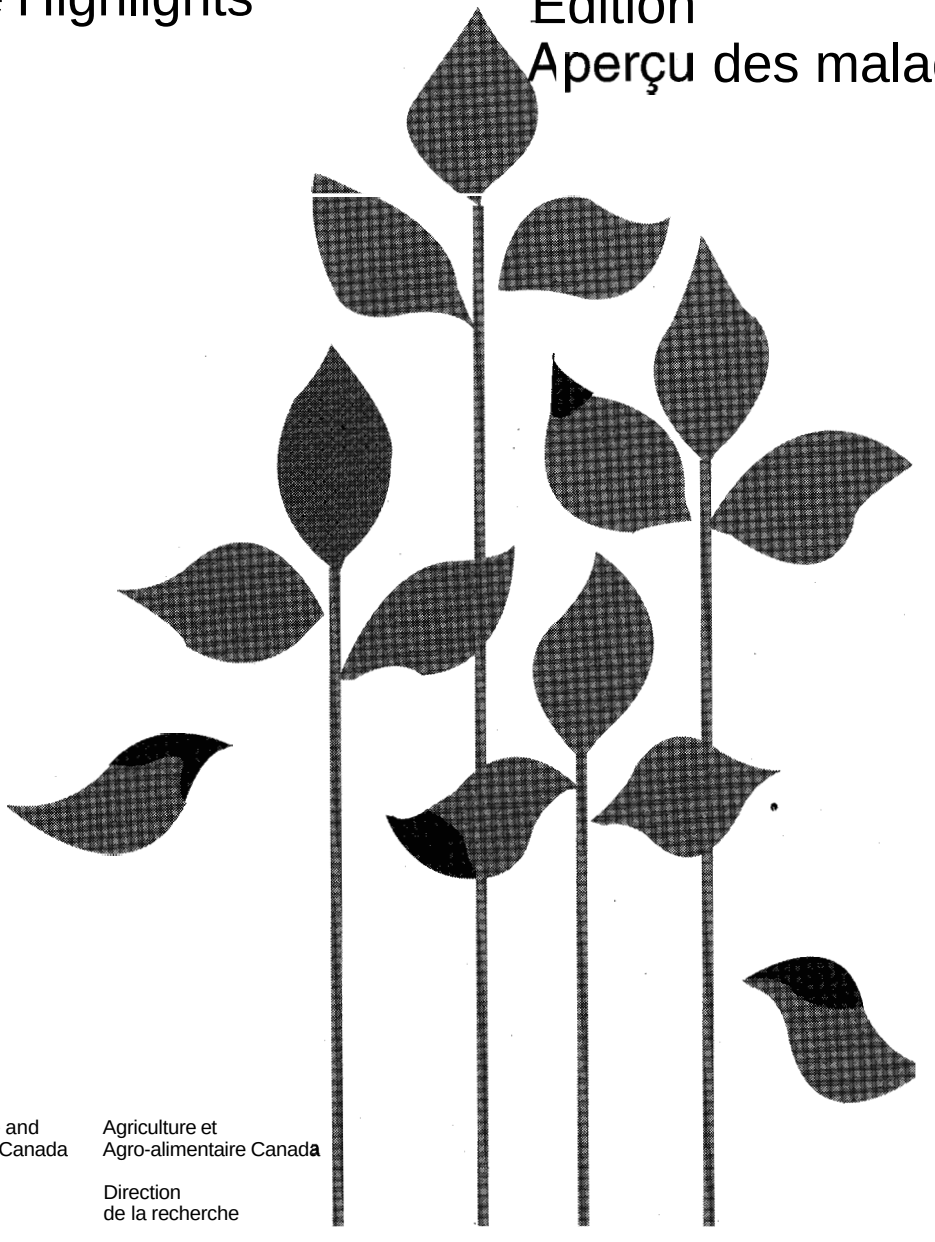
Canadian Plant Disease Survey

Inventaire des maladies des plantes au Canada

Vol. 74, No. 1, 1994
Disease Highlights Edition

Vol. 74, NO 1, 1994
Edition Aperçu des maladies



Agriculture and Agri-Food Canada
Research Branch

Agriculture et Agro-alimentaire Canada
Direction de la recherche

Canada

Canadian Plant Disease Survey

Inventaire des maladies des plantes au Canada

Volume 74, Number 1, 1994

CPDS 74(1) 1-125 (1994) ISSN 0008-476X

Volume 74, Numero 1, 1994

Contents

Disease highlights 1993 Aperçu des maladies

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 periodique d'information sur la frequence des maladies des plantes au Canada, leur gravite, et les pertes qu'elles occasionnent. La redaction accepte d'autres communications originales notamment sur la mise au point de nouvelles methodes d'enqête et de lutte ainsi que sur l'evaluation des nouveaux produits. De temps a autre, il inclut des revues et des syntheses de rapports d'intérêt immediat pour les phytopathologistes.

Research Branch, Agriculture Canada

Compilers: R.M. McNeil, B.Sc. and
B.A. Morrison
Information and Planning Services
Agriculture Canada, Ottawa, Ontario K1A 0C6

Direction de la recherche, Agriculture Canada

Compilateurs : R.M. McNeil, B.Sc. et
B.A. Morrison
Services d'informations et de planification
Agriculture Canada, Ottawa (Ontario) K1A 0C6

Foreword

This issue of the *Canadian Plant Disease Survey* includes a compilation of plant disease survey results for the 1993 crop year. This is the seventh year the Canadian Phytopathological Society and Information and Planning Services (formerly 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
National Coordinator

R.M. McNeil and B.A. Morrison
Compilers, Canadian Plant Disease Survey

Avant-propos

Ce numero de l'*Inventaire des maladies des plantes au Canada* contient les résultats compiles d'etudes effectuees sur les maladies des plantes pour la campagne agricole de 1993. Ce periodique, publié conjointement par la Societe canadienne de phytopathologie et les Services d'information et de planification (l'ancien Service aux programmes de recherches) de la Direction générale de la recherche d'Agriculture Canada, en est a sa septieme annee.

La Societe reconnaît la necessite de publier ces résultats 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 bénévole de phytopathologistes canadiens et au collationnement de leurs résultats par des spécialistes des maladies des grandes cultures. Comme la publication des résultats 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 à eux pour obtenir les formulaires et la marche a suivre pour presenter ces rapports. On trouvera en annexe la liste des analystes faisant le collationnement.

Nous tenons a remercier tous les contributeurs et analystes qui ont consacré une grande partie de leur temps a la production de cette publication et nous esperons vous compter de nouveau parmi nos collaborateurs.

L.W. Stobbs
Coordonnateur national

R.M. McNeil et B.A. Morrison
Compilateurs, de l'Inventaire des maladies des plantes au Canada

Control of apple powdery mildew *(Podosphaera leucotricha)* in British Columbia by demethylation-inhibiting fungicides

P.L. Sholberg and P. Haag[1]

In greenhouse studies inoculated McIntosh apple seedlings sprayed with the demethylation-inhibiting (DMI) fungicides myclobutanil, flusilazole, triadimefon and propiconazole developed significantly fewer powdery mildew colonies than control plants. Fewer colonies were observed on myclobutanil-treated plants than on plants treated with the other fungicides. An average of only 0.60 mildew colonies developed on the leaves of myclobutanil-treated plants within 10 days after inoculation compared with an average of 48.2 colonies on the leaves of the control plants. The DMI fungicides were more effective than thiophanate-methyl in field trials conducted in 1989 and 1990 on infected Jonagold apple foliage. The DMI fungicides flusilazole and myclobutanil effectively controlled foliar powdery mildew under heavy inoculum pressure on Jonathan apple trees in 1987 and 1988, respectively. The cultivars used herein showed no detectable phytotoxic effects of applying DMI fungicides, neither injury to fruit or foliage nor altered shape or weight.

Can. Plant Dis. Surv. 74:1, 5-11, 1994.

Une étude effectuée en serre sur des jeunes plants inoculés de pommiers McIntosh, ayant été traités à l'aide de fongicides inhibant la déméthylation, soit le myclobutanil, le flusilazole, le triadimefon et le propiconazole, a permis de démontrer que ces plants ont form6 beaucoup moins de colonies de blanc que les plants témoins. Les plants traites au myclobutanil ont present6 moins de colonies que les plants traites avec les autres fongicides. Dix jours après l'inoculation, une moyenne de 0,60 colonie de blanc seulement est apparue sur les feuilles des plants ayant reçu du myclobutanil, alors que dans le cas des plants témoins une moyenne de 48,2 colonies se sont développées. Les fongicides inhibant la déméthylation se sont révélés plus efficaces que le thiophanate-methyl dans les essais au champ qui ont été effectues en 1989 et en 1990 sur le feuillage infect6 des pommes Jonagold. En 1987 et en 1988, du flusilazole et du myclobutanil appliques sur des pommiers Jonathan, en presence d'une forte action de l'inoculum, ont permis de lutter efficacement contre le blanc sur le feuillage. Par suite de l'application des fongicides, aucun effet phytotoxique (dommages aux fruits ou aux feuillages, modification de la forme ou du poids du fruit) n'a été détecté sur les cultivars dont il est question ici.

