **purpurea**) and Take-all (Gaeumannomyces **graminis**) were seen in trace amounts mostly in the Quebec City and Lake St. John regions. Winterkill was very severe in most winter wheat fields in southwestern Quebec.

Crop / Culture: Winter Wheat

Location / Emplacement: Province of Quebec
Region of St. Hyacinthe

Title / Titre: SURVEY OF WINTER WHEAT DISEASES IN 1991

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METHODS: Eight fields - two of cultivars Absolvent, Augusta, and Karat, and one of Perlo and Ruby were surveyed for leaf, root, and head diseases. Foliar diseases were assessed before and after heading on 10-20 plants at 10 sites on a W transect in the field examined. Samples of 10 plants were pulled out at each site to assess for root and basal stem diseases just after heading. Disease severity of leaves were recorded as percentage leaf area affected on the whole plant before heading, but on flag leaves only after heading using the Horsfall and Barratt grading system[1]. Stem necrosis was assessed as the percentage stems showing necrosis after removal of the leaf sheath of the basal portion. Head blight was measured as the percentage of heads and spikelets visually infected on 50 heads chosen at random at four different sites in the field.

RESULTS AND COMMENTS: Table 1 shows the minimum-maximum percentage disease intensity for the diseases recorded before and after heading. Before heading, tan spot (*Pyrenophora tritici-repentis*) was observed in all of the eight fields with a maximum of 2.3% of leaf surfaces affected in the cultivar Karat. Powdery mildew (*Erysiphe graminis*) was low on the leaves before and after heading with a maximum of 2.1% at heading on cultivar Augusta and 1.4% after heading on Absolvent. Leaf rust (________ *recondita*) was observed only after heading on all cultivars except Absolvent and Ruby with maximum leaf infection of 2.8% on cultivar Augusta. Stem necrosis due mostly to *Bipolaris sorokiniana* and some *Fusarium* spp. was observed mostly as a slight stem necrosis in six of the fields with a maximum of 38.7% on stems of Augusta. Head blight (*Fusarium graminearum*) was very low except in one field of Karat where 16.4% heads and 3.1% spikelets were infected. However, one field of Absolvent, one of Augusta, and one of Ruby showed no infections. In other fields, infections varied from 0.07% to 0.1% infected spikelets. Take all (*Gaeumannomyces graminis*) was found in trace amounts in fields of Absolvent, Karat, and Perlo. *Fusarium* stem rot was found in trace amounts only in a field of cultivar Augusta.

Table 1. Prevalence and intensity of winter wheat diseases in the St. Hyacinthe region in 1991.

	Percent Minimum-Maximum Disease Intensity[2]					
Growth Stages[1]	Leaf spots	Powdery mildew	Leaf rust	Stem necrosis	Head Blight Heads	Head Blight Spikelets
Before heading*						
31	2.1-2.3	0-0.7	0	-		
51	2.3-2.3	0-2.1	0	-		-
After heading**						
80	2.3-4.0	0-1.4	0-2.8	0-38.7	0-16.4	0-3.1

[1]Horsfall and Barratt grading system. 1945. Phytopathology 35 (8): 655 (Abstr.).
[2]Zadoks et al. Growth stages of cereals. 1974. Weed Res. 14 (6): 415-421.

*Disease assessment on all the leaves.
**Disease assessment on flag leaves only.

Crop / Culture: Spring Wheat

Location / Emplacement: Province of Quebec
Region of St. Hyacinthe

Title / Titre: SURVEY OF SPRING WHEAT DISEASES IN 1991

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METHODS: Three fields of the cultivar Max, two of Laura and Messier, and one of Ankra, Celtic, Columbus, and Roblin were surveyed for leaf, root, stem, and head diseases at Zadoks et al. growth stages 47, 59, and 77. The intensity of foliar diseases was assessed on 10-20 plants at 10 sites along a W transect in the fields. Samples of 10 plants were pulled out at each site at ZGS 77 to note stem and root diseases. Leaf diseases were evaluated before and at heading as a percentage leaf area affected on the whole plant using the Horsfall and Barratt grading system[2]. After heading, only the flag leaves were assessed. Head blight was measured as the percentage of heads and spikelets lesioned on 50 heads chosen at random at four different sites in each field.

RESULTS AND COMMENTS: Table 1 shows the minimum-maximum percentage disease severity recorded at growth stages 47, 59, and 77. At heading, tan spot (*Pyrenophora tritici-repentis*) was observed in all the fields with a maximum intensity of 3.2% leaf area affected on cultivars Columbus, Laura, Messier, and Max. Powdery mildew (*Erysiphe graminis*) was observed on Columbus, Laura, and Messier with a maximum intensity of 1.2% infected leaf area. After heading, tan spot was mixed with *Septoria* leaf spot (*Septoria nodorum*) and affected a maximum of 21.1% of the surfaces of flag leaves of cultivar Max and from 3.1 to 18.3% of flag leaves of the other cultivars. Powdery mildew affected up to 1.6% of leaf surfaces of cultivar Laura, and leaf rust (*Puccinia recondita*) up to 18.3% of those of Ankra. Slight stem necrosis caused by *Bipolaris sorokiniana* and some *Fusarium* spp. on basal portion of stems affected up to 22.8% of stems of cultivar Max and only 2.8% of Celtic. In other cultivars infections varied from 5.1% to 18.9%. *Fusarium* head blight (*F. graminearum*) was noted on all cultivars except Laura with a maximum of 0.4% infected spikelets on cultivar Columbus. Take-all and *Fusarium* stem rot were observed only in trace amounts in fields of the cultivars Messier and Max respectively.

Table 1. Prevalence and intensity of winter wheat diseases in the St. Hyacinthe region in 1991.

Growth Stages[1]		Percent Minimum-Maximum Disease Intensity[2]					
		Leaf spots	Powdery mildew	Leaf rust	Stem necrosis	Head Blight: Heads	Head Blight: Spikelets
Before heading:	47*	0-2.3	0.0	0-0.2	-	-	-
Heading:	59*	1.6-2.3	0-1.1	0	-	-	-
After Heading:	77**	3.1-21.1	0-1.6	0-18.3	2.9-22.8	0-3.6	0-0.4

[1] Zadoks et al. Growth stages of cereals. 1974. Weed Res. 14 (6).
[2] Horsfall and Barratt grading system. 1945. Phytopathology 35 (8): 655 (Abstr.).

*Disease assessment on all the leaves.
**Disease assessment on flag leaves only.

Oilseeds and special crops / Oleagineux et cultures speciales

Crop / Culture: Canola

Location / Emplacement: Manitoba

Title / Titre: DISTRIBUTION, PREVALENCE AND INCIDENCE OF CANOLA DISEASES IN 1991

Name and Agency / Nom et Organisation:
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Methods: Two surveys were conducted in Manitoba. During the first, 69 fields of Brassica napus and three of B. rapa (syn. B. campestris) were surveyed in the southern crop districts in the third week of August. During the second, 37 fields of B. napus and four fields of B. rapa were surveyed in the northern crop districts in the fourth week of August. The presence of diseases was noted in each field. For each field, disease incidence was determined on a sample of 50 plants. In addition, 142 samples of canola were submitted for analysis to the Manitoba Agriculture Plant Pathology Laboratory by agricultural representatives, growers and representatives of agribusiness.

Results: Sclerotinia stem rot, caused by Sclerotinia sclerotiorum, was observed in 85 of 113 fields (Table 1, Figure 1). Affected fields were found in all crop districts. Disease incidence was low in most fields but reached 64% in one. Mean incidence ranged from 3 to 7% in the western crop districts (1-5), and from 11 to 17% in the eastern crop districts. Morrall et al. (1984) found that disease incidence multiplied by 0.5 equalled the yield loss. Based on this relationship, the average yield loss caused by S. sclerotiorum was about 2% in the western crop districts and 6% in the eastern crop districts.

Blackleg, caused by Leptosphaeria maculans, was found in 61 fields (Table 1; Figure 1). Blackleg was found in all crop districts. Mean incidence ranged from 7% in crop district 7 to 21% in crop district 3. In comparison to 1990, mean incidence decreased in crop district 1, 2 and 6, but increased in all others. Blackleg symptoms observed within any field were variable. Even in fields with low incidence, a few, small plants could often be found with severe cankers.

Foot rot (Fusarium spp., Rhizoctonia solani) was observed in 23 fields distributed throughout Manitoba (Table 1). Incidence was less than 10% in all fields. A trace of aster yellows (aster yellows mycoplasma) was observed in seven fields, distributed among several crop districts. Staghead (Albugo candida) was observed in one field in each of Crop Districts 3 and 4. Incidence was 2% in both fields. Black spot (Alternaria spp.) was observed in one field in each of Crop Districts 3 and 9 and two in Crop District 4. White leaf spot (Pseudocercosporella capsellae) was observed in one field of Crop Districts 3 and 6, and in two fields of Crop Districts 4 and 5. Affected fields were located at higher elevations close to the Riding Mountain National Park.

The results of identification of specimens submitted to the Manitoba Agriculture Plant Pathology Laboratory are presented in Table 2. Blackleg was the major disease problem. Herbicide injury, found in 67 samples was primarily attributed to spray tank contamination where sulfonylurea-type herbicides had been previously used in the tank prior to spraying canola fields.

Reference: Morrall, R.A.A., J. Dueck, and P.R. Verma. 1984. Yield losses due to sclerotinia stem rot in western Canadian rapeseed. Can. J. Plant Pathol. 6:265 [Abstr.].

Table 1. Prevalence and incidence of major canola diseases by crop district in Manitoba in 1991