Introduction

Powdery mildew (PM), caused by *Podosphaera leucofricha* (Ell. & Ev.) Salm., is an important disease of apple in the interior of British Columbia. Disease severity and need for control measures are related to host susceptibility and to the intended market for the cultivar (Yoder and Hickey 1983). The pathogen may cause death of vegetative shoots or flower buds, and russetting of fruit (Jones and Sutton 1984). The grower's primary concern with mildew is the russet symptoms that markedly reduce fruit quality (Spotts *et al.* 1981). Infected young trees of susceptible cultivars may be seriously damaged or become poorly shaped because of retarded vegetative growth or loss of terminal buds. In British Columbia the very susceptible apple cultivars, such as McIntosh and Golden Delicious, are treated regularly with fungicides for control of fruit russet. The fungicides most commonly used for powdery mildew are sulfur and thiophanate-methyl. Several new cultivars have been recently introduced, which also will require regular fungicide treatments (Anon. 1992).

P. leucofricha is an obligate ,parasite that overwinters on apple as mycelium in dormant buds infected during the previous growing season (Hickey and Yoder 1990). The "primary infection phase" of the disease is initiated by conidia produced on overwintering mycelium at bud break, which infect young leaves, flowers and shoots. Newly formed conidia from these sources are inoculum for the "secondary infection phase", which is the infection of healthy leaves during the growing season (Burchill 1960). The

1 Agriculture Canada, Research Station, Summerland, British Columbia V0H 1Z0. Contribution No. 820. Accepted for publication November 19, 1993.

reduction of primary inoculum and the protection of leaves, fruit and buds from secondary infections are two areas of concern for effective disease control measures. Timely application of fungicides is widely used to prevent new infections and to reduce the number of spores produced on new lesions.

The most promising new fungicides for control of powdery mildew are the broad-spectrum, sterol-inhibiting compounds (Ogawa and English 1991). With the exception of the morpholines, all sterol inhibitors have a common site of action within the biosynthesis pathway and are grouped together as demethylation inhibitors or DMIs (Scheinpflug 1988). Although myclobutanil was registered for the control of powdery mildew on apples and grapes in Canada, it is unclear whether the fungicidal properties of myclobutanil are comparable to those of thiophanate-methyl or to other DMI fungicides such as triadimefon, which are used to control powdery mildew on apples in the United States.

This study compares the activities of DMI fungicides and thiophanate-methyl on mildew of apple plants under controlled conditions in the greenhouse and in an orchard. Results of tests to evaluate phytotoxicity to apple also are presented.

Materials and methods

Fungicides

The fungicides used in these experiments [flusilazole (Nustar 20 DF, Dupont Canada Inc.), myclobutanil (Nova 40 W, Rohm and Haas Canada Inc.), propiconazole (Orbit 40 W, Ciba-Geigy Canada Ltd.), thiophanate-methyl (Easout 70 W, Ciba-Geigy Canada Ltd.) and triadimefon (Bayleton 50 W, Chemagro Ltd.)] were commercial formulations provided by the manufacturers.

Greenhouse studies

McIntosh apple seeds were stratified for 6 weeks at 10°C and planted in 10-cm dia. pots in a soil mixture containing equal volumes of loam, sand and vermiculite. The pots were placed in the greenhouse (22°C day, 18°C night, 77-84% RH) for germination and subsequent growth for approximately three weeks without pesticides for disease or insect control.

The inoculum source was infected apple shoots from an eight year old Jonagold tree in the Summerland Research Station orchard. The fungus was identified as *Podosphaera leucotricha* (Ell. & Ev.) Salm. on the basis of symptom development and a comparison of the morphological characters of the conidia and fruiting bodies with those described for *P. leucotricha* by Ogawa and English (1991). The infected shoots were placed in a 1°C cold storage room for approximately 4 hrs while the fungicide suspensions were being prepared. McIntosh seedlings were sprayed to runoff using a hand operated mister (Table 1). The leaves were allowed to dry for 30-min before inoculation with *P. leucotricha* conidia. Each treatment consisted of 10 seedlings. A conidial suspension was prepared by brushing conidia from diseased shoots into sterile water containing 20 µl/mL of Triton X 100. The concentration was adjusted to 8.0 x 10^{11} conidia/mL with a haemacytometer. Within 15-min of preparation the suspension was sprayed on the leaves. The seedlings were inoculated using the method Dekker (1982) developed to evaluate powdery mildew on cucumber leaves.

Mildew development was estimated by counting colonies on leaves 6, 8 and 10 days after inoculation. Each small white spot at least 3-mm in diameter was counted as a colony. Mildew colonies were counted on both surfaces of six leaves at positions -1 to +4, where leaf 0 was the youngest leaf behind the shoot apex at the time of inoculation and -1 was the next unrolled leaf and youngest leaf at the shoot tip when the colonies were counted (Jeger *et al.* 1986). One plant was removed from each treatment because it had on average fifteen times more colonies than the mean, and therefore had been apparently infected with powdery mildew before the start of the experiment. Conidial production per cm^2 of leaf surface was estimated 10 days after inoculation for samples containing 10 leaves from each of the six positions. The 10 leaf samples were rinsed with 25 mL of sterile water to remove conidia and 10 aliquots were counted in a haemacytometer chamber. The average of these 10 counts was used as the concentration of conidia in the 25 mL suspensions. Leaf area was determined by tracing each leaf on drawing paper and measuring the area with a digitizing tablet (Jandel Scientific, Corte Madera, CA).

Orchard studies

For the field test uniform trees of apple cv. Jonagold were selected in the orchard at the Summerland Research Station. Apple trees on M.106 or M.26 rootstocks, approximately 4m and 3m high, respectively, were 9 years old when the first test was conducted in 1989. Thirty-five selected trees in two rows were grouped into five randomized blocks with seven random single trees separated by an unsprayed control tree. Treatments (Table 3) were applied until runoff with a handgun operated at 690 kPa on May 4 (pink stage of blossom development), May 16 (petal fall), June 2 (first foliage cover spray), and June 15 (second cover). The active ingredient (a.i.) dosages applied for the DMI materials were those recommended by the manufacturer while for thiophanate-methyl the dosage was that recommended for British Columbia (Anon. 1992).
Secondary powdery mildew development was evaluated on

June 26 by selecting 10 shoots at random on each single tree replicate and determining the incidence and the number of leaves with mildew. Mildew severity was based on visual estimates of the percentage of bottom leaf surface area showing symptoms using 10 increments between 10 and 100%. Severity was the average percent for all of the infected leaves on each tree.

Twenty-five fruit per replicate were harvested on September 11 and each fruit was examined for russet due to mildew. Possible phytotoxic effects that might alter fruit size were assessed using measurements of fruit shape, the ratio of length to diameter, and of fruit weight.

In 1990 the DMI fungicides were tested on the untreated control trees, which served as border trees the previous year. Treatments (Table 4) were applied on April 24 (pink), May 4 (full bloom), May 11 (petal fall), May 23 (first cover) and May 30 (second cover). Secondary mildew development on foliage was evaluated on June 15 and russet and fruit shape and weight were evaluated on September 13.

Trees of cv. Jonathan also were used in this study because this cultivar was reported to be extremely susceptible to powdery mildew (Koepsell and Pscheidt 1990). Six trees were sprayed with flusilazole in 1987, and six alternating control trees were sprayed with myclobutanil in 1988. Flusilazole was applied on April 9 (tight-cluster), April 21 (pink), May 8 (petal-fall), May 22 (first cover) and June 5 (second cover). Foliar powdery mildew (PM) was evaluated on June 15 and fruit PM on September 24. Myclobutanil was applied on April 29 (pink), May 10 (petal fall), May 20 (first cover) and June 1 (second cover). Foliar PM was evaluated on June 17 and fruit PM on September 24.

Results

Greenhouse trials

Powdery mildew colonies developed on every leaf of the unsprayed control plants except leaf -1, which was small and tightly rolled at the time of inoculation (Table 1). Control and treated leaves at positions 2 *to* 4 had many more colonies than younger leaves. For control plants, leaves at position 2 had about 15 colonies while those at 3 or 4 had about 13 colonies. Leaves 1 to 4 treated with fungicide had significantly fewer colonies than comparable control leaves. PM colonies were observed on leaves at position 4 when the plants were sprayed with myclobutanil at 4.50 µg/mL. The six fungicides evaluated in this experiment were equally effective in controlling the formation of colonies at each leaf position.

Conidia per cm^2 of leaf area on the control plants were increasingly more abundant as the age of the leaves increased (Table 2). Each of the five fungicide treatments significantly reduced conidial numbers in leaves at positions 0 to 4. The total number of conidia, averaged per cm^2 of leaf area for the 6 leaves per plant was 88.4, 148.1, 170.4, 354.4 and 518.9 conidia for myclobutanil, triadimefon, propiconazole, flusilazole and thiophanate-methyl, respectively, compared with 1827.1 for the control.

There were 4.0±3.1 visible powdery mildew colonies on control plants 6 days after inoculation and the number increased to 48.2±27.2 by the tenth day (Fig. 1). Thiophanate-methyl or myclobutanil reduced the number of colonies that developed during the 10 days of incubation (Fig. 1). Leaves on plants sprayed with myclobutanil were free of mildew colonies during the first 8 days of inoculation and less colonies were visible after 10 days of incubation (Fig. 1).

Field trials

The effectiveness of the DMI fungicides was shown in field trials on cv. Jonagold in 1989 and 1990 (Tables 3 and 4). In 1989, trees treated with four sprays of myclobutanil (45.0 µg/mL) or triadimefon (37.5 µg/mL) had lower incidences of mildew 7.0 and 8.6%, respectively, compared with the other fungicides and with the 68.6% incidence in the control (Table 3). Myclobutanil and triadimefon also reduced foliar mildew severity to 1.0 and 1.4%, respectively, compared with 18.6% in the control. Fruit weight and shape were not affected by application of these fungicides. Trees sprayed with thiophanate-methyl (350 µg/ml) had a higher incidence of mildew, 37.8%, and disease severity, 7.1%, than plants sprayed with myclobutanil and triadimefon. In 1990, myclobutanil was applied five times at 30.0 µg/mL dosages and gave complete control of foliar mildew. Thiophanate-methyl (350 µg/mL) was less effective than myclobutanil, but reduced mildew incidence to 11.8%, which was lower than that observed in 1989. As in 1989 fruit weight and shape were not affected by fungicide application.

Field trials in 1987 with flusilazole (32.0 µg/mL) and in 1988 with myclobutanil (40.0 µg/mL) on apple cv. Jonathan showed that both these fungicides effectively controlled powdery mildew (Table 5). The incidence of powdery mildew on unsprayed trees was extremely high in 1988 with 87% of the leaves infected and a severity rating of 39%. Myclobutanil reduced the number of infected leaves to 21.7% and the severity to 4.6%. Furthermore, russet due to mildew was reduced from 7.0 to 1.7%. Neither DMI fungicide significantly affected fruit weight and shape and injury was not observed on leaves or fruit.

Discussion

The most effective DMI fungicide in these studies was myclobutanil. In greenhouse tests at a rate of 4.5 µg/mL, myclobutanil allowed only an average of 0.56 mildew colonies per plant compared to **47.1**1 for the control. It also was very effective in reducing sporulation and in delaying the development of powdery mildew colonies. In the 1989 and 1990 field trials with cv. Jonagold, myclobutanil was more effective in reducing mildew development than the other fungicides tested, however, the other DMI fungicides also showed good control of mildew. In greenhouse tests flusilazole, triadimefon and propiconizole were as effective as myclobutanil even at the lower rates that were applied to the plants. In the Jonagold apple field trial of 1989 flusilazole and propiconazole were not as effective as triadimefon or myclobutanil, probably because they were used at considerably lower rates. The manufacturers of flusilazole and propiconazole recommended these rates because there is concern that DMI fungicides will cause phytotoxicity. Roper *et al.* (1985) found, in greenhouse and field tests on powdery mildew with the DMI, etaconazole, that it had growth-inhibiting effects, however, the rate was 260 µg/mL compared to 45 µg/mL for myclobutanil which was the highest rate used in our trials.

Thiophanate-methyl, a benzimidazole fungicide, was not as effective as the DMI compounds. In greenhouse tests thiophanate-methyl at 350 µg/mL provided slightly less effective disease control than the DMIs at less than 5 µg/mL. At those dosages, conidial production (per cm^2 of leaf area) was significantly higher on leaf 3 with thiophanate-methyl than for the three DMIs except flusilazole. Thiophanate-methyl also was not as effective as myclobutanil in reducing colony incidence (Fig. 1). In the 1989 and 1990 field trials thiophanate-methyl at 350 µg/mL was less effective than 45 µg/mL or less of the DMIs. Roper *et a/.* (1985) reported that another benzimidazole, benomyl, did not control powdery mildew as well as the DMI, etaconazole.

Field trials with apple cultivars Jonagold and Jonathan, and greenhouse tests on the highly susceptible McIntosh apple seedlings, have shown that DMI fungicides are very effective for the control of secondary powdery mildew. They provide better control at lower rates than thiophanate-methyl, which has long been the standard fungicide for powdery mildew control in British Columbia. The fact that myclobutanil was the most effective mildewcide in these tests is important and helped to register it for control of apple powdery mildew in Canada. The other DMIs are in development and may be registered in the future. The DMIs have been used to control apple scab (Wilcox *et a/.* 1992) and can be used in spray programs where control of both mildew and scab are required. Thiophanate-methyl is very limited in its control of apple scab due to widespread resistance to benzimidazoles in British Columbia (Sholberg *et al.* 1989).

Phytotoxic effects were not detected on foliage or fruit in any of these trials. Spotts and Cervantes (1986) found that the DMIs tradimefon and etaconazole did not significantly affect fruit set, percent floral buds, or fruit weight and shape. However, they noted that if the application rate was high enough there could be effects on fruit shape, as they found in an experiment when triadimefon was used at twice the rate, 0.28 kg a.i./ha and applied ten times during the season. The myclobutanil label states a rate of 0.14 kg a.i./ha, which provides a wide safety margin before any phytotoxic effects might occur.

Acknowledgments

We thank Ray Palmer, formerly of the Summerland Research Station, and Tracy Seddon for technical assistance. We also thank Bill Fleming for assistance on graphics.

Literature cited

1. Anon. 1992. Tree Fruit Production Guide for Commercial Growers, Interior Districts. Province of British Columbia, Ministry of Agriculture, Fisheries and Food, Victoria, British Columbia, Canada.
2. Burchill, R.T. 1960. The role of secondary infections in spread of apple powdery mildew, ***Podosphaera leucotricha*** (Ell. & Ev.) Salm. J. Hort. Sci. 35:66-72.
3. Dekker, J. 1982. Method of fungicide resistance in powdery mildew of cucumber - FAO Method No. 27. Food and Agriculture Organization of the United Nations. FAO Plant Prot. Bull. 30:59-61.
4. Hickey, K.D. and K.S. Yoder. 1990. Powdery mildew. Pages 9-10 in: A.L. Jones and H.S. Aldwinckle, eds. Compendium of Apple and Pear Diseases. APS Press, St. Paul, MN.
5. Jeger, M.J., D.J. Butt and A.A.J. Swait. 1986. Components of resistance of apple to powdery mildew ***(Podosphaera leucotricha).*** Plant Pathol. 35:477-490.
6. Jones, A.L. and T.B. Sutton. 1984. Diseases of Tree Fruits. Cooperative Extension Service, Michigan State University, East Lansing, MI.
7. Koepsell, P.A. and J.W. Pscheidt. 1990. Pacific Northwest Plant Disease Control Handbook. Extension Services of Oregon State University, Washington State University and the University of Idaho. 293 pp.
8. Ogawa, J.M. and H. English. 1991. Powdery mildew of pome fruit. Pages 50-53 in: Diseases of Temperate Zone Tree Fruit and Nut Crops. University of California, Division of Agriculture and Natural Resources, Publication 3345, Oakland, CA.

9. Roper, T.R., D.J. Weber, W.R. Andersen. 1985. Impact of etaconazole and benomyl on powdery mildew, leaf characteristics, growth and yield of Rome Beauty apple trees. J. Hort. Sci. 60:29-32.

10. Scheinpflug, H. 1988. History of DMI fungicides and monitoring for resistance. Pages 77-78 in: Fungicide Resistance in North America. C.J. Delp, ed., American Phytopathological Society, St. Paul, MN.

11. Sholberg, P.L., J.M. Yorston and D. Warnock. 1989. Resistance of *Venturia inaequalis* to benomyl and dodine in British Columbia, Canada. Plant Dis. 73:667-669.

12. Spotts, R.A., R.P. Covey and I.C. MacSwan. 1981. Apple powdery mildew and scab control studies in the Pacific Northwest. Plant Dis. 65:1006-1009.

13. Spotts, R.A. and L.A. Cervantes. 1986. Effects of fungicides that inhibit ergosterol biosynthesis on apple powdery mildew control, yield, and fruit growth factors. Plant Dis. 70:305-306.

14. Wilcox, W.F., D.I. Wasson and J. Kovach. 1992. Development and evaluation of an integrated, reduced-spray program using sterol demethylation inhibitor fungicides for control of primary apple scab. Plant Dis. 76:669-677.