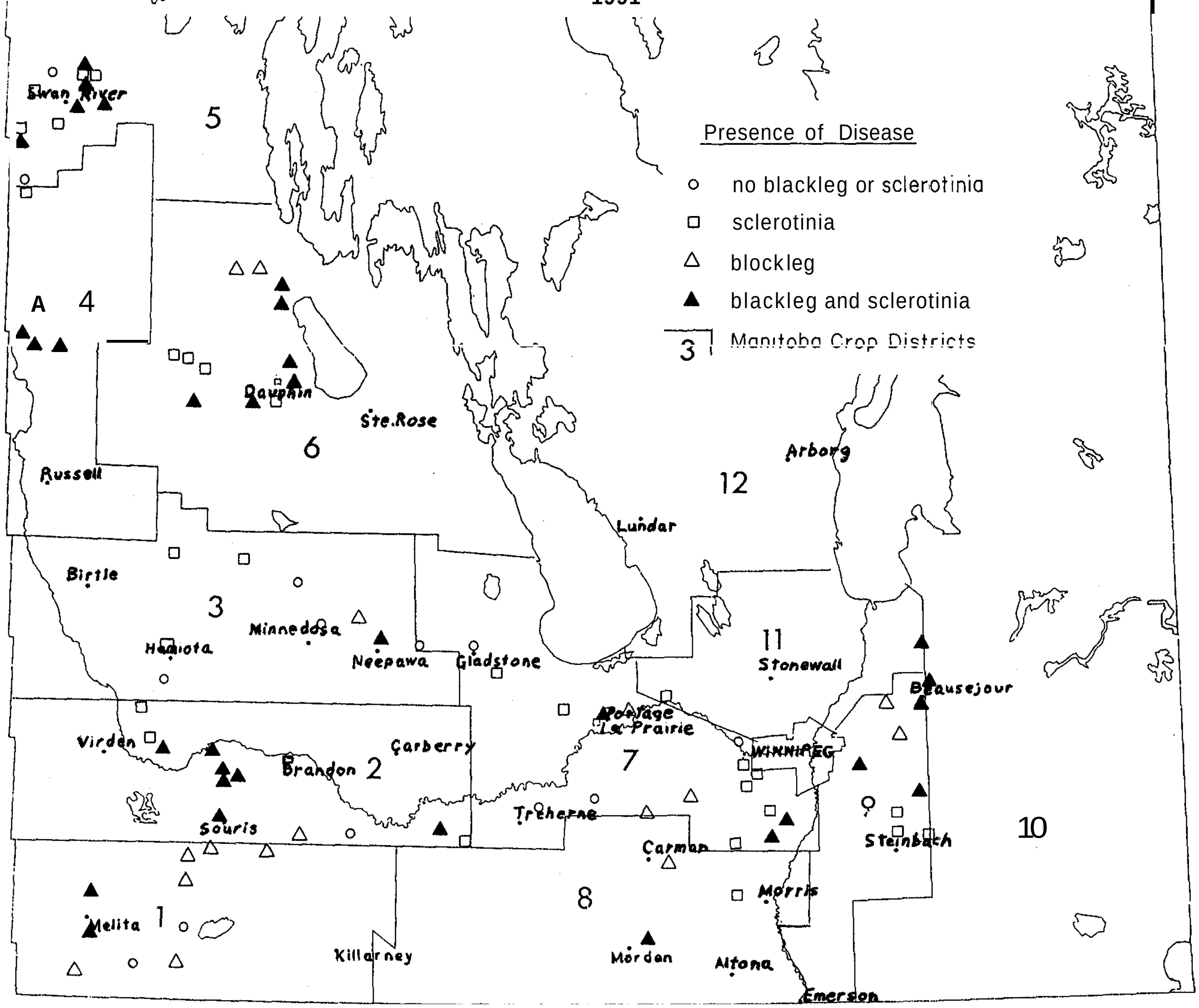
Crop district	No. of fields sampled	No. of affected fields				Range of incidence	
		Sclerotinia	Blackleg	Foot rot	Aster Yellows	Sclerotinia	Blackleg
1	8	4	8	-	3	t-6	2-36
2	11	9	8	-	-	2-12	2-16
3	8	4	2	2	1	t-14	4-38
4	6	4	5	-	1	4-10	4-32
5	19	14	8	4	1	t-20	t-34
6	16	13	13	2	-	2-40	t-38
7	23	17	6	6	2	t-36	2-16
8	6	6	3	-	2	4-36	4-20
9	16	14	8	9	3	t-64	2-30
Total	113	85	61	23	13		

t = present in the field at a trace level, not detected in the 50 plant sample.

Table 2. Summary of specimens submitted to the Manitoba Agriculture Plant Pathology Laboratory

DISEASE	PATHOGEN	NUMBER OF SAMPLES
Blackleg	Leptosphaeria maculans	23
Root Rot	Rhizoctonia solani	8
Downy mildew (early infection on leaves)	Peronospora parasitica	6
Stem rot	Sclerotinia sclerotiorum	5
White leaf spot	Pseudocercosporella capsellae	3
Herbicide injury		67
Nutrient deficiency	sulphur deficiency	10
Environmental stress		6

DISTRIBUTION OF FIELDS INCLUDED IN MANITOBA CANOLA SURVEY
1991



Crop / Culture: Canola

Location / Emplacement: Northern Alberta

Name and Agency / Nom et Organisation: HARRISON, L.M.
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TOH 1L0

Title / Titre: CANOLA DISEASES IN THE PEACE RIVER REGION IN 1991

METHODS: In August 1991, 47 randomly selected canola fields were surveyed for major diseases in the Peace River region. Canola production in 1991 was approximately 800,000 acres (323,700 hectares).

The root rot complex, which is the most important disease, was rated for severity on a 0-4 scale as described in 1990 (1). Each field was sampled as in previous years,

RESULTS AND COMMENTS: Spring weather conditions were wet and conducive to disease development. However, the weather changed in mid summer and became extremely hot and dry causing drought stress in most districts. Diseases were prevalent in most fields but incidence was generally low. The most prevalent disease was the root rot complex which was found in all 47 fields surveyed (Table 1). The disease incidence ranged from 64 to 100% with a mean of 93.7%. Root rot severity ranged from 0.68 to 3.16 with a mean rating of 1.49. Prevalence of sclerotinia stem rot was low, as in 1990, due to hot and dry weather in late June and July. Incidence ranged from 2 to 24%. Alternaria black spot was observed in 87% of fields where disease levels were generally low ranging from 2 to 56%. Prevalence of foot rot and avirulent blackleg was higher than in previous years with 98% and 87% respectively. Virulent blackleg was not observed in any fields surveyed. Incidence of avirulent blackleg increased from 4.3% in 1990 to 21.7% in 1991. Other diseases observed were white rust (staghead), grey stem, aster yellows, herbicide damage, hail damage and pod drop from drought and heat stress. Insect damage from lygus bugs, thrips and root maggots was also observed.

REFERENCE: 1. Harrison, L.M. and J. Loland. 1991. Canola disease survey in the Peace River region in 1990. Can. Plant Dis. Survey. 70 (1): 100.

Table 1. Prevalence and incidence of diseases of canola in the Peace River region in 1991.

Disease	Prevalence (% fields infested)	Incidence % Mean	Incidence % Range
Root Rot (Rhizoctonia, Pythium, Fusarium)	100	93.7	64-100
Black Spot (Alternaria spp.)	87	15.3	2-56
Foot Rot (Rhizoctonia, Fusarium)	98	46.2	2-96
Stem Rot (Sclerotinia sclerotiorum)	40	3.0	2-24
Avirulent Blackleg (Leptosphaeria maculans)	87	21.7	2-76

Crop / Culture: Canola

Location / Emplacement: Alberta

Title / Titre: BLACKLEG OF CANOLA SURVEY IN ALBERTA - 1991

Name and Agency/
Nom et Organisation:

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KHARBANDA, P.D., Alberta Environmental Centre, Vegreville, Alberta;
HARRISON, L., Regional Crop Laboratory, Alberta Agriculture, Fairview, Alberta;
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INTRODUCTION AND METHODS:

A fourth annual province-wide survey for virulent blackleg (Leptosphaeria maculans) of canola was carried out this summer. The survey, co-ordinated by the Crop Protection Branch, Alberta Agriculture has done by municipal fieldmen, Alberta Agriculture staff and Agriculture Canada seed inspectors. Diagnostic assistance was available from plant pathologists at Brooks, Fairview, and Vegreville.

The survey by the municipal fieldman was usually based on inspecting one commercial field for every 2,000 ha of canola grown in a municipality or district. Agriculture Canada seed inspectors checked all canola fields intended for pedigreed *seed* for the presence of blackleg. Alberta Agriculture staff also followed up on the crop rotations in 47 fields where virulent blackleg had been confirmed in the canola crop in 1989. All 67 municipalities and districts in the province co-operated in this survey. Each field was sampled as previously described (1, 2, 3).

RESULTS AND COMMENTS:

In the eastern Alberta municipalities, in census divisions 7 and 10 (3), up to 50% of canola fields had infestations of virulent blackleg. Disease incidence was generally 10% or less except when canola had been planted within two years of the previous canola crop. A few such fields showed disease incidence between 25 and 50%. In the County of Flagstaff where the fieldman did an extensive survey, virulent blackleg was confirmed in 208 of 417 canola fields surveyed (49.9%). Infection levels in this county were frequently between 10 and 20% whereas crop yields in infested fields were reported as fair to good.

A follow-up survey was done on 47 randomly selected fields in which virulent blackleg had been confirmed on canola in 1989. In each instance, depending on the municipal policy, the grower had been informed about the presence of virulent blackleg or issued a notice prohibiting the growing of canola for four years in that field. Enforcement also depended on municipal policy. In 1990 no canola was grown in these fields, but in 1991 one grower planted canola and virulent blackleg developed on the main stems of 30% of the plants.

Agriculture Canada seed inspectors did not find virulent blackleg in *any* of a total of 620 pedigreed canola fields totalling over 11,600 hectares.

Southern and western Alberta remain relatively free of virulent blackleg with only a few scattered fields reported to be infested. No virulent blackleg has been found in the Peace where about a third of the provincial crop is grown (4).

REFERENCES:

1. Evans, I.R., P. Kharbanda, L. Harrison, D. Kaminksi, 1991. Blackleg of canola survey in Alberta - 1990. Can. Plant. Dis. Surv. 71: 98-99.

2. Evans, I.R., P. Kharbanda, L. Harrison, D. Kaminski, 1990. Blackleg of canola survey in Alberta - 1989. Can. Plant. Dis. Surv. 70: 63-64.

3. Kharbanda, P.D., I.R. Evans, L. Harrison, S. Slopek, H.C. Huang, D. Kaminski, and J.P. Tewari, 1989. Blackleg of canola survey in Alberta - 1988. Can. Plant Dis. Surv. 69: 55-57.

4. McGee, D.C. and G.A. Petrie. 1978. Variability of Leptosphaeria maculans in relation to blackleg of oilseed rape. Phytopathology 68: 625-630.

Crop / Culture: Canola

Location / Emplacement: British Columbia

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Title / Titre: 1991 CANOLA DISEASE SURVEY IN BRITISH COLUMBIA

METHODS: The main purpose of the survey was to determine if virulent blackleg (Leptosphaeria maculans) had been introduced into the Peace River region of British Columbia. Root rot and other diseases were recorded if they were observed. The survey was conducted from September 9 - 12 and on October 7 in the Peace River region. Every Brassica napus and every third B. campestris field were surveyed. Sampling was done by walking 30 m into a field and then starting an inverted W pattern. Ten plants were pulled and examined for diseases every 30 m for a total of 50 stems per field. Canola stems with lesions resembling blackleg were collected from 60 fields for analysis by cultural methods (1) at the provincial plant diagnostic lab, and monoclonal antibody testing by Dr. P. Ellis, Agriculture Canada Research Station, Vancouver, B.C. Root rot ratings were based on a severity index of 0-4 where 0 = no disease, 1 = a few lesions on taproot, 2 = coalesced lesions on taproot, 3 = girdling lesions on taproot (not wirestem) and 4 = completely girdled taproot (like wirestem).

RESULTS AND COMMENTS: There were 126 fields surveyed totalling 9700 ha out of 48 000 ha grown in 1991. Eleven of the fields were B. napus. None of the collected samples had severely girdled stems, Virulent blackleg was not detected in this survey and has not been detected in previous surveys of the B.C. Peace River region. The weakly virulent strain of blackleg was detected in 21 fields, only one of which was B. napus. Root rot (Rhizoctonia solani) was present in all surveyed fields. All fields were examined after swathing so that root rot ratings would be at the highest level for the year. The average rating for all fields was 1.85 with field averages ranging from 0.2 to 3.8. There was no pattern to the severity of root rot and the district averages ranged from 1.4 to 2.2.

Alternaria black spot and staghead (Albugo candida) were each present in 3 fields. The low incidence may be due in part to the timing of the survey which was after swathing, and often after harvest. Sclerotinia stem rot was less prevalent this year with 2% of fields with infected plants compared to 33% in 1989. Overall, stand conditions were poorer than normal due to dry conditions during the early part of the growing season.

Table 1. Prevalence of diseases in canola fields in the B.C. Peace River region in 1991

Disease	% Fields Infested
Avirulent Blackleg (L. maculans)	16.7
Root Rot (Rhizoctonia)	100
Sclerotinia Stem Rot (Sclerotinia sclerotiorum)	2
Staghead (Albugo candida)	2
Black Spot (Alternaria spp.)	2

1. McGee, D.C. and G.A. Petrie. 1978. Variability of Leptosphaeria maculans in relation to blackleg of oilseed rape. Phytopathology 68: 625 - 630.

Acknowledgement: Many thanks to J. Dobb, G. Jesperson, G. Carter, K. Nickel, K. Murphy, K. Tosczak, M. Barliszen, D. Coates and other Peace River staff for assistance in the survey.