15. Yoder, K.S. and K.D. Hickey. 1983. Control of apple powdery mildew in the Mid-Atlantic region. Plant Dis. 67:245-248.

Table 1. Number of colonies of *Podosphaeraleucotricha* on inoculated McIntosh apple seedling leaves after 10 days of incubation in a 22°C greenhouse.

Treatment	Rate a.i. (µg/ml)	Leaf Position*					
		-1	0	1	2	3	4
Control	—	0.0 a**	0.22 a	4.33 a	15.67 a	13.67 b	13.22 a
Myclobutanil	2.52	0.0 a	0.00 a	0.00 b	0.00 b	0.56 b	3.56 b
Myclobutanil	4.50	0.0 a	0.00 a	0.00 b	0.00 b	0.00 b	0.56 b
Flusilazole	1.34	0.0 a	0.00 a	0.00 b	0.22 b	1.00 b	1.44 b
Triadimefon	3.75	0.0 a	0.11 a	0.11 b	0.67 b	3.44 b	3.78 b
Propiconazole	1.16	0.0 a	0.00 a	0.00 b	0.00 b	0.56 b	1.89 b
Thiophanate- methyl	350.0	0.0 a	0.33 a	0.00 b	1.44 b	2.11 b	3.11 b

* Powdery mildew development was monitored on both surfaces of the six leaves at positions -1 to 4 where leaf 0 was the youngest expanded leaf at the time of inoculation and -1 was the adjacent unrolled leaf.

** Treatment means in the same column followed by the same letter are not significantly different at $P < 0.05$ according to the Waller-Duncan K-ratio T test.

Table 2. Number of conidia of *Podosphaera leucotricha* per cm² of leaf area washed from McIntosh apple leaves at different stages of development 10 days after inoculation.

Treatment	Rate a.i. (µg/mL)	Leaf Position*						
		-1	0	1	2	3	4	Total
Control	—	54.5 ab**	137.0	155.3 a	242.0 a	563.9 a	674.4 a	1827.1
Myclobutanil	2.52	7.5 bc	18.1 b	0.0 c	7.1 d	23.2 c	32.5 b	88.4
Propiconazole	1.16	20.8 abc	15.0 b	17.2 bc	20.3 cd	30.7 c	66.4 b	170.4
Flusilazole	1.34	43.5 abc	16.4 b	65.0 b	106.2 b	49.8 bc	73.5 b	354.4
Triadimefon	3.75	0.0 d	13.2 b	14.0 bc	24.7 cd	35.7 c	60.5 b	148.1
Thiophanate-methyl	350.0	67.1 a	63.5 b	61.5 bc	83.6 bc	120.0 b	123.2 b	518.9

* Powdery mildew development was monitored on both surfaces of the six leaves at positions -1 to 4 where leaf 0 was the youngest leaf at the time of inoculation and -1 was the adjacent unrolled leaf.

** Treatment means in the same column followed by the same letter are not significantly different at $P < 0.05$ according to the Waller-Duncan K-ratio T test.

Table 3. Effects of DMI fungicides and thiophanate-methyl on powdery mildew incidence and severity, and on fruit weight and shape of Jonagold apple in field trials in 1989.

Treatment	Rate a.i. (µg/ml)	% Foliage Mildew		Fruit	
		Incidence	Severity	Weight (g)	Shape*
Control	—	68.6 a**	18.6 a	202 a	0.865 a
Myclobutanil	45.0	7.0 f	1.0 d	204 a	0.875 a
Triadimefon	37.5	8.6 ef	1.4 d	214 a	0.861 a
Myclobutanil	25.0	16.8 de	2.6 cd	202 a	0.882 a
Propiconazole	12.0	23.2 cd	3.6 cd	202 a	0.877 a
Flusilazole	13.0	27.6 c	4.3 c	206 a	0.878 a
Thiophanate- methyl	350.0	37.8 b	7.1 b	210 a	0.862 a

* Ratio of length to diameter.

** Numbers followed by the same letter within the columns are not significantly different at P= 0.05 according to Duncan's multiple range test.

Table 4. Effects of DMI fungicides and thiophanate methyl on powdery mildew incidence and severity on foliage, fruit mildew, and on fruit weight and shape of Jonagold apple in field trials in 1990.

Treatment	Rate a.i. (µg/ml)	% Foliage Mildew		Fruit		
		Incidence	Severity	% Mildew	Wt (g)	Shape*
Control	—	49.0 a**	13.18 a	14.0 a	183.0 a	0.883 a
Myclobutanil	30.0	0.0 c	0.00 b	0.0 b	188.8 a	0.887 a
Propiconazole	12.0	2.6 bc	0.40 b	0.0 b	183.4 a	0.891 a
Flusilazole	13.0	5.6 bc	0.80 b	0.0 b	220.0 a	0.893 a
Thiophanate- methyl	350.0	11.8 b	1.44 b	3.0 b	197.4 a	0.896 a

* Ratio of length to diameter.

** Numbers followed by the same letter within the columns are not significantly different at P= 0.05 according to Duncan's multiple range test.

Note: An additional application of propiconazole was applied 30 days before harvest on August 15 and flusilazole was applied four times with the last application on May 23, 1990.

Table 5. Effects of flusilazole and myclobutanil on powdery mildew incidence and severity on leaves, fruit mildew and on fruit weight and shape of Jonathan apple in field trials in 1987 and 1988.

Year	Treatment	Rate a.i. (µg/ml)	Incidence	Severity	Fruit		
					% Mildew	Wt (g)	Shape*
1987	Control	—	68.3 b**	22.5 b	0.0 a	141.1 a	0.838 a
	Flusilazole	32.0	27.4 a	6.2 a	0.0 a	142.5 a	0.831 a
1988	Control	—	87.0 b	39.0 b	7.0 b	124.5 a	0.889 a
	Myclobutanil	40.0	21.7 a	4.6 a	1.7 a	131.1 a	0.873 a

* Ratio of length to diameter.

** Numbers followed by the same letter within the columns are not significantly different at P= 0.05 according to the analysis of variance and **F** test.

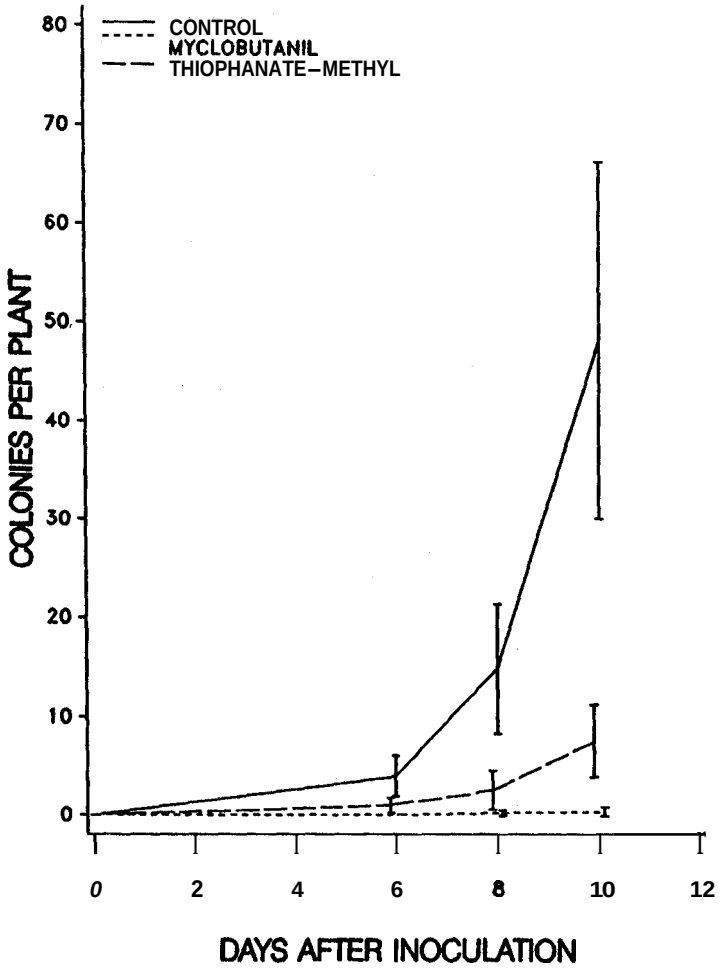


Figure 1. Powdery mildew colonies on McIntosh apple seedlings inoculated in the greenhouse and treated with the registered fungicides myclobutanil (4.5 µg/mL) and thiophanate-methyl (350.0 µg/mL). Myclobutanil is a DMI fungicide and thiophanate-methyl is a benzimidazole.

Severity of, and resistance of barley varieties to, scald and net blotch in central Alberta

G. Xue[1], P.A. Burnett[1] and J. Helm[2]

Forty-eight barley fields were examined for severities of scald ***(Rhynchosporium secalis)*** and net blotch ***(Pyrenophora teres)*** in 18 counties in central Alberta in 1993. On a scale of 0 (no disease) to 9 (whole plants were severely affected), average and maximum scald severities were 3.4 and 9.0 (n=48), average and maximum net blotch severities were 3.2 and 8.3 (n=48). Scald was most severe in Stettler, Lacombe, Flagstaff, Leduc, Mountainview and Rockyview counties, and net blotch was most severe in Paintearth Red Deer, Flagstaff and Clearwater counties. Of 48 barley varieties and lines evaluated in four cooperative tests, 11 were resistant (severity score≤2) to scald and 12 were resistant to net blotch. Cultivars Falcon and Tukwa, and line SD402 showed resistant reactions to both scald and net blotch.

Can. Plant Dis. Surv. 74:1, 13-17, 1994.

En 1993, dans 18 comtés du centre de l'Alberta, quarante-huit champs d'orge on été examines afin de determiner le degré de virulence de la tache pile ***(Rhynchosporium secalis)*** et de la rayure réticulée ***(Pyrenophora teres).*** Sur une échelle de 0 (abscence de maladie) A 9 (plante en entier sévèrement atteinte), les degrés moyen et maximum de virulence de la tache pâle sont de 3,4 et de 9,0 (n=48), tandis que les degrés moyen et maximum de virulence de la rayure réticulée sont de 3,2 et 8,3 (n=48). Ce sont dans les comtés de Stettler, Lacombe, Flagstaff, Leduc, Mountainview et Rockyview que la tache pâle s'est manifestée avec le plus de vigueur, pendant que dans les comtés de Paintearth Red Deer, Flagstaff et Clearwater la rayure réticulée faisait des ravages. Sur 48 variétés et lignées d'orge qui ont été évaluées dans quatre essais coopératifs, 11 se sont révélées résistantes (degré de virulence ≤2) à la tache pale et 12 à la rayure réticulée. Les cultivars Falcon et Tukwa et la lignée SD402 se sont montrés resistants autant A la tache pale qu'à la rayure réticulée.

Introduction

Barley (***Hordeum vulgare*** L.) is an important feeding and malting crop in Alberta (6). During the past decade, the annual area has been over 5 million acres and the farm value was around 300 million dollars per year (1). Over seventy five percent of this barley production was in central Alberta. Scald [***Rhynchosporium secalis*** (Oudem.) J.J. Davis] and net blotch ***(Pyrenophora*** teres Drechs.) have been the most destructive diseases of barley in central Alberta (2, 7). Yield losses of up to 30%, due to either disease, have been reported in commercial fields (5, 10). Control of these diseases has been primarily through 2-3 year rotations with non-host crops in Alberta (4). However, with the recent widespread use of conservation tillage and expansion of susceptible barley variety cultivation in the province, the severities of these diseases have increased. To maintain yield and grain quality, the fungicide propiconazole (Tilt) was registered for ground and aerial applicaltion in Alberta (4, 9). Propiconazole is effective for the control of both scald and net blotch. However, the relatively high cost of the fungicide (vs. the price of barley) has limited its use to pedigree seed and malting barley. Development of resistant barley cultivars and their use in commercial production would be the most effective methods of controlling scald and net blotch. This paper reports the distributions and severities of scald and net blotch on barley in central Alberta, and reactions of barley cultivars and advanced lines to the two diseases in cooperative tests in 1993.

Materials and methods

Forty-eight commercial barley fields were assessed for severities of scald and net blotch. The fields were distributed in 18 counties which are the centres for barley production in central Alberta (Fig. 1). Up to 40% of the barley fields in Alberta are seeded with the cultivar Harrington (8) and eight fields of this cultivar were selected from the 48 fields as controls for the two disease

1 Agriculture and Agri-Food Canada Research Station, Bag Service 5000, Lacombe, Alberta, Canada TOC 1S0.
2 Alberta Agriculture, Field Crop Development Centre, Crop Research Section, Bag Service #47, Lacombe, Alberta, Canada TOC 1S0.
Accepted for publication January 7, 1994.

assessments. The cultivars in the other 40 fields were not determined.

Forty-eight cultivars and advanced lines in the cooperative tests were examined at Lacombe (L), Stettler (S), and Drumheller (D), and 29 of these varieties were examined at Oyen (O). Field plots of these cultivars were established using culture practices recommended for central Alberta. The plots were 8 rows, 2.5 m long and arranged in a complete randomized block design with four replicates.

Assessments of the two diseases were conducted in commercial fields between July 27 -August 10 and in cooperative tests between August 12-19 when the barleys were in milk dough stage, development stage 75-80 on Zadoks scale (11). Severity of each disease was determined by rating 10 randomly chosen plants in 2-4 sampling sites in each commercial field or in two replicate plots in each cooperative test. An assessment scale of 0 (no disease) to 9 (all leaves of the plant severely affected) was used (3). Average scores <2.1, between 2.1 to 3.0, or >3.0 were considered resistant, moderately resistant, and susceptible reactions, respectively, relative to the overall infection levels. Fields having scores above 7.0 for either scald or net blotch were considered as having severe epidemics of the diseases.

Results and discussion

Net blotch was observed in all of the 48 fields examined and scald was observed in 47 fields; one field in Mountainview County was free of scald (Fig. 1). Although the two diseases were commonly found in almost all of the fields, their severity differed from county to county and from field to field. Severe epidemics of scald (ratings >7.0) were observed in eight fields in Stettler, Lacombe, Flagstaff, Leduc, Mountainview and Rockyview counties. Severe epidemics of net blotch were observed in four fields in Paintearth, Red Deer, Flagstaff and Clearwater counties. The level of both diseases in barley fields in Ponoka, Wetaskiwin and Brazeau was less than 3.0. The average scald severity was 3.4 and the range varied from 0.0 to 9.0, while the net blotch severity averaged 3.2 and ranged from 0.1 to 8.3. Difference in severity between the two diseases was significant ($t=272.2$, $P < 0.001$).

Severe scald and net blotch developed on cv. Harrington in the eight fields selected as control. In these fields the severity of scald averaged 6.2, and that of net blotch averaged 3.6 . The disease levels for Harrington were significantly higher than the averages of 2.9 and 3.1 for scald and net blotch, respectively, recorded for the cultivars in other 40 fields.

Infection with scald and net blotch occurred in each of the four cooperative tests (Table 1). The severity of the two diseases and the differential resistance of the cultivars and lines varied among the four test sites. At each site, scald was more prevalent than net blotch. At Stettler 28 cultivars and lines had scald severity scores of 8 to 9, which almost completely obscured net blotch symptoms. The maximum net blotch severity recorded in the cooperative tests was 6.0 on cv. Harrington seeded at Lacombe.

Relatively lower scald severity was observed on cv. Harrington in the cooperative tests compared to the severity recorded in the commercial fields. Among the 13 malt barleys evaluated, Harrington had an average disease severity score of 4.4 while the values for the other 12 cultivars were above 4.6. Of the 35 feed varieties tested, eleven were resistant and five were moderately resistant to scald. The desending order of resistance for the 16 barley entries was CDC Richard, Falcon, SD507, Duke, SD506, CDC Guardian, HB314, Leduc, SD402, TR129, Seebe, AC Lacombe, Brier, SD903, Tukwa and TR318. Three malt barley and nine feed barley cultivars and lines showed resistance reactions to net blotch.. Among these net blotch resistant entries, Duel, Tankard, Stein, BT374, BT421, CDC Buck, Noble, TR128 and TR232 had severe scald infections. The cultivars Falcon and Tukwa and line SD402 showed resistance to both scald and net blotch (Table 1). Tukwa and Falcon were registered in 1992. They were developed at the Field Crop Development Centre, Alberta Agriculture at Lacombe, Alberta. Line SD402 was bred at the Crop Development Centre, University of Saskachewan, Saskatoon, Saskachewan. The three cultivars have as yet not been used to any extent commercially in Alberta.

The widespread distribution of scald and net blotch on barley in Alberta reported herein and the severe levels of infection on the most popular commercial cultivar Harrington suggest that these continue to be economically important diseases. It appears that the annual yield losses for each disease in Alberta may have increased to more than the 2-4% estimated in 1982 (5). Harrington, although being generally considered susceptible to both scald and net blotch, is still the most resistant genotype to scald among the 13 malt barley varieties. The result suggests that breeding for scald resistance in malting barleys is required to produce cultivars more adapted to central Alberta.

Acknowledgment

We thank the research personnel at Chinook Applied Research Association (Oyen) and Mr. W.E. Davies for their assistance in locating fields and research trials, Mr. N.G. Miller, District Agriculturist, Alberta Agriculture, Lacombe and Mr. C. Su, Economic Services Division, Alberta Agriculture, Edmonton for providing statistical information, and Dr. R. Wolfe and Miss D.D. Orr for reading the manuscript and making valuable suggestions. Financial support from the Natural Science and Engineering Research

Council of Canada through Visiting Fellowships in Canadian Government Laboratories, and Alberta Agriculture through a Farming for the Future grant is gratefully acknowledged.