Crop / Culture: Canola

Location / Emplacement: Central Alberta

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Title / Titre: SURVEY OF ALTERNARIA BLACKSPOT AND SCLEROTINIA STEM ROT OF CANOLA IN CENTRAL ALBERTA IN 1991

METHODS: Fifty fields of canola were surveyed in central Alberta during the third week of August. Thirty-seven of these fields were of Brassica campestris and 13 were of B. napus. The disease severity at 2 locations within each field, away from the edge, was estimated visually and the mean recorded. For assessment of alternaria blackspot caused by Alternaria brassicae, percent areas of siliques covered with lesions were determined using an assessment key (Conn et al., 1990). Fields with between 0 and 1% alternaria blackspot were categorized as having trace levels. For assessment of sclerotinia stem rot caused by Sclerotinia sclerotiorum, the percentage of stems with symptoms was determined. Fields with between 0 and 1% sclerotinia stem rot were categorized as having trace levels.

RESULTS AND COMMENTS: Every field surveyed had alternaria blackspot. Percent areas of siliques covered with lesions ranged from a trace to 10% (Fig. 1). If the fields with trace levels are set to 0%, then the mean for the 50 fields was 1.3%. This low-level of infection was likely due to the hot and dry weather during the latter part of July and early part of August in central Alberta. The percentage of stems with sclerotinia stem rot ranged from a trace to 70% (Fig. 2). If the fields with trace levels are set to 0%, then the mean for the 50 fields was 8.3%. Infection occurred at the base of stems about 50% of the time. Sclerotinia stem rot did not appear as early this year as in the oast two years but progressed quickly in the latter part of August due to wet conditions.

During this survey the presence or absence of some other diseases was also noted. Staghead caused by Albugo candida, aster yellows caused by MLO, and gray stem caused by Pseudocercosporella capsellae were observed in many of the fields surveyed.

ACKNOWLEDGEMENT: This survey was financed by grants from the International Development Research Centre, Ottawa and the Natural Sciences and Engineering Research Council of Canada, Ottawa.

REFERENCES: Conn, K.L., Tewari, J.P. and R.P. Awasthi. 1990. A disease assessment key for alternaria blackspot in rapeseed and mustard. Can. Plant Dis. Surv. 70(1):19-22.

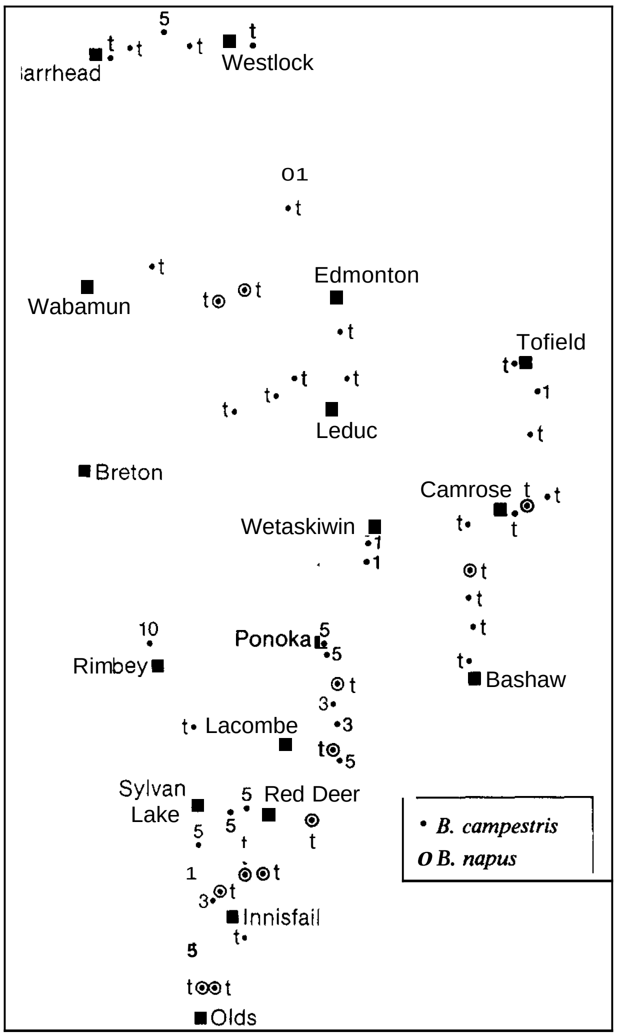

Figure 1. Locations of fields in central Alberta surveyed for alternaria blackspot in 1991. The numbers represent percent areas of siliques covered with lesions. Fields with between 0 and 1% infection were categorized as having trace (t) levels.

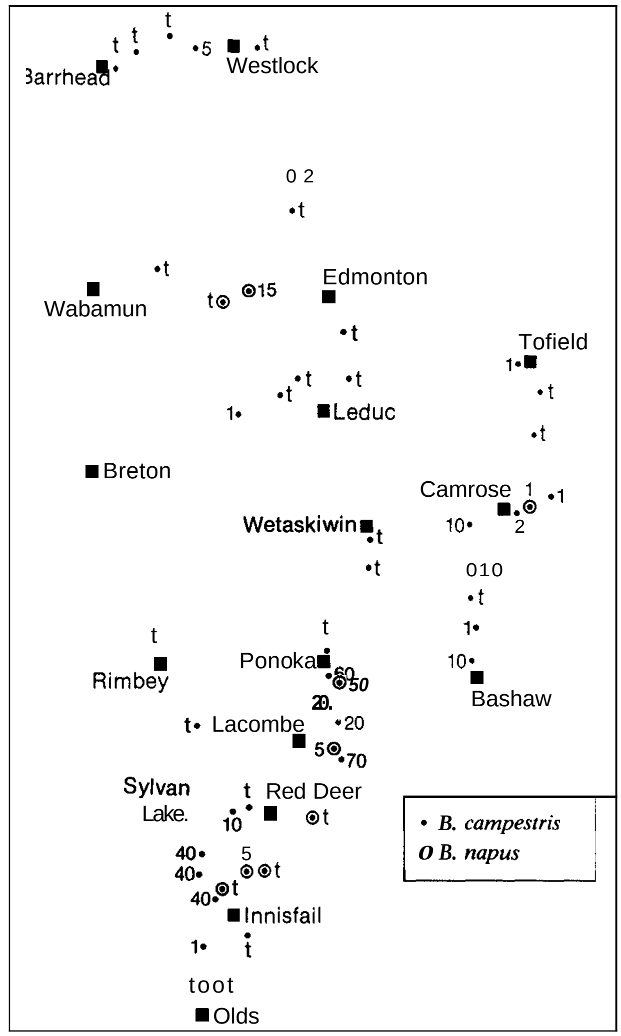

Figure 2. Locations of fields in central Alberta surveyed for sclerotinia stem rot in 1991. The numbers represent percent of stems with symptoms. Fields with between 0 and 1% infection were categorized as having trace (t) levels.

Crop / Culture: Canola

Location / Emplacement: Saskatchewan

Title / Titre: CANOLA DISEASES IN N.E. SASKATCHEWAN, 1991

Name and Agency / Nom et Organisation:

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METHODS: Sixty-seven canola fields were surveyed between July 31 and August 9, 1991, in Saskatchewan Agriculture Crop Districts 5b, 8a, 8b and 9a. Fields were chosen at random and sampled by collecting one plant at each of ten sites located on a diagonal transect. Diseases were identified by leaf or stem symptoms, and the severity was recorded as an estimated percentage area affected. Root rot and blackleg were assessed on a scale of 0 = healthy, 2 = trace, 5 = moderate and 10 = severe. Results were averaged over the total number of samples and fields, and the disease index, an estimate of severity, was calculated for each disease. The percentage of fields affected was calculated for an estimate of prevalence.

RESULTS AND COMMENTS: The severity and prevalence of canola diseases in the four crop districts surveyed are shown in Table 1. Blackspot (Alternaria spp.) which is usually present in most rapeseed growing areas, was found at trace levels in each crop district. The most common symptom was leaf spotting. Conditions were favorable for the development of blackleg (Leptosphaeria maculans), which was found mainly on the stems. It was most prevalent and severe in Crop District 8b where some fields, mainly of the cultivar Westar, had extensive girdling of the stems and were lodged quite badly; this probably caused major yield losses. White rust (Albugo candida) of leaves was most widespread in crop District 9a, though at: very low levels. Staghead, which is caused by the same fungus as white rust, was found in only two fields. Stem rot (Sclerotinia sclerotiorum) was found at negligible levels in each crop district, but in many instances the disease was just beginning to develop, so the low levels may not reflect severity and losses at. harvest. Aster yellows (MLO) was of minor importance, being observed mainly around the edges of a few fields and only occasionally among the sampled plants. Root rot, which is usually present at low levels, was not found.

Table 1. Severity and prevalence of canola diseases in 1991

Crop district	Number of fields	Disease index/% fields affected				
		Blackspot	Blackleg	White rust	Stem rot	Aster yellows
5b	12	3.8/100	1.6/83	1.3/8	0.1/17	0.5/8
8a	13	3.0/100	0.4/62	0.2/23	0.1/23	0.5/8
8b	19	1.4/89	2.5/95	0.2/26	0.5/16	<0.1/5
9a	23	3.3/96	1.0/65	0.7/43	0.2/26	0.9/17
Total or average	67	2.9/96	1.4/76	0.6/25	0.2/27	0.5/10

Crop / Culture: Lentil

Location / Emplacement: Manitoba

Title / Titre: DISEASES OF LENTIL IN SOUTHERN MANITOBA IN 1991

Name and Agency / Nom et Organisation:

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Methods: In 1991, 52 lentil fields were surveyed for anthracnose by the Department of Plant Science, University of Manitoba. Samples of 15-50 plants from each field were rated for the disease and percent anthracnose was calculated as follows: 100 x [(no. of plants with few small stem lesions x 1) + (no. of plants with larger lesions on some of the stems x 2) + (no. of plants with severe lesions on all stems x 3), divided by total number of plants in the sample x 31. Samples from another 67 lentil fields were diagnosed at the Manitoba Agriculture Plant Pathology Laboratory.

Results: Locations of the 52 lentil fields in the survey are shown in Figure 1 with symbols indicating the level of anthracnose. In the southern Manitoba Red River Valley area the level of disease was high: 52-100% in 8 fields around St. Jean Baptiste, and 20-100% in 15 fields between Rosenort and Morris. One field south of Morden had 44% anthracnose and one field at Graysville had 18%. High levels of anthracnose, between 60 and 90%, were also found in 4 fields in the area west of Portage la Prairie. Levels of anthracnose were generally lower in the northwest of Manitoba; 3 fields around Minnedosa had 0-27% anthracnose and 5 fields in the Dauphin-Roblin area had 0-20% disease, while 4 other fields had 60-100%. Further north between Ethelbert and Fork River 3 fields had 0-30% anthracnose and 7 fields between Benito and Bowsman had only 0-2% infection. The high levels of anthracnose can be attributed to abundant rainfall during the growing season as well as to frequent planting of lentil in areas such as Rosenort-Morris-St. Jean Baptiste, Portage-Bagot and Dauphin. Low levels of sclerotinia stem rot (*Sclerotinia sclerotiorum*) were recorded in a few fields, but ascochyta blight (*Ascochyta fabae* f. sp. *lentis*) and other diseases were not detected in the plant samples.