Literature cited

1. Anon. 1993. Agriculture statistics year book 1990. Statistics Branch, Alberta Agriculture, Edmonton, Alberta. 115 pp.

2. Bailey, K.L., L.J. Duczek, L. Jones-Flory, R. Kutcher, M.R. Fermandez, G.R. Hughes, C. Kirkham, K. Mortensen, S. Boyetchko, P.A. Burnett and D.D. Orr. 1992. Saskatchewan/Central Alberta barley disease survey, 1992. Can. Plant Dis. Surv. 73:59-63.

3. Couture, L. 1980. Assessment of severity of foliage diseases in cooperative evaluation tests. Can. Plant Dis. Surv. 60:8-10.

4. Evans, I. 1993. Scald and net blotch of barley - Cultral and chemical control. Print Media Branch, Alberta Agriculture, Edmonton, Alberta. 4 pp.

5. McDonald, W.C. and K.W. Buchannon. 1964. Barley yield reductions attributed to net blotch infection. Can. Plant Dis. Surv. 44:118-119.

6. McLelland, M.B. 1982. Barley production in Alberta. Print Media Branch, Alberta Agriculture, Edmonton, Alberta. 36 pp.

7. Orr, D.D. and L.J. Piening. 1989. Cereal disease incidence in central Alberta - 1988. Can. Plant Dis. Surv. 69:38.

8. Prairie Pools Inc. 1992. Prairie grain variety survey - 1992. Royal Bank Centre, Ottawa, Canada. 5 pp.

9. Shaffeek, A. 1993. Crop protection with chemicals. Soil and Crop Management Branch, Alberta Agriculture. 262 pp.

10. Skoropad, W.P. 1960. Barley scald in the Prairie Provinces of Canada. Commonw. Phytopathol. News 6:25-27.

11. Zadoks J.C., T.T. Chang and C.F. Konzak. 1974. A decimal code for the growth stages of cereals. Eucarpia Bull. No. 7. 10 pp.

Table 1. Reactions of barley cultivars and lines to scald and net blotch at Lacome (L), Stettler (S), Drumheller (D), and Oyen (O) in central Alberta in 1993.

Variety	No. of row	Disease severity on 0 to 9 scale*									
		Scald					Net blotch				
		L	S	D	O	Mean	L	S	D	O	Mean
Malt barley											
Argyle	6	6.5	8.5	4.5	5.0	5.0	2.5	0.5	2.5	4.0	2.4
BT926	6	4.0	8.5	3.0	4.5	5.3	2.5	1.0	3.5	3.0	2.2
BT930	6	4.0	7.5	3.0	4.0	4.6	2.5	1.5	2.5	2.5	2.3
B1602	6	6.0	8.5	3.5	3.5	5.4	4.0	1.0	2.0	2.5	2.4
Duel	6	6.0	8.5	3.5	5.5	5.1	2.0	0.5	1.0	2.0	1.4
Tankard	6	6.0	9.0	5.0	5.0	6.3	2.0	0.0	1.0	2.0	1.3
AC Oxbow	2	6.0	8.5	4.5	5.0	5.0	2.0	0.5	2.5	4.5	2.4
B1215	2	7.0	8.0	5.0	5.0	6.3	2.5	1.5	2.0	2.5	2.1
Harrington	2	3.0	9.0	1.5	4.0	4.4	6.0	1.0	5.5	5.5	3.3
Manley	2	5.0	8.5	3.0	4.0	5.1	2.0	1.5	2.0	4.5	2.5
Stein	2	5.0	9.0	5.0	6.5	6.4	2.5	0.0	2.0	2.0	1.6
TR118	2	5.0	8.0	3.0	4.0	5.0	3.0	1.5	2.0	3.5	2.5
TR229	2	4.5	8.5	3.0	5.5	5.4	2.0	1.5	3.0	3.5	2.5
Feed barley											
AC Albright	6	4.5	7.0	3.5	3.0	4.5	2.0	1.0	2.5	3.5	2.3
AC Lacombe	6	2.0	4.0	1.5	1.5	2.3	3.0	1.5	2.5	2.0	2.3
Brier	6	3.5	3.0	1.5	1.0	2.3	3.5	2.5	3.0	2.0	2.8
BT374	6	5.5	9.0	4.0	—	6.2	3.0	0.0	2.0	—	1.7
BT419	6	6.0	8.0	2.5	—	5.5	4.0	1.0	3.0	—	2.7
BT421	6	6.5	8.5	3.5	—	6.2	2.0	0.5	3.5	—	2.0
BT672	6	5.0	8.0	3.0	—	5.3	3.0	1.0	2.5	—	2.2
CDC Buck	6	4.0	8.5	4.0	—	5.5	1.5	0.0	2.0	—	1.2
Duke	6	2.0	1.0	1.0	1.0	1.3	4.0	2.5	1.5	2.5	2.6
Falcon	6	1.0	2.5	1.0	2.0	1.2	2.0	1.5	1.0	1.5	1.5
Galt	6	5.5	8.5	2.5	4.0	5.1	3.0	0.5	3.0	2.5	2.3
HB314	6	1.0	2.0	1.5	—	1.5	2.5	3.0	1.0	—	2.2
Heartland	6	5.0	7.5	2.0	5.0	4.9	3.0	1.0	3.0	1.5	2.1
Jackson	6	6.0	8.5	3.5	—	6.0	3.0	0.5	3.5	—	2.3
Leduc	6	1.0	2.0	1.5	1.5	1.5	3.5	3.0	3.5	2.0	3.0
Noble	6	3.5	6.5	3.0	4.5	4.4	1.5	1.0	2.5	1.5	1.6
SD402	6	1.5	2.0	1.0	—	1.5	2.0	1.5	2.5	—	2.0
SD506	6	1.5	1.0	1.5	—	1.3	4.0	2.5	4.0	—	3.5
SD507	6	1.5	1.0	1.0	—	1.2	4.0	3.0	4.0	—	3.7
SD903	6	3.0	3.0	1.0	—	2.3	4.0	2.0	3.5	—	3.2
Tukwa	6	1.5	5.5	1.5	2.0	2.6	2.5	1.5	1.5	1.5	1.8
Abee	2	6.5	9.0	3.0	5.0	5.4	3.5	0.5	3.5	2.0	2.4
Bridge	2	1.0	9.0	2.0	2.0	3.5	4.5	0.5	3.0	2.0	2.8
CDC Guardian	2	1.0	1.5	2.0	1.0	1.4	5.5	2.0	2.5	2.5	3.1
CDC Richard	2	1.0	1.5	1.0	1.0	1.1	5.5	3.5	2.5	2.5	3.5
Condor	2	4.5	8.5	4.0	4.5	5.4	4.5	1.0	3.5	2.5	2.9
HB313	2	6.0	8.0	3.5	—	5.8	3.0	1.5	2.5	—	2.3
Phoenix	2	4.5	7.5	2.5	—	4.8	3.0	1.5	2.5	—	2.0
Seebe	2	1.5	2.5	1.5	—	1.8	4.5	3.0	2.5	—	3.3
TR128	2	5.0	9.0	5.0	—	6.3	3.0	0.5	2.0	—	1.8
TR129	2	1.0	2.0	1.5	—	1.5	4.5	2.0	4.5	—	3.7
TR232	2	4.5	8.0	2.5	—	5.0	2.0	1.5	1.5	—	1.7
TR318	2	1.0	2.5	3.5	—	2.3	3.5	3.5	2.0	—	3.0
TR320	2	4.0	9.0	4.0	—	5.7	3.5	0.5	3.5	—	2.5
Winthrop	2	7.0	9.0	4.0	4.5	6.1	2.0	0.0	4.5	5.0	2.9

* 0 = no disease and 9 = whole plants were severely affected.

— Was not tested at Oyen.