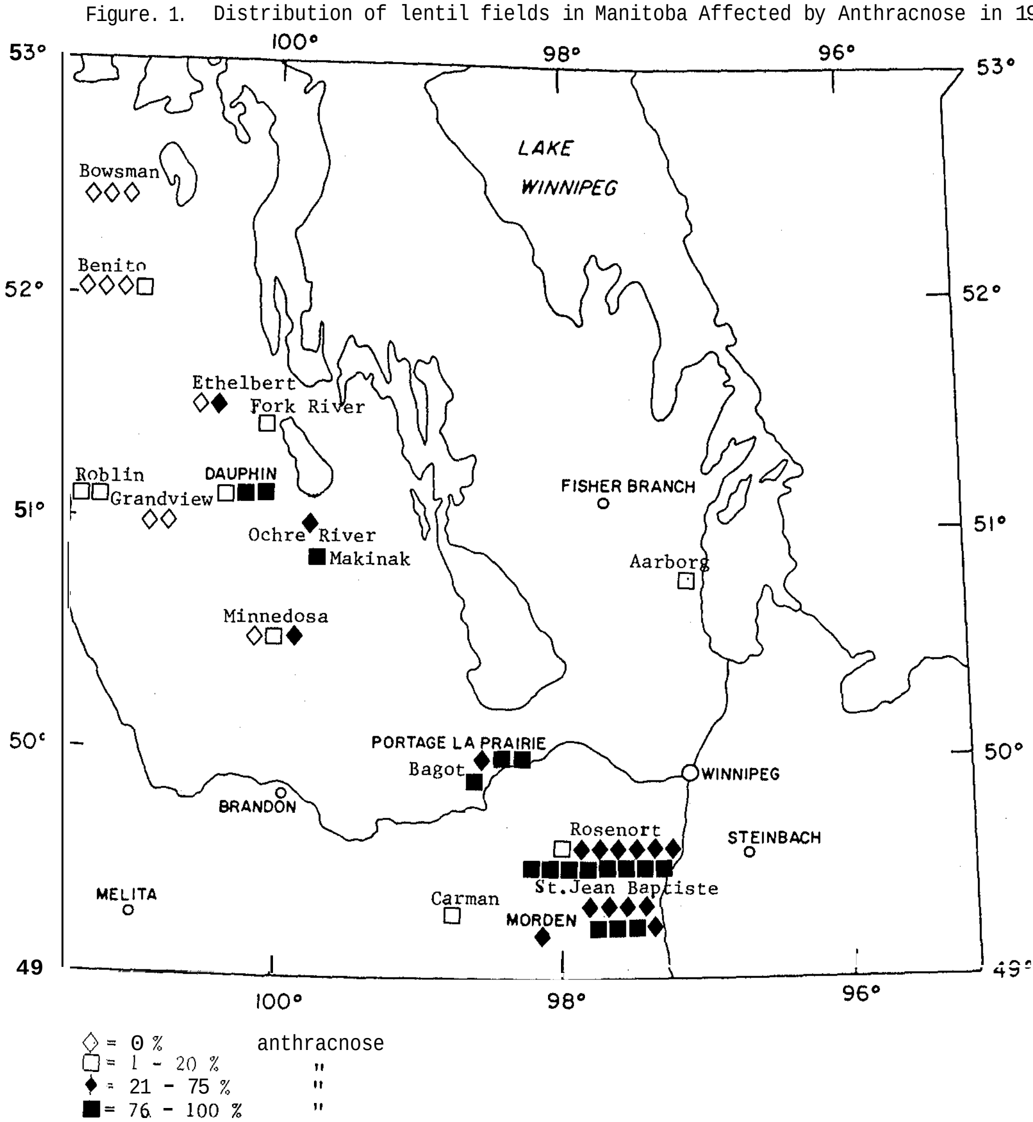
The development of anthracnose was followed closely in 6 fields near Rosenort. The first symptoms were detected on June 18 in a lentil plot which had been seeded on lentil stubble. One week later the first symptoms were detected in commercial crops on lentil plants with 3-5 internodes. The disease developed rapidly and had reached 100% in 4 of the 6 fields by July 19.

The results of identification of specimens submitted to the Manitoba Plant Pathology Laboratory are presented in Table 1. The most commonly diagnosed disease was anthracnose which was detected in 32 samples. In many of the samples the level of disease approached 100%.

Table 1. Summary of Diseases Diagnosed on Lentil Samples Submitted to the Manitoba Agriculture Plant Pathology Laboratory in 1991 -- 67 samples.

DISEASE	PATHOGEN	NUMBER OF SAMPLES
Anthracnose	Colletotrichum truncatum	32
Ascochyta blight	Ascochyta fabae f. sp. lentis	9
Root rot	Fusarium spp.	5
Sclerotinia stem rot	Sclerotinia sclerotiorum	2
Botrytis stem rot	Botrytis spp.	3
Herbicide Injury		10
Nutrient Deficiency		4
Environmental stress	deep seeding, excess moisture	2

Figure. 1. Distribution of lentil fields in Manitoba Affected by Anthracnose in 1991



Crop / Culture: Lentil

Location / Emplacement: Saskatchewan

Name and Agency / Nom et Organisation:

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Title / Titre: DISEASES OF LENTIL IN SASKATCHEWAN IN 1991

METHODS: Anthracnose of lentil caused by Colletotrichum truncatum (Schwein.) Andrus and W.D. Moore was reported for the first time in Saskatchewan in 1990 (3). The principal objective of the present study was to determine the prevalence of anthracnose in the province. However, during field surveys aswchyta blight. [Ascochyta fabae Speg. f. sp. lentis Gossen et al.], sclerotinia stem rot [Sclerotinia sclerotiorum (Lib.) de Bary, botrytis stem and pod rot [Botrytis sp.] and root rot [Fusarium spp. and Rhizoctonia sp.] were also assessed.

Early in the growing season occasional inspections of lentil crops were made during the course of other work., In the period July 22-August 22 all major lentil producing regions were visited and 109 crops were inspected. Generally every fifth lentil crop observed while driving through a district was surveyed. During an inspection two observers walked at least 100 m through the crop and made a subjective assessment of the severity of each disease as absent, trace, slight, moderate or severe. When symptoms were uncertain, specimens were taken back to the laboratory and checked microscopically, often after incubation for 24 hours in a moist chamber. Also, 15 plant samples suspected of being infected with anthracnose were received for diagnosis frm growers in July and August.

After harvest a few plant residue and seed samples were received from growers for testing. seed samples were surface-disinfected for 10 min. in 0.6% NaOCl, plated on Bacto-Difco potato dextrose agar amended with 25 ppm ampicillin and 25 ppm streptomycin sulphate and incubated at room temperature for 10 days before pathogen colonies were counted. Two commercial seed testing companies provided information on the number and origin of samples from the 1991 crop which had tested positive for anthracnose and on the range of infection levels with ascochyta.

An attempt was made to relate the occurrence of anthracnose to cropping practices. Twenty-five growers in whose crops anthracnose had been detected *and* 15 in whose crops anthracnose had not been detected were contacted. Information was obtained about the crop rotation of the field in question, as well as the crops *grown* in adjacent fields in 1990.

RESULTS AND COMMENTS: The growing season was marked by relatively late seeding due to cool wet soils, excessive rainfall in most areas in May and June and relatively dry weather in a few areas frm early July onwards. The 109 fields surveyed were distributed among 11 Saskatchewan Crop Districts (Fig. 1) but not in proportion to lentil acreages in the districts.

Anthracnose was observed for the first time on June 13 in the Zealandia area (Crop District 6B), where the disease was first reported in 1990 (3). This was only about one month after planting, whereas previously the disease had not been observed in the field on lentil seedlings. Anthracnose was found in 47 (43%) of the crops surveyed and was generally more severe in Crop Districts 3B-N, 5A, 6B and 8B (Table 1). Of the 15 plant samples submitted by grmers, 6 were infected with anthracnose; however, none of these came from areas where the disease was not detected in the field survey. To the *end* of November, only 17 seed samples tested either in *our* laboratory or by commercial companies were positive for anthracnose. Most *shmed* only 0.25% infection, but two samples showed 1.75% infection. Infected seed was detected from several locations not included in the field survey (Fig. 1).

The survey *showed* that anthracnose of lentil was more widely distributed in Saskatchewan than reported in 1990 (3) and, indeed, was present in most mjor areas of production (Fig. 1). Only a small proportion of crops were severely diseased and overall losses were probably low. In the Zealandia area, where anthracnose appeared early, dry weather after early July restricted disease development and reduced losses. However, the destructive potential of the disease is illustrated not only by previous reports frm Manitoba (2) and Saskatchewan (3), but also by the experience of one farmer in 1991 who harvested 900 kg/ha frm an infested field but *2000* kg/ha frm a relatively disease-free crop less than 0.5 km away.

In the 40 crops tested there was no clear relationship between the presence of anthracnose and the length of crop rotation or the crops grown in adjacent fields in 1990 (Table 2). Most infested crops were in fields either on short rotations or adjacent to 1990 lentil residues. Hmever, four moderately or severely diseased crops were in fields in which lentil had not be grown for more than 4 years and which were not adjacent to 1990 lentil residues. This suggests that the anthracnose fungus m y survive for lengthy periods in soil and be capable of substantial aerial dissemination; hmever, there is an urgent need to clarify mechanisms of transmission of the pathogen.

Ascochyta blight was found in most crop districts and in over 55% of all crops (Table 1). The high levels of this disease were in marked contrast with those found in the last general provincial survey of lentil diseases in 1988 (1) and were undoubtedly due to the wet conditions in May and June. Levels of ascochyta in some 1000 seed samples tested commercially by the end of November ranged from 0% to 61% with a mean of about 5% and only about 10% of the samples testing 0%. The levels of seed-borne infection were considerably higher than in the previous four years (R.A.A. Morrall, unpublished).

Botrytis pod and stem rot and sclerotinia stem rot were each found in about 17% of the crops surveyed. However, they were at sufficiently high levels to cause yield losses in only a few cases (Table 1). Trace levels of root rots were observed in a few crops but a severe infestation occurred in one field in Crop District 8A.

ACKNOWLEDGEMENTS: The financial assistance of the Saskatchewan Pulse Crop Development Board and the Western Grains Research Foundation is gratefully acknowledged. We appreciate the assistance of Neil Whatley and a number of growers for providing samples and of Janet Paisley (Newfield Seeds) and Marilyn French (Saskatchewan Wheat Pool) for providing data from seed testing. Technical assistance was provided by Rosanne Beaule.

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2) Morrall R.A.A., R.J. Gibson and C.C. Bernier. 1990. Anthracnose of lentil in Manitoba in 1989. Can. Plant Dis. Survey 70: 79.
3) Morrall R.A.A. and E.A. Pedersen. 1991. Discovery of lentil anthracnose in Saskatchewan in 1990. Can. Plant Dis. Survey 71: 105-106.

Table 1. Severity of four major diseases in lentil crops inspected in Saskatchewan in 1991.

Crop District**	Total No. Crops	ANTHRACNOSE Ab	Tr	Sl	Mo	Se	ASCOCHYTA BLIGHT Ab	Tr	Sl	Mo	Se	BOTRYTIS POD & STEM ROT Ab	Tr	Sl	Mo	Se	SCLEROTINIA STEM ROT Ab	Tr	Sl	Mo	Se
2B	14	11	1		2		4	1	2	7		14					13	1			
3B-N	18	12	2		3	1	6	5	3	2	2	11	3	2	2		14	2	1	1	
5A	10	5		3	2		3		4	2	1	9		1			9	1			
5B	1	1					1					1					1				
6A	1		1							1				1			1				
6B	29	9	7	7	3	3	15	7	6	1		24	2	3			23	4	2		
7A	14	11	1	1	1		2	7	1	4		11	2		1		11	2		1	
8A	7	6		1			4	1			2	5				2	6				1
8B	8	2	3		3		6	2				7			1		5		2	1	
9A	3	3					3					3					3				
9B	4	2		1	1		3	1				4					4				
Total	109	62	15	13	15	4	47	24	16	17	5	89	7	7	4	2	90	10	5	3	1

Column heading: No. of crops in five severity categories* for four diseases

* Ab = Absent; Tr = Trace; Sl = Slight; Mo = Moderate; Se = Severe.
** See Fig. 1 for location of crop districts.