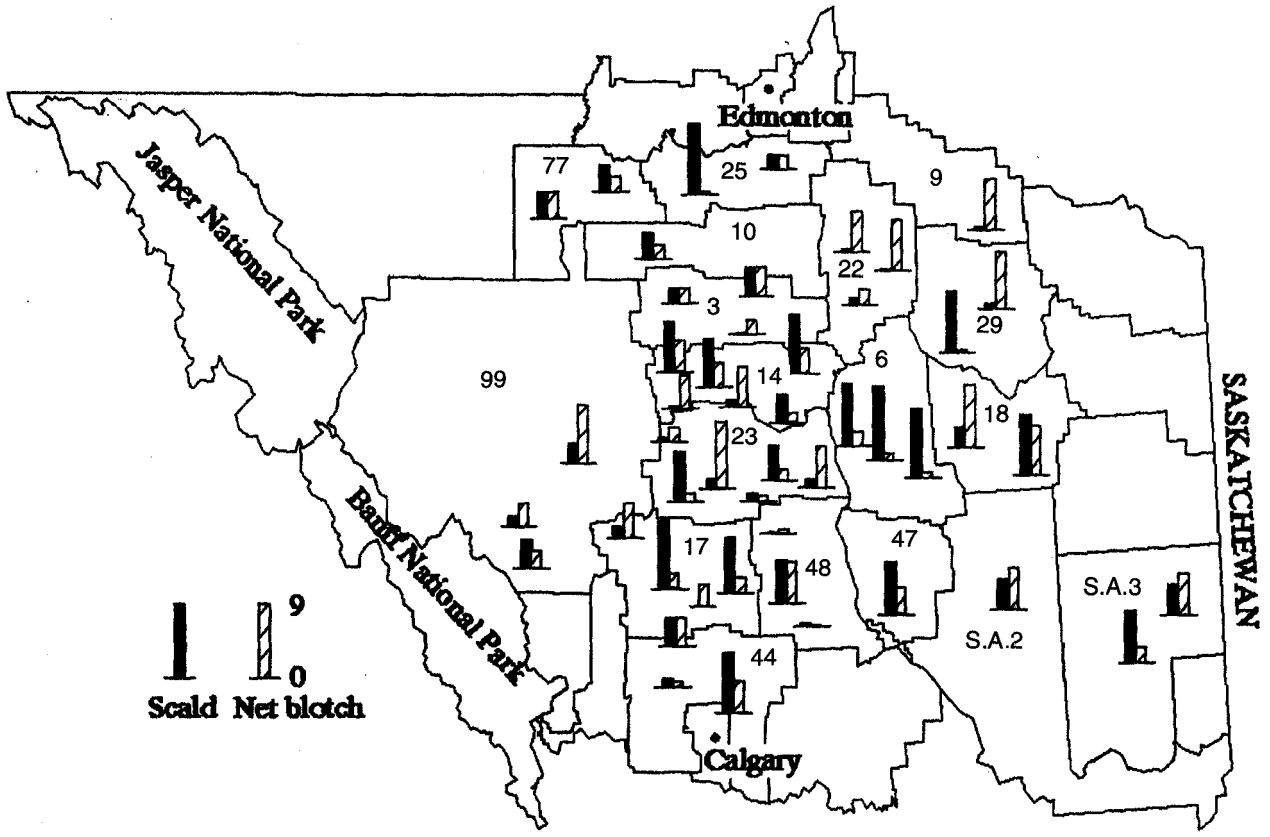


Figure Severity of scald and net blotch on barley in 18 counties in central Alberta in 1993. Disease severity 0 = no disease, 9 = whole plant was severely affected on a 0 - 9 scale.
3 = Ponoka, **6** = Stettler, 9 = Beaver, 10 = Wetaskiwin, 14 = Lacombe, 17 = Mountainview, 18 = Paintearth, 22 = Camrose, 23 = Red Deer, 25 = Leduc, 29 = Flagstaff, 44 = Rockyview, 47 = Starland, 48 = Kneehill, 77 = Brazeau, 99 = Clearwater, S.A.2 = Hanna (Special Area), **S.A.3** = Oyen (Special Area).

CANADIAN PHYTOPATHOLOGICAL SOCIETY / CANADIAN PLANT DISEASE SURVEY - DISEASE HIGHLIGHTS

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

NATIONAL COORDINATOR / COORDINATEUR NATIONAL

Dr. Lorne W. Stobbs
Agriculture Canada
Vineland Research Station / Station de recherches de Vineland
Vineland Station, Ontario LOR 2E0
(416) 562-4113 FAX: (416) 562-4335
Agrinet: OTTB::VINERA::STOBBS

COLLATORS / COLLATIONNEURS

Diagnostic laboratories/
Laboratoires diagnostiques
Dr. Marilyn D. Dykstra
Ontario Ministry of Agriculture and Food
Agriculture and Food Laboratory Services
Centre, Box 3650
95 Stone Road West
Loading Zone 2
Guelph, Ontario N1H 8J7
Tel. (519) 824-4120 ext. 2700
FAX (519) 767-6240

Cereals, East / Cereales - Est
Dr. H. Winston Johnston
Agriculture Canada
Research Station
Charlottetown, P.E.I. C1A 7M8
Tel. (902) 566-6800
FAX (902) 566-6821
Agrinet: OTTB::AG3030000

Cereals, West / Cereales - Ouest
Dr. Andy Tekauz
Agriculture Canada
Research Station
195 Dafoe Road
Winnipeg, Manitoba R3T 2M9
Tel. (204) 983-5533
FAX (204) 983-4604
Agrinet: OTTB::AG3640000

Forage legumes/
Legumineuses fourrageres
Dr. Bruce D. Gossen
Agriculture Canada
Research Station
107 Science Crescent
Saskatoon, Saskatchewan S7N 0X2
Tel. (306) 975-7014
FAX (306) 242-1839
Agrinet: OTTB::AG3750000

Oilseeds and special crops / Oleagineux et cultures speciales
Dr. Robin A.A. Morrall
Department of Biology
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 0W0
Tel. (306) 966-4410
FAX (306) 966-8709 / 373-6080

Vegetables / Legumes
Dr. Paul D. Hildebrand
Agriculture Canada
Kentville Research Station
Kentville, Nova Scotia B4N 1J5
Tel. (902) 678-2171
FAX (902) 679-2311
Agrinet: OTTB::AG3060000

Tree fruits / Arbres fruitiers
Mr. John Warner
Agriculture Canada
Smithfield Experimental Farm
P.O. Box 340
Trenton, Ontario K8V 5R5
Tel. (613) 392-3527
FAX (613) 392-0359
Agrinet: OTTB::AG3480000

Small fruits and berries / Petits fruits et baies
Dr. R.R. Martin
Agriculture Canada
Research Station
6660 N.W.Marine Drive
Vancouver, British Columbia
V6T 1X2
Tel (604) 224-4355
FAX (604) 666-4994
Agrinet: OTTB::AG4040000

Ornamentals / Plantes ornementales
Dr. Peter F. Rice
Plant Pathologist
Royal Botanical Gardens
P.O. Box 399
Hamilton, Ontario L8M 3H8
Tel. (416) 527-1158
FAX (416) 577-0375

Turfgrass / Gazon
Dr. T. Hsiang
Dept. of Environmental Biology
University of Guelph
Guelph, Ontario N1G 2W1

Forest trees / Arbres forestiers
Dr. John A. Muir
2031 CasaMarcia Crescent
Victoria, British Columbia V8W 3E7
Tel. (604) 477-1805

Diagnostic laboratories/ Laboratoires diagnostiques

CROP: Diagnostic Laboratory Report - Alfalfa

LOCATION: Manitoba

NAME AND AGENCY:
R.G. Platford
Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent
Winnipeg, Manitoba R3T 5S6

TITLE: DISEASES DIAGNOSED ON ALFALFA CROPS BY THE MANITOBA AGRICULTURE CROP DIAGNOSTIC CENTRE IN 1993

METHODS: The Manitoba Agriculture Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by Manitoba agriculture extension staff, farmers, agri-business and the general public. Diagnosis is based on visual examination for symptoms and culturing onto artificial media.

RESULTS AND COMMENTS: The results of alfalfa submissions are shown in Table 1. The most common problem affecting alfalfa was root and crown rot caused by *Fusarium* spp. Leaf diseases including common leaf spot, downy mildew, Leptosphaerulina leaf spot and yellow leaf blotch were also diagnosed. Wet weather favoured development of black stem. A blossom blight disease in seed alfalfa fields was diagnosed as being caused by *Botrytis* sp. This disease caused a severe loss of blossoms to several fields in the Interlake region and Eastern Manitoba.

Table 1. Diseases diagnosed on alfalfa samples submitted to the Manitoba Agriculture Crop Diagnostic Centre in 1993.

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Root and crown rot	*Fusarium* spp.	5
Black stem	*Phoma medicaginis*	4
Blossom blight	*Botrytis* spp.	3
Common leaf spot	*Pseudopeziza medicaginis*	3
Downy mildew	*Peronospora trifoliorum*	1
Leptosphaerulina leaf spot	*Leptosphaerulina* spp.	1
Root rot	*Cylindrocarpon* spp.	1
Yellow leaf blotch	*Leptotrochila medicaginis*	1
Physiological stress	Winter injury, white spot	4
Nutrient deficiency		2
Herbicide injury		1

CROP: Diagnostic Laboratory Report - Cereal Crops

LOCATION: Manitoba

NAME AND AGENCY:
R.G. Platford
Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent
Winnipeg, Manitoba R3T 5S6

TITLE: DISEASES DIAGNOSED ON CEREAL CROPS BY THE MANITOBA AGRICULTURE CROP DIAGNOSTIC CENTRE IN 1993

METHODS: The Manitoba Agriculture Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by Manitoba agriculture extension staff, farmers, agri-business and the general public. Diagnosis is based on visual examination for symptoms and culturing onto artificial media.