Table 2. Distribution of lentil crops in Saskatchewan in 1991 in relation to anthracnose infection and cropping practices.

Anthracnose Severity Class	No. of fields in each category: No. years since previous lentil or pea crop in the field: 1	2	3	4	>4	Crops in adjacent fields in 1990: No lentil	Lentil
Absent	1	1	2	3	8	7	8
Trace	1						1
Slight		2	1	2	5	1	9
Moderate	1	2	2		6	5	6
severe		1	1	1		1	2

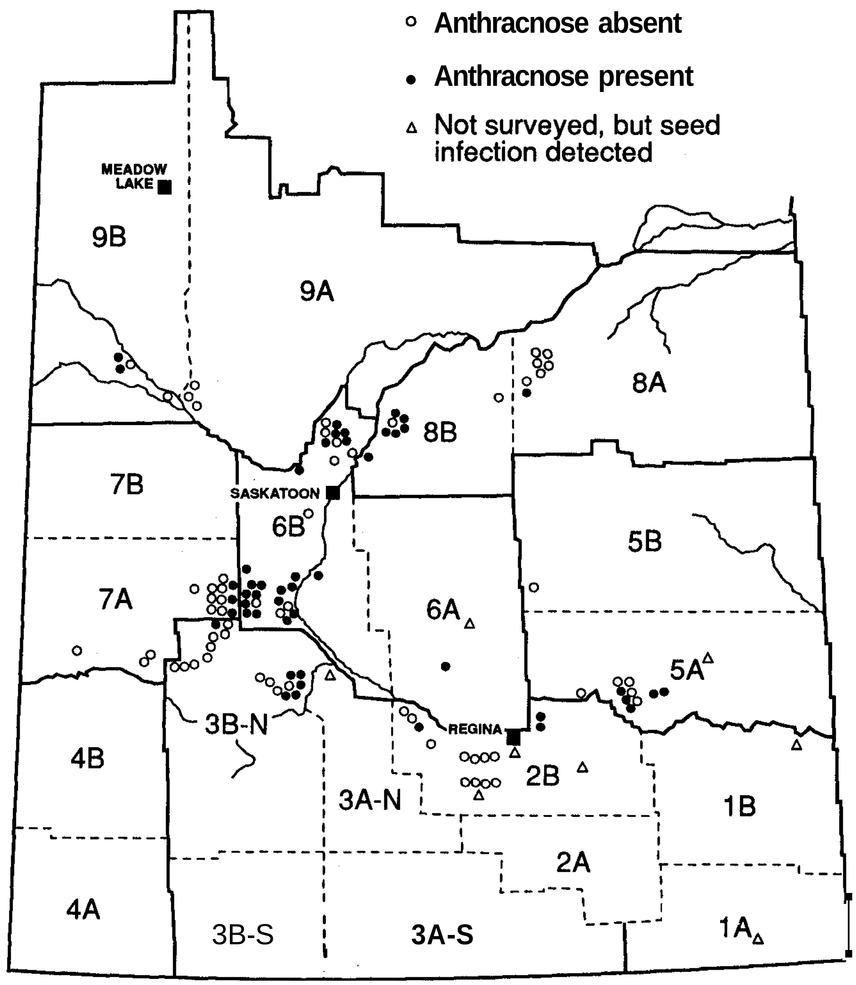

Figure 1. Map of Saskatchewan crop districts showing lentil crops surveyed and where anthracnose was found in 1991.

Crop / Culture: Flax

Location / Emplacement: Manitoba

Title / Titre: SURVEY OF FLAX DISEASES IN MANITOBA IN 1991

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Methods: A total of 50 flax fields were surveyed in southern Manitoba in 1991. Five fields were surveyed on July 17, four on July 30, 18 on August 20, 17 on August 28, and six on September 5. Fields were selected at random in different regions. Each field was sampled by two persons walking 100 m in opposite directions in the field following an inverted V pattern. Diseases were identified by symptoms and the incidence and severity of each disease were recorded. In addition, 12 samples of flax were submitted for analysis to the Manitoba Agriculture Plant Pathology Laboratory by agricultural representatives and growers.

Results: Crop emergence was good and stand was excellent in most of the fields surveyed. The soil moisture was adequate and the crop vigour was generally good to excellent in most fields. The incidence of heat canker was very low in the spring. Fusarium wilt, caused by Fusarium oxysporum f. sp. lini was observed in two fields; 1% infected plants were found in one field and less than 1% in the other.

Pasmo, caused by Septoria linicola was the most common disease in 1991. Pasmo was observed in 84% of the fields surveyed with incidence ranging from trace to 100% infected plants (Table 1). The severity also varied amoung the different fields surveyed and ranged from trace to greater than 50% of stem area covered with lesions. The fungus Alternaria linicola was frequently encountered with pasmo infections.

Rust, caused by Melampsora lini, was not observed in any of the 50 fields surveyed nor on the 30 rust differential lines planted at Morden and Portage la Prairie. Aster yellows (mycoplasma-like organism) was observed in two fields at trace levels. Chlorosis, stunting and premature ripening, caused by water-logging in flooded areas, was observed in several fields in southern Manitoba.

Of the 12 samples submitted to the Manitoba Agriculture Plant Pathology Laboratory 3 showed pasmo (Septoria linicola), 1 aster yellows (mycoplasma-like organism), 1 root rot (Fusarium spp.), 3 environmental stress and 4 herbicide injury.

TABLE 1. Incidence and severity of pasmo on flax in southern Manitoba in 1991.

No. of Fields	Incidence*	Severity$
8 (16) @	0	0
9 (18)	Trace	less than 1%
9 (18)	1-5%	1%
8 (16)	5-20%	1-5%
8 (16)	20-40%	5-10%
7 (14)	20-40%	5-20%
1 (2)	100%	10-50%

* Incidence is the percentage of infected plants in each field

$ Severity is estimated as the percentage of stem area infected.

@ Values in brackets are percentages of fields surveyed.

Crop / Culture: Flax

Location / Emplacement: Saskatchewan

Title / Titre: FLAX DISEASES IN N.E. SASKATCHEWAN, 1991

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METHODS: Twenty-three flax fields were surveyed between July 31 and August 9, 1991, in Saskatchewan Agriculture Crop Districts 5b, 8a, 8b and 9a. Fields were chosen at random and sampled by collecting one plant at each of ten sites located on a diagonal transect. Diseases were identified by symptoms, and the severity of each disease recorded as the estimated percentage of leaf, stem or root area affected. Results were averaged over the number of samples and fields, and the disease index, an estimate of severity, was calculated for each disease. The percentage of fields affected was calculated for an estimate of prevalence.

RESULTS AND COMMENTS: Flax plants were generally quite healthy with relatively low levels of disease found (Table 1). Pasmo (Septoria linicola) was fairly widespread, but was found only at trace levels. Root rot (several fungi) although more widespread than in 1990, was found at very low disease severity. Traces of aster yellow (MLO) were noted along the edges of three fields in Crop District 8a, but it was not found among the sampled plants. Green bugs were quite prominent in Crop District 5b, however at the time of the survey, we were unable to predict the damage.

Table 1. Severity and prevalence of flax diseases in 1991

Crop district	Number of fields	Disease index/% fields affected	
		Root rot	Pasmo
5b	5	0.1/40	2.9/100
8a	8	0.6/50	0.8/63
8b	7	>0.1/29	0.6/57
9a	3	0/0	3.2/100
Total or average	23	0.2/30	1.9/80

Crop/Culture: Field Pea and Field Bean

Location/Emplacement: Manitoba

Title/Titre: DISEASES ON FIELD PEA AND FIELD BEAN IN SOUTHERN MANITOBA IN 1991

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FIELD PEA

Method: Thirty-nine fields were examined in 1991. Eleven were surveyed on June 18, 14 on July 17 and 14 on August 13. The fields were located in the areas marked on the map in Figure 1. This year the survey pattern in each field followed an inverted V, the point of the V being approximately 100 m into the field. At approximately 20 m intervals, 5-10 plants were examined for diseases. The diseases were identified by symptoms and the severity of each disease recorded. In addition to the field surveys, samples were submitted by producers and agricultural representatives to the Manitoba Agriculture Plant Pathology Laboratory for examination. Diagnosis was based on visual examination for symptoms and culturing on artificial media.

Results: Damage due to numerous and heavy rains in southern Manitoba, especially in the Morden, Winkler, Plum Coulee, Altona and Morris areas was substantial in some fields.

Mycosphaerella blight (Mycosphaerella pinodes) was present in 9 of 11 fields at light levels on the lower foliage on June 18, in the Morden, Winkler, Plum Coulee and Roland areas. By July 17 mycosphaerella blight was severe in all 14 pea fields surveyed; the area surveyed, similar to that surveyed on June 18, included also the area around Portage la Prairie. In addition to mycosphaerella blight, light to moderate downy mildew (Peronospora viciae) and bacterial blight (Pseudomonas pisi) were found in the Carman-Elm Creek-Portage la Prairie areas. The third survey, carried out August 13, covered the area west of Morden to Cartwright, north to Neepawa, Westbourne and Bagot. Mycosphaerella blight was light around Cartwright but was severe near Westbourne. Bacterial blight was light in a field at Manitou and moderate in a field near Miami. Also, sclerotinia stem rot was found in a field near Winkler. By August 13 powdery mildew was abundant on the green upper foliage in most fields, in which the crops were nearing maturity, and in late-sown fields.

Of 20 samples of field pea submitted to the Manitoba Agriculture Plant Pathology Laboratory, 7 showed root rot caused by Fusarium spp. and Rhizoctonia solani, 3 mycosphaerella blight, 1 downy mildew (Peronospora viciae) and 2 powdery mildew (Erysiphe polygoni). There were also 7 samples that showed herbicide injury.

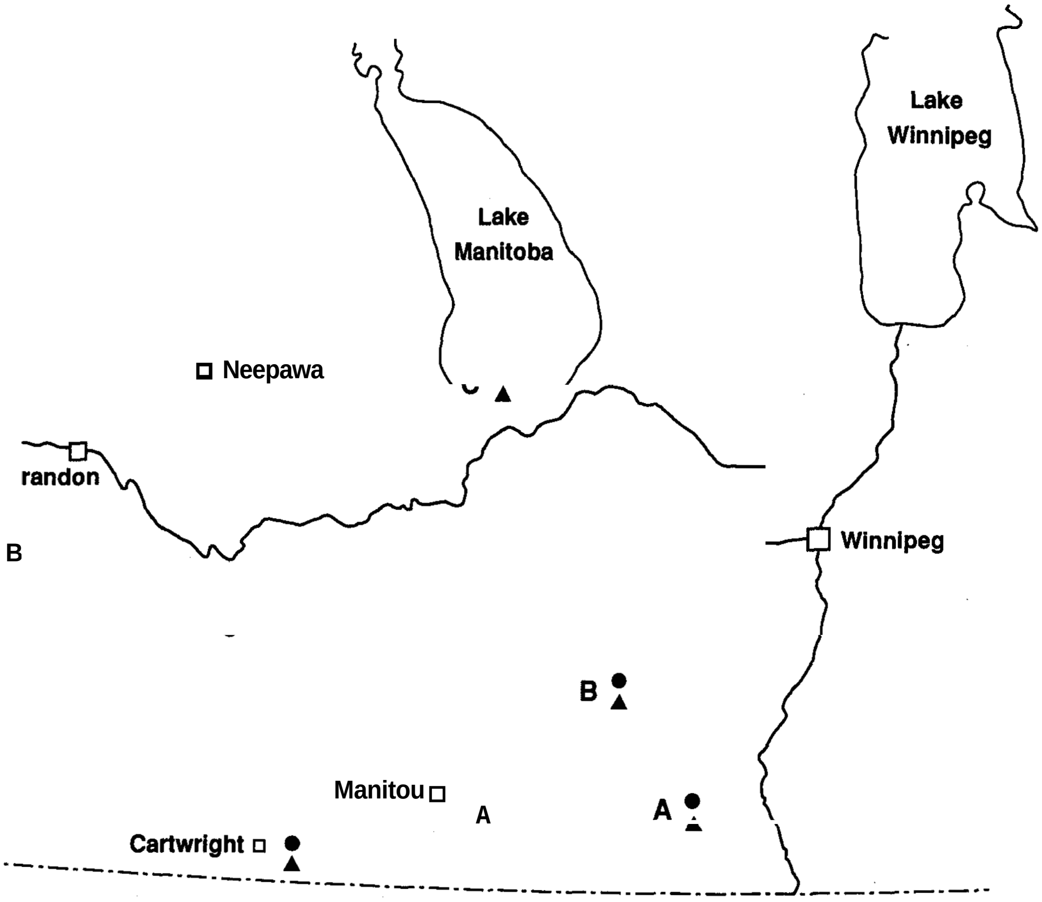
FIELD BEAN

Two surveys were carried out in 1991. In mid-June, 10 fields in the Morden-Graysville area were examined. No root rot symptoms were visible on the above-ground parts of the plant; however, superficial rust-coloured areas were common on the hypocotyl below the soil surface. This would not have affected growth or yield. By mid-July, foliar bacterial infection was present in each of 26 fields examined. Severity ranged from light to severe. Common blight was the only bacterial blight disease found in commercial fields. In most of the fields, the foliage had not overgrown the space between the rows; in 3 fields in the Graysville area where the crop canopy had closed, the incidence of white mold (Sclerotinia sclerotiorum) was 10-25%

A field bean screening trial was located in the Graysville area. Bacterial blight was present at light to moderate severity on most of the 38 lines. Three lines were moderately affected and one was highly susceptible. Most infection was caused by common blight, but halo blight was also present. Virus diseases were almost totally absent. Although not conclusive, the overall survey results in 1991 suggest that seed infection could have been important in the incidence of bacterial blight in Manitoba.

Of the 15 samples of field bean submitted to the Manitoba Agriculture Plant Pathology Laboratory, 6 showed common blight, 3 root rot (Fusarium spp.), 2 white mold, and 4 herbicide injury.

FIGURE 1. General locations of field bean (O) and field pea (A) fields surveyed for disease in Manitoba in 1991.



A = includes area around: Altona, Morden, Morris, Plum Coulee and Winkler;
B = includes area around: Elm Creek, Carman, Graysville, Miami, and Roland;
C = includes area around: Portage la Prairie, Westbourne and Bagot.

Crop/Culture: Pea

Location/Emplacement: Saskatchewan

Title/Titre: PEA DISEASES IN N.E. SASKATCHEWAN, 1991

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METHODS: Seventeen pea fields were surveyed between July 31 and August 9, 1991 in Saskatchewan Agriculture Crop Districts 8a, 8b and 9a. Fields were sampled by collecting one plant at each of ten sites located on a diagonal transect. Diseases were identified by symptoms, and the severity of each foliar disease was recorded as the estimated percentage leaf or stem area affected. Root rot and foot rot were assessed on a scale of 0 = healthy, 2 = trace, 5 = moderate and 10 = severe. Results were averaged over total number of samples and fields, and the disease index, an estimate of severity, was calculated for each disease. The percentage of fields affected was calculated for an estimate of prevalence.

RESULTS AND COMMENTS: Results of the survey are shown in Table 1. Mycosphaerella blight (*Mycosphaerella pinodes*) was found in every field surveyed at twice the level of the previous year. Powdery mildew (*Erysiphe polygoni*) was found at low levels, but this may have been due to the early timing of the survey; plots located at the Melfort Research Station did not develop high powdery mildew levels until two weeks after the survey. Foot rot (*Ascochyta* sp.) was found at trace levels in approximately two-thirds of the fields surveyed. Downy mildew (*Peronospora viciae*) was also found at low levels, but was mainly concentrated in Crop District 8b near Humboldt, Muenster and Lake Lenore. Ascochyta leaf spot (*Ascochyta pisi*) and root rot, usually found in trace amounts, were not found during this survey.

Table 1. Severity and prevalence of pea diseases, 1991

Disease	Severity %	Prevalence %
Mycosphaerella blight	11.9	100
Powdery mildew	3.1	30
Foot rot	1.3	60
Downy mildew	1.2	14

DISEASE	% OF FIELDS INFESTED	MEAN OF DISEASE INDEX*	RANGE OF DISEASE INDEX*
Downy mildew	20%	1.1	1-3
Rust	95%	1.8	1-4
Sclerotinia wilt	45%	1.2	1-2
Verticillium wilt	90%	1.4	1-4
Leaf spot (Septoria Alternaria)	46%	1.4	1-4
Stand	-	1.2	1-3
Vigour	-	1.3	1-3

* Disease index is based on a scale of 1 to 5; 1= trace to 5% disease, 2= 5% to 20% disease, 3= 20% to 40% disease, 4= 40% to 60% disease and 5= greater than 60% disease levels. Index is based on disease incidence for downy mildew, sclerotinia wilt and verticillium wilt, and on disease severity measured as percent leaf area infected for rust and septoria leaf spot. Indexes for stand and vigour are based on 1-5 scale (1= very good and 5= very poor).

Crop/Culture: Sunflower

Location/Emplacement: Manitoba

Title/Titre: SURVEY OF SUNFLOWER DISEASES IN MANITOBA IN 1991

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Methods: A total of 57 sunflower fields were surveyed in southern Manitoba in 1991. Seven fields were surveyed on July 17, four on July 30, 17 on August 20, 16 on August 28, eight on August 29, and five on September 4. Fields were selected at random in different regions. Each field was sampled by two persons walking 100 m in opposite directions in the field following an M pattern. Diseases were identified by symptoms and the incidence of downy mildew (Plasmopara halstedii), sclerotinia wilt (Sclerotinia sclerotiorum) and verticillium wilt (Verticillium dahliae) were recorded. Disease severity for rust (Puccinia helianthi) and septoria leaf spot (Septoria helianthi) were measured as percent leaf area infected. A disease index was calcualted for each disease in every field based on disease incidence or disease severity (Table 1). In addition, 18 samples of sunflower were submitted for analysis to the Manitoba Agriculture Plant Pathology Laboratory by agricultural representatives and growers.

Results: The crop conditions were generally good with stand and vigour ranging from excellent to good. Rust was the most prevalent disease and was observed in 95% of fields surveyed. Rust severity in 1991 was lower than observed in previous years (1,2), and ranged from trace to 40% leaf area infected. The severity of rust in most fields surveyed in July was in the trace to 1% range. Fields surveyed towards the end of the season had 5% to 40% leaf area infected.

The prevalence and incidence of verticillium wilt were high in 1991. The disease was observed in 90% of the fields surveyed with incidence ranging from trace to 5% infected plants in the majority of the fields. However, the highest disease incidence of 20-40% infected plants was observed in a few non-oil sunflower hybrids which are susceptible to this disease.

The prevalence and incidence of sclerotinia wilt were low in comparison to those observed in previous years (1,2). However the incidence of mid-stem infections was higher in 1991 than in previous years. Sclerotinia wilt/mid-stem infections were observed in 45% of fields surveyed with incidence ranging from 1% to 10% infected plants. A high incidence of sclerotinia wilt/mid-stem infections was observed in a few fields towards the end of the season. Sclerotinia head rot was not encountered in 1991 or in any of the disease surveys conducted in the last four years (1,2).

Downy mildew was observed at lower levels than in previous years (1). The disease occurred in 20% of the fields surveyed and the disease incidence ranged from trace to 2% in all infested fields except one with 30% infected plants.

Leaf spots caused by Septoria helianthi and Alternaria spp. were observed in 46% of the fields surveyed with severity ranging from trace to 10% leaf area infected. Traces of stem lesions (Phoma spp. and Phomopsis spp.) were observed in various sunflower fields towards the end of the season. Other diseases such as botrytis head rot (Botrytis spp.) and rhizopus head rot (Rhizopus spp.) were not encountered in this survey.

Of the 18 samples submitted to the Manitoba Agriculture Plant Pathology Laboratory, 1 showed sclerotinia wilt, 2 downy mildew, 1 rust, 1 septoria leaf spot and 1 alternaria leaf spot. One of the samples showed environmental stress from drought conditions. In addition to diseases, 12 of the samples were found to be affected by herbicide drift.

Reference: (1) Rashid, K. Y. and R. G. Platford. 1990. Survey of sunflower diseases in Manitoba in 1989. Can. Plant Dis. Surv. 70 (1): 85-86

(2) Rashid, K. Y. and R. G. Platford. 1991. Survey of sunflower diseases in Manitoba in 1990. Can. Plant Dis. Surv. 71 (1): 110-111.

Small fruits / Petits fruits

Crop/Culture: Saskatoon, *Amelanchier alnifolia* (Nutt.)

Location/Emplacement: Alberta

Title/Titre: EVALUATION OF ELEVEN SASKATOON CULTIVARS FOR RESISTANCE TO POWDERY MILDEW

Name and Agency/ Nom et Organisation:
R.J. Howard[1], P.S. Bains[2]
E.R. Moskaluk[1] and
Z. Pesic-Van Esbroeck[2]
[1]Alberta Special Crops and Horticultural Research Center, Brooks, AB; [2] Alberta Tree Nursery and Horticulture Centre, Edmonton, AB.

METHODS: Incidence of powdery mildew [*Podosphaera clandestina* (Wallr.:Fr.) Lév.] on saskatoon was visually rated in two variety trial orchards in Alberta in 1991. Both orchards had the same ten cultivars, except that Pearson II replaced Moonlake in Edmonton. The orchards were planted in a randomized complete block design with four replications and four bushes per replication in Brooks and three replications and five bushes per replication in Edmonton. The orchard at Brooks contained bushes ranging in age from 8 to 14 years. All of the bushes were bearing fruit at the time of disease assessment on July 17 and 18. In Edmonton, the orchard was three years old and not all of the bushes were bearing fruit at the time of disease assessments on July 24 and September 24. At Brooks, mildew incidence was assessed on both the foliage and fruit. On the foliage, the percentage mildew was determined by counting the number of leaves with the disease on each of four branches per bush. One, chest-height branch was selected per compass point (N, S, E, & W) on each bush and, starting at the tip and progressing basipetally, the number of leaves with mildew out of 25 was recorded. The percentage of mildewed leaves per cultivar per replicate was calculated by pooling the data for the four bushes in each replicate. The percentage of mildewed berries was measured by sampling two to three fruit clusters per branch at each compass point and counting the number of mildewed berries out of 100 per bush. An average disease incidence was determined for each replicate by pooling the individual data for the four bushes examined. The data were arcsin-transformed and subjected to ANOVA. In Edmonton, the disease incidence was assessed by observing the presence or absence and severity of mildew infection on leaves and berries (when available).

RESULTS AND COMMENTS: At Brooks, mildew was generally distributed throughout the orchard. It was more severe at the tips of branches and on the north side of the bushes. Mildew incidence was higher on the foliage compared to the fruit (Table 1). Cultivars Parkhill, Success and Forestburg had the highest incidence of mildew on the leaves and berries. Moonlake, Honeywood, Thiessen and Regent exhibited significantly less foliar mildew than the other cultivars. Moonlake, Honeywood, Thiessen, Smoky and Pembina had significantly fewer mildewed berries than the remaining five cultivars.

In Edmonton, Parkhill exhibited a severe infection of leaves and a 100% incidence of powdery mildew on berries. Leaves of Success were also severely mildewed, but its berries were not as severely affected as those of Parkhill. Powdery mildew was also observed on the leaves of Forestburg, Northline, Pembina and Smoky, but it was much less severe than on Parkhill and Success. Observations done late in the season (September 24) revealed that the leaves on all of the bushes of all ten cultivars were affected by mildew.

Of the eleven cultivars evaluated, Parkhill and Success had the least and Honeywood, Thiessen and Moonlake the best powdery mildew resistance.

Table 1. Incidence of powdery mildew on the leaves and fruit of ten saskatoon cultivars at the ASCHRC, Brooks, in 1991.

	Powdery mildew incidence (1%) [1]	
Cultivar	Leaves	Berries
Moonlake	15.3 b	0.8 a
Honeywood	4.6 ab	1.3 a
Thiessen	10.5 ab	0.1 a
Smoky	36.2 c	0.1 a
Northline	44.6 c	4.0 ab
Forestburg	83.3 d	51.3 c
Pembina	39.0 c	0.4 a
success	94.2 de	66.7 cd
Regent	1.5 a	10.4 b
Parkhill	98.4 e	72.5 d

[1] Each figure in this table is the mean of four replications. Mildew incidence data were arcsin-transformed prior to ANOVA. Detransformed means are reported here. Numbers followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test ($P < 0.05$).

Crop / Culture:

Name and Agency / Nom et Organisation:

Location / Emplacement:

Title / Titre: EVALUATION OF ELEVEN SASKATOON CULTIVARS FOR RESISTANCE TO POWDERY MILDEW

METHODS: Incidence of powdery mildew [Podosphaera clandestina (Allr.:Fr.) Lev.] on saskatoon was visually rated in two variety trial orchards in Alberta in 1991. Both orchards had the same ten cultivars, except that Pearson II replaced Moonlake in Edmonton. The orchards were planted in a randomized complete block design with four replications and four bushes per replication in Brooks and three replications and five bushes per per replication in Brooks. The orchard at Brooks contained bushes ranging in age from 8 to 14 years. All of the bushes were bearing fruit at the time of disease assessment on July 17 and 18. In Edmonton, the orchard was three years old and not all of the bushes were bearing fruit at the time of disease assessments on July 24 and September 24. At Brooks, mildew incidence was assessed on both the foliage and fruit. On the foliage, the percentage mildew was determined by counting the number of leaves with the disease on each of four branches per bush. One, chest-height branch was selected per compass point (N,S,E, & W) on each bush and, starting at the tip and progressing basipetally, the number of leaves with mildew out of 25 was recorded. The percentage of mildewed leaves per cultivar per replicate was calculated by pooling the data for the four bushes in each replicate. The percentage of mildewed berries was measured by sampling two to three fruit clusters per branch at each compass point and counting the number of mildewed berries out of 100 per bush. An average disease incidence was determined for each replicate by pooling the individual data for the four bushes examined. The data were arcsin-transformed and subjected to ANOVA. In Edmonton, the disease incidence was assessed by observing the presence or absence and severity of mildew infection on leaves and berries (when available).

RESULTS AND COMMENTS: At Brooks, mildew was generally distributed throughout the orchard. It was more severe at the tips of branches and on the north side of the bushes. Mildew incidence was higher on the foliage compared to the fruit (Table 1). Cultivars Parkhill, Success and Forestburg had the highest incidence of mildew on the leaves and berries. Moonlake, Honeywood, Thiessen and Regent exhibited significantly less fewer foliar mildew than the other cultivars. Moonlake, Honeywood, Thiessen, Smoky and Pembina had significantly fewer mildewed berries than the remaining five cultivars.

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Northline	44.6 c	4.0ab
Porestburg	83.3 d	51.3 c
Pembina	39.0 c	0.4a
Success	94.2 de	66.7 cd
Regent	1.5a	10.4b
Parkhill	90.4 e	72.5 d

1 Each figure in this table is the mean of four replications. Mildew incidence data were arcsin-transformed prior to ANOVA. Detransformed means are reported here. Numbers followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P 0.05)

Tree fruits and nuts / Arbres fruitiers et noix

Crop / Culture: Appie

Location / Emplacement: Ontario

Title / Titre: DISEASE SURVEY OF COMMERCIAL APPLE ORCHARDS IN SOUTHERN ONTARIO

Name and Agency / Nom et Organisation:
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NETWODS: Fruit harvest assessments were carried out in Southern Ontario in 79 different commercial orchards and 3 ahandoned orchards. At most sites, McIntosh or Red Delicious were checked, hut occasionally Empire, Spy and Cortland were assessed. Fruit were sampled at or just prior to harvest maturity.

From standard sized trees, four trees per orchard were examined. Thirty-three fruit from the top, skirt inside and skirt outside were checked. One extra apple was checked from each tree to bring the sample total to 100 apples per tree. From dwarf sized trees, 50 fruit from each of eight trees were checked.

Exceptions to this sampling procedure was the Essex-Kent area, where 200-1000 fruit per orchard were checked. In the ahandoned orchards, 100 fruits were checked from Durham and 200 fruits from Norfolk-Brant.

Observations from abandoned orchards in Durham and Norfolk-Brant are included for comparison.

Fruit was checked for apple scab (Venturia inaequalis (Cke.) Wint.), fly speck (Leptothyrium pomi (Mont. and Fr.) Sacc.), sooty blotch (Gloeodes pomigena (Schw.) Colby), quince rust (Gymnosporangium clavipes Cke., and Pk.), cedar apple rust (G. juniperi-virginianae Schw.), powdery mildew (Podosphaera leucotricha (Ell. & Ev.) Salm.), black rot (Botryosphaeria ohtusa (Schwein) Shoemaker), calyx end rot (causal organism not determined) and insect injury. These were reported by area as to the presence or absence of disease or insect. injury.

RESULTS AND COMMENTS: The incidence of disease, particularly scab, was generally higher in 1991 than in the past four years. No quince rust or cedar apple rust, however, was reported in the harvest assessments this year.

ACKNOWLEDGEMENTS: We thank the Horticultural Crop Advisors, Pest Management Advisors and others who collected the data for the apple harvest assessments.

COMPARISON OF DISEASE INCIDEHCE AND INSECT DAMAGE
IN COMMERCIAL AND ARANDONED ORCHARDS, 1991

Area	Number of Fruit	Percent Fruit Affected				
		Scab	Fly Speck	Sooty Blotch	Calyx End Rot	Black Rot
Ontario (Commercial)	31,150	4.4	0.2	0.03	0.1	0.03
Abandoned: Durham	100	17.0	39.0	34.0	1.0	1.0
Norfolk-Brant	200	82.0	6.5	31.0	0	0

APPLE HARVEST ASSESSMENT, SOUTHERN ONTARIO, 1991

Area	Number of Orchards	Number of Apples	Total Number of Fruit Affected (Range)[1] Scab	Fly Speck	Sooty Blotch	Calyx End Rot	Powdery Mildew	Black Rot	Percent Damage Insect	Percent Damage Disease
Essex-Kent	10	4550	78 (0-40)	0	2(0-2)	13(0-8)	0	0	4.9	2.0
Woodstock	5	2000	130(0-50)	0	0	2(0-2)	0	0	4.6	6.6
London	11	4400	170(0-148)	19(0-12)	2(0-1)	9(0-9)	1(0-1)	3(0-1)	1.3	4.6
Norfolk-Brant	20	8000	255(0-193)	52(0-42)	0	0	0	0	9.6	3.8
Hamilton-Wentworth	5	2000	214(0-100)	0	3(0-3)	0	0	3(0-3)	7.8	11.0
Niagara	4	1600	419(1-388)	1(0-1)	2(0-1)	0	0	3(1-2)	8.8	26.6
Georgian Bay	6	2400	66(0-18)	1(0-1)	0	0	0	0	5.5	2.8
Durham	5	2000	10(0-7)	1(0-1)	0	8(1-5)	0	0	5.8	1.0
Northumber. Prince Ed. Hastings	8	3200	83(1-46)	0	0	0	0	0	5.8	2.6
St. Lawrence Valley	5	2000	104(0-92)	0	0	0	0	0	8.4	5.2

Fruit: not necessarily nut of grade

APPLE HARVEST ASSESSMENT, SOUTHERN ONTARIO, 1991

Area	Number of Orchards	Number of Orchards Affected Scab	Fly Speck	Sooty Blotch	Calyx End Rot	Powdery Mildew	Black Rot
Essex-Kent	10	8	0	1	5	0	0
Woodstock	5	4	0	0	1	0	0
London	11	7	4	2	1	1	3
Norfolk-Brant	20	7	10	0	0	0	0
Hamilton-Wentworth	5	3	0	1	0	0	1
Niagara	4	4	1	2	0	0	2
Georgian Bay	6	5	1	0	0	0	0
Durham	5	3	1	0	3	0	0
Northumberland Prince Edward Hastings	8	5	0	0	0	0	0
St. Lawrence Valley	5	4	0	0	0	0	0

Crop / Culture: Sweet Cherry

Location / Emplacement: Okanagan Valley
British Columbia

Title / Titre: LITTLE CHERRY VIRUS DISEASE SURVEY IN THE OKANAGAN VALLEY OF BRITISH COLUMBIA

Name and Agency / Nom et Organisation:

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B.C. Ministry of Agriculture,
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Vernon, B.C., V1T 4K7

METHODS: The annual survey of sweet cherry trees in the Okanagan Valley of British Columbia was conducted between July 5 and July 19, 1991 for symptoms of little cherry disease. Two employees of the B.C. Ministry of Agriculture, Fisheries and Food examined orchards in districts with a history of the disease, including the areas around Penticton, Naramata, Summerland, Westbank, Kelowna and Oyama. Approximately 40 orchards and 40 residential yards were included in the survey. Diagnosis of little cherry disease was based on symptoms, including small, often pointed and angular fruit with poor colour and delayed maturity. Following diagnosis, tree owners were issued removal notices. Trees with questionable symptoms were indexed at the Agriculture Canada Research Station at Summerland by grafting buds on to indicator trees, including the varieties Sam and Canindex. Leaves of these varieties turn red in late summer of the following year if the disease is present.

RESULTS AND COMMENTS: Twenty-five diseased trees were identified in 1991, with the majority (twenty-three) located in the Penticton area. One diseased tree was found in Naramata, and one in Summerland. Budwood samples for indexing were taken from an additional 95 trees.

The number of little cherry infected trees in 1991 was the lowest since the early 1970's, when the disease was just beginning to spread in the Okanagan. However, the 1991 survey was severely hampered by winter damage to cherry trees. Winter injury tends to obscure the symptoms of little cherry virus, making it difficult to identify diseased trees. Winter injury occurred throughout the Okanagan, but was most extensive in the areas north of and including Westbank and Kelowna. Attempts to survey severely injured trees proved to be futile, and little time was devoted to them.

Ornamentals / Plantes ornementales

Crop / Culture: Elm

Location / Emplacement: Manitoba

Title / Titre: Incidence of Dutch elm disease in Manitoba in 1991

Name and Agency / Nom et Organisation:
Platford, R. G.
Manitoba Agriculture
Plant Pathology Laboratory
Agricultural Services Complex
201-545 University Crescent
Winnipeg, Manitoba
R3T 5S6

METHODS: Results are based on 1,950 samples of American elm, *Ulmus americana* and Siberian elm, *Ulmus pumila* submitted to the Plant Pathology Laboratory from a survey conducted by the Manitoba Department of Natural Resources. Trees were selected for sampling and submissions to the laboratory on the basis of presence of wilted brown leaves and internal brown staining of the cambium. All samples submitted were cultured on potato dextrose agar medium and incubated for 7 days at 20°C. Fungal identifications were done after 7 days.

RESULTS: There were 1,950 elm trees showing symptoms of leaf wilt and vascular staining sampled in Manitoba in the 1991 survey. Branch samples were submitted to the Manitoba Agriculture Plant Pathology Laboratory for culturing. The results of the survey are presented in Table 1. Tree removals are also included as this indicates the real impact of Dutch elm disease (DED) in the areas sampled. In many areas where DED is prevalent only a few samples are taken to confirm presence of DED and surrounding elms with similar symptoms of trees with more than 50% of the crown dead are marked for removal. The sampling results do not give a full indication of the impact of DED in rural Manitoba as sampling and tree removals are concentrated in cities, towns and municpal parks, areas which have a cost sharing agreement with the Manitoba Department of Natural Resources.

Ninety-four percent (94%) of elms sampled were infected with DED caused by *Ophiostoma ulmi* (*Ceratocystis ulmi*). There were 1,151 trees in Winnipeg which were either confirmed in the laboratory as having DED or were highly suspect of being diseased. In addition, 4,775 trees were classified as hazard trees (ie: more than half dead from natural or disease causes and marked for removal). The 5,853 trees were marked for removal in 1991 is about 47% less than last years number of 11,040.

There were less trees marked for removal in the Brandon (-30%), Winnipeg (-47%), Central (-62%) and Eastern (-11%) regions in 1991. There was an increase in trees marked for removal in the interlake (73%) region. DED is now almost completely co-existent with the range of native American elm in Manitoba, except for elm trees in the Northwest part of the province north of Dauphin. The native range of American elm in Manitoba extends to The Pas.

Dothiorella dieback (*Dothiorella ulmi*) was found in 24 samples of American elm and Verticillium wilt (*Verticillium* spp.) was found in 31 samples of American elm.

The decrease in tree removals in 1991 was not entirely caused by a reduction in the incidence of DED but was also due to a sharp reduction in the budget allocated to the DED program.

INCIDENCE OF DUTCH ELM DISEASE IN MANITOBA IN 1991

AREA	TREES SAMPLED		TREES DISEASED		% INFECTED		TREES MARKED FOR REMOVAL		PERCENTAGE CHANGE
	1990	1991	1990	1991	1990	1991	1990	1991	
Winnipeg	1078	1151	960	1078	89	94	11040	5853	–47
Brandon	106	4	93	3	88	75	1515	1111	–30
Interlake	80	172	73	165	91	96	298	515	+73
Central	427	538	368	501	86	93	8153	3070	–62
Eastern	327	51	293	45	90	88	2948	2614	–11
Western	38	34	29	33	76	97	2071	2559	+24
Total	2056	1950	1816	1825	520	94	26025	15722	–40

Turfgrass / Gazon

Crop / Culture: Kentucky bluegrass (Poa pratensis)

Location / Emplacement: Ontario

Title / Titre: Incidence of Necrotic Ring Spot Disease of Turfgrass in Southern Ontario.

Name and Agency / Nom et Organisation: Hsiang, T., D. O'Gorman and J. Trakalo
Dept. Environmental Biology
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METHODS:

Surveys and Field Specimens

A survey was drawn up and sent to turfgrass industry associations for distribution to Golf Course Superintendents, Park Supervisors, Sod Farm Managers, and Lawn Care Companies. Information was requested on their dealings with turfgrass patch diseases, especially necrotic ring spot. The survey also solicited specimens of patch diseases to be sent to the University of Guelph for isolation. Other isolates were obtained from the Pest Diagnostic Advisory Clinic at the University of Guelph, and from Annette Anderson, the Turf Extension Specialist of the Ontario Ministry of Agriculture and Food. Confirmed specimens were obtained from Leslie MacDonald of the British Columbia Ministry of Agriculture and Fisheries for comparisons with our isolates.

Isolations

Numerous isolations were made of fungi from roots in diseased patches. The technique involved root washes of up to 24 hours, followed by 1 min surface sterilization in 1% silver nitrate, a 30 sec rinse in 5% NaCl and then a final wash in autoclaved distilled water. The root pieces were then blotted dry and placed on 1/5 strength potato dextrose in 2% agar amended with 30 ppm streptomycin. After a week, hyphal tips were transferred to full strength potato dextrose agar (PDA) and incubated at 20°C. In attempts to fruit the fungus, plugs from isolates which resembled Leptosphaeria korrae Walker & Smith, the causal agent of necrotic ring spot, were then inoculated onto autoclaved hard fescue seeds on 2% water agar, and the petri plates sealed with parafilm. Excess condensation was removed periodically from the petri plates.

RESULTS:

We currently have 42 isolates that resemble L. korrae. These characteristics include a relatively slow radial growth rate (3.0 mm/day) on potato dextrose agar, and a grey floccose mycelium which is very dark on the underside. Such isolates have frequently come from samples of Kentucky bluegrass with abundant dark runner hyphae on discoloured roots. By growing the pure isolates on tall fescue seed, we have managed to induce ascospore production of 9 of these cultures (including 4 of the 6 B.C. isolates), and have made positive identification of these isolates as L. korrae.

In conclusion, the fungus L. korrae is present in Ontario. Prior confirmed reports of this fungus in Canada come from B.C. (Can. Plant Dis. Surv. 70:35 & 71:128), but as far as we know, this is the first published report of L. korrae in Ontario. Necrotic ring spot disease on Kentucky bluegrass lawns, which has in the past been called "Fusarium blight" or "Frog-eye", is likely caused by this fungus in Ontario. From the distribution of survey respondents and verified isolates, this disease and thus the fungus is common throughout southern Ontario.

Forest trees / Arbres forestiers

Crop / Culture: Conifer forests

Location / Emplacement: British Columbia

Name and Agency / Nom et Organisation: D. Norris, R. Stewart, and J. Muir
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V1L 4C6

Title / Titre: A SURVEY OF SUSPECT FOREST SITES FOR ROOT DISEASES AND OTHER DAMAGE IN SOUTHEASTERN BRITISH COLUMBIA.

~~METHODS~~: In the Nelson Forest Region, 429 forest sites, defined on inventory maps as polygons, were selected and inspected for root diseases, damaging insects, and other agents. Suspect sites were judged to have reduced site productivity or potential growing problems based on attributes of: past selective logging; a large proportion of hardwood trees; reduced tree height growth (site index) as compared to expected growth based on ecological features (ecosystem association); and below average crown closure. Field personnel traversed each polygon, and recorded tree data from three standard inventory plots.

RESULTS AND COMMENTS: Of the total 19 344 ha of suspect sites that was sampled, only 16 per cent was free of any damaging agents. Fifty per cent of the polygons had root diseases - mostly armillaria root disease - and the remainder had dwarf mistletoe, bark beetles, animal damage, and other damage totalling approximately 5 to 7 per cent of the area in each category. There was no damage from defoliating insects, and area damaged by other insects was 2 per cent.

From compilations of forest inventory file data, suspect sites amounted to 85 to 98 per cent of the operable forest land or 840 000 hectares for the region. From inventory data these sites were expected to produce a total of 2 300 000 cubic meters of wood volume per year. However, our sampling results indicated: 1) that the current productivity on these sites was 2 650 000 cubic meters or 16 per cent more than expected; and 2) if these suspect sites were treated and managed to prevent or suppress the damage from root diseases and other damaging agents, productivity could be 3 300 000 meters annually, 44 per cent more than currently produced.

Research results, current trials, and economic analyses, indicate that these sites could be treated, especially for root disease, to achieve almost all of these potential gains in productivity. We believe that a forest health treatment program would yield substantial economic, social and environmental benefits.

Instructions to authors

Articles and brief notes are published in English or French. Manuscripts (original and one copy) and all correspondence should be addressed to Dr. H.S. Krehm, Research Program Service, Research Branch, Agriculture Canada, Ottawa, Ontario K1A 0C6.

Manuscripts should be concise and consistent in style. spelling, and use of abbreviations. They should be typed, double spaced throughout, on line-numbered paper. All pages should be numbered, including those containing abstract, tables, and legends. For general format and style. refer to recent issues of the Survey and to *CBE Style* Manual 3rd ed. 1972. American Institute of Biological Sciences, Washington, D.C. Whenever possible, numerical data should be in metric units (SI) or metric equivalents should be included. Square brackets may be used to enclose the scientific name of a pathogen, following the common name of a disease, to denote cause.

Titles should be concise and informative providing, with the Abstract, the key words most useful for indexing and information retrieval.

Abstracts of no more than 200 words, in both English and French, if possible, should accompany each article.

Figures should be planned to fit, after reduction, one column (maximum 84 × 241 mm) or two columns (maximum 175 × 241 mm), and should be trimmed or marked with crop marks to show only essential features. Figures grouped in a plate should be butt-mounted with no space between them. A duplicate set of unmounted photographs and line drawings is required. Figures should be identified by number, author's name, and abbreviated legend.

Tables should be numbered using arabic numerals and have a concise title; they should not contain vertical rules; footnotes should be identified by reference marks (* † § # ¶ ** ††) particularly when referring to numbers.

Literature *cited* should be listed alphabetically in the form appearing in current issues; either the number system or the name-and-year system may be used. For the abbreviated form of titles of periodicals refer to the most recent issue of Biosis List of Serials published by Biosciences Information Service of Biological Abstracts or to the NCPTWA *Word Abbreviation* List, American National Standards Institute.

Recommandations aux auteurs

Les articles et les communiques sont publiés en anglais ou en franqais. Les manuscrits (l'original et une copie) et toute la correspondance qui s'y rapporte doivent être envoyés à D[r] H.S. Krehm, Service des programmes de recherche, Direction de la recherche, ministère de l'Agriculture du Canada, Ottawa, (Ontario) K1A 0C6.

Les *manuscrits* doivent être concis et faire preuve de suite dans le style, l'orthographe et l'emploi des abréviations. Ils doivent être dactylographies à double interligne, de preference sur des feuilles à lignes numérotées. Toutes les pages doivent être numérotées y compris celles portant le résumé, les tableaux et les légendes. Pour plus de renseignements sur le format des feuilles et le style, prière de consulter nos dernières publications et le *CBE Style Manual* (3e ed. 1972) de l'American Institute of Biological Sciences, Washington (DC). Dans la mesure du possible, les donnees numériques doivent être exprimées en unites mbtriques, (SI) ou être suivies de leur équivalent metrique. L'emploi de crochets est autorisé pour l'identification du nom scientifique d'un micro-organisme pathogène après le nom commun de la maladie dont il est l'agent causal.

Les titres doivent être courts et revelateurs en contenant, avec le resume, les mots clés les plus utiles pour le classement et l'extraction de l'information.

Chaque article doit être accompagne d'un resumed'au plus 200 mots en anglais et en franqais, si possible.

Les figures doivent pouvoir, après reduction, remplir une colonne (maximum 84 x 241 mm) ou deux colonnes (maximum 175 × 241 mm) et devraient être taillées ou montrer les parties essentielles à garder. Les figures groupées sur une même planche doivent être montées côte à cote, sans intervalle. L'article doit être accompagne d'un double des photographies non montées et des graphiques. Les figures doivent être numérotées, porter le nom de l'auteur et une legende abrégée.

Les tableaux doivent être numérotés en chiffres arabes et avoir un titre concis. Ils ne devraient pas avoir de lignes verticales. Les renvois doivent être identifies par un signe typographique particulier (* t § # ¶ ** ††) surtout lorsqu'il s'agit de nombres.

Les references *bibliographiques devraient* être citées par ordre alphabetique comme dans les livraisons courantes. On peut utiliser le système de numeration ou le système nom-et-année. Pour l'abrégé du titre des pbriodiques, on suivra l'édition la plus récente de *Biosis* List *of Serials* publiee par les Biosciences Information Services de Biological Abstracts ou la NCPTWA *Word Abbreviation* List et l'American National Standards Institute. Standards Committee 239.