RESULTS AND COMMENTS: Results of cereal submissions are presented in Tables 1, 2 & 3. The most commonly encountered problems in wheat in 1993 were leaf diseases caused by *Septoria* spp. and *Pyrenophora tritici-repentis*. Fusarium head blight was severe in the southern Red River Valley area resulting in extensive crop loss and downgrading of wheat to feed and sample. In four municipalities in southern Manitoba in the Red River Valley area over 90% of the wheat graded feed or sample on account of tombstone (ie) Fusarium infected kernels being over 5% by weight.

The results of barley submissions are shown in Table 2. Barley yellow dwarf was detected in 4 samples from western Manitoba. Flame chlorosis was associated with several barley fields, one from near Shoal Lake in western Manitoba and two from near Niverville in southeastern Manitoba. Fusarium head blight was also found in barley and although there were only 2 samples submitted to the Crop Diagnostic Centre it was quite widespread in the southern Red River Valley area.

The results of oat submissions are presented in Table 3. The most serious disease problems affecting oats was crown rust.

Table 1a. Diseases diagnosed on cereal crops submitted to the Manitoba Agriculture Crop Diagnostic Centre in 1993. WHEAT — 254 SAMPLES SUBMITTED.

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Septoria leaf blotch	*Septoria* spp.	72
Head blight	*Fusarium graminearum*	25
Glume blotch	*Septoria* spp.	24
Tan spot	*Pyrenophora tritici-repentis*	16
Common root rot	*Fusarium* spp.	
	Cochliobolus sativus	10
Flame chlorosis	Flame chlorosis virus like-agent	6
Seedling blight	*Fusarium* spp.	
	Cochliobolus sativus	6
Barley yellow dwarf	Barley yellow dwarf virus	2
Leaf rust	*Puccinia recondita*	2
Take all root rot	*Gaeumannomycesgraminis* var *tritici*	2
Ergot	*Claviceps purpurea*	1
Loose smut	*Ustilago tritici*	1
Herbicide injury		42
Environmental stress		25
Other		20

Table **1b.** Diseases diagnosed on cereal crops submitted to the Manitoba Agriculture Crop Diagnostic Centre in 1993. BARLEY — 17 SAMPLES SUBMITTED.

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Barley yellow dwarf	Barley yellow dwarf virus	4
Flame chlorosis	Flame chlorosis virus like-agent	2
Fusarium head blight	*Fusarium graminearum*	2
Septoria	*Septoria* spp.	2
Common root rot	*Fusarium* spp.	
	Cochliobolus sativus	1
Net blotch	*Pyrenophora teres*	1
Spot blotch	*Cochliobolus sativus*	1
Environmental stress	Frost, deep seeding, nutirent deficiency, excess water	4

Table 1c. Diseases diagnosed on cereal crops submitted to the Manitoba Agriculture Crop Diagnostic Centre in 1993. OAT — 12 SAMPLES SUBMITTED.

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Barley yellow dwarf	Barley yellow dwarf virus	2
Crown rust	***Puccinia coronata***	2
Fusarium head blight	***Fusarium graminearum***	2
Bacterial blight	***Pseudomonas syringae***	1
Septoria leaf blotch	***Septoria*** spp.	1
Environmental stress		4

CROP: Diagnostic Laboratory Report - Cereal Crops

LOCATION: Alberta

NAME AND AGENCY:

J.D. Holley[1] and J.C. Calpas[2]

[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, T1R 1E6

[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON CEREAL CROP SAMPLES SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORY AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on samples of cereal crops submitted by district agriculturalists, extension specialists and farmers from January 1 to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on cereals in 1993 have been pooled and are summarized in Table 1.

Table **1.** Summary of diseases diagnosed on cereal crop samples submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in **1993.**

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Barley	Blackpoint	*Alternaria* spp.
		Cochliobolus spp.
		Fusarium spp.
	Browning root rot	*Pythium* spp.
	Chlorosis	Physiological stress
	Crown/root rot	*Fusarium* spp.
	Net blotch	*Pyrenophora teres*
	Scald	*Rhynchosporium secalis*
	Spot blotch	*Cochliobolus sativus*
	Stem eyespot	*Pseudocercosporella herpotrichoides*
	Stunting	Physiological stress
Oats	Leaf spot	Nutritional deficiency
Wheat	Blackpoint	*Alternaria* spp.
		Cochliobolus spp.
		Fusarium spp.
	Chlorosis	Physiological stress
		Spray drift injury
	Crown/root rot	*Cochliobolus sativus*
		Fusarium spp.
	Dieback	Spray drift injury
	Leaf blotch	*Septoria* spp.
	Leaf shatter	Hail
	Leaf tip dieback	Physiological stress
	Prematurity blight	*Fusarium* spp.
	Sooty mold	*Alternaria* spp.
		Cladosporium spp.
	Spot blotch	*Cochliobolus sativus*
	Stem eyespot	*Pseudocercosporella herpotrichoides*
	Take-all	*Gaeumannomyces tritici* subsp. *tritici*
	Tanspot	*Pyrenophora tritici-repentis*

CROP: Diagnostic Laboratory Report - Commercial Crops

LOCATION: Prince Edward Island

NAME AND AGENCY:
A.V. Sturz
P.E.I. Department of Agriculture, Fisheries and Forestry
Research, Resources and Laboratories, Plant Health Services, P.O. Box 1600
Charlottetown, Prince Edward Island C1A 7N3

TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS IN PRINCE EDWARD ISLAND, 1993

METHODS: The P.E.I. Department of Agriculture, Fisheries and Forestry's Plant Health Services group provides diagnosis of, and control recommendations primarily for, disease problems of commercial crops produced on P.E.I. The following data lists samples submitted to the laboratory by agricultural extension staff, producers, agribusiness and the general public. Diagnoses are based on visual examination of symptoms, microscopic observation and culturing on artificial media. Assisting with the diagnoses were K.I.Al-Mughrabi, M.M. Clark, and J.F. Diamond.

RESULTS AND COMMENTS: A total of 396 samples were processed during the period November 1992 - November 1993. Results are summarized in Table 1. Problems associated with insect-related damage and nutrient imbalance are listed under the heading 'Other'.

Table 1. Diseases diagnosed on commercial crops in Prince Edward Island, 1993.

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO. OF TIMES AGENTS WERE IDENTIFIED
CEREALS:			
Oats	Powdery Mildew	*Erysiphe graminis*	1
Wheat	Head Blight	*Fusarium* spp.	2
	Bacterial Blight	*Pseudomonas* spp.	1
	Powdery Mildew	*Erysiphe graminis*	1
SMALL FRUITS:			
Raspberry	Root Rot	*Armillaria melle*	1
Strawberry	Fruit Rot	*Rhizoctonia* spp.	3
	Wilt	*Verticillium* sp.	1
	Red Stele	*Phytophthora fragariae*	1
	Leaf Spot	*Mycosphaerella fragariae*	4
		Botrytis spp.	2
	Other		2

(cont'd)

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO. OF TIMES AGENTS WERE IDENTIFIED
SPECIALITY CROPS:			
Ginseng	Leaf Spot	*Alternaria* sp.	1
		Alternaria alternata	1
		Helminthosporium sp.	1
	Root Rot	*Alternaria* sp.	1
Tobacco	White Mold	*Sclerotinia sclerotiorum*	1
VEGETABLES:			
Cabbage	Damping Off	*Rhizoctonia solani*	1
		Rhizopus sp.	1
Carrot	Dry Rot	*Fusarium* spp.	3
	Crown Rot	*Rhizoctonia* spp.	1
	Botrytis Rot	*Botrytis* spp.	1
	Leaf Spot	*Cercospora* spp.	1
	Scab	*Streptomyces scabies*	1
Cauliflower	Wilt	*Fusarium roseum*	1
	Root and Stem Rot	*Erwinia* spp.	1
		Pseudomonas spp.	1
Garlic	Mold-Rot	*Helminthosporium* sp.	1
Green Pepper	Wilt	*Fusarium* sp.	1
Lettuce	Wilt	*Botrytis* sp.	1
	Head Rot	*Rhizopus* sp.	1
Parsnip	Leaf Spot	*Septoria* sp.	1
Potato	Leaf Spot	*Botrytis cinerea*	38
		Stemphylium spp.	3
		Fusarium spp.	4
		Alternaria spp.	47
		Phytophthora infestans	31
	Dry Rot	*Fusarium* spp.	42
		Phoma spp.	3
	Soft Rot	*Clostridium* spp.	2
		Pseudomonas spp.	4
		Erwinia spp.	14
		Rhizopus spp.	3
	Pink Rot	*Phytophthora erythroseptica*	3
	Skin Spot	*Polyscytalum pustulans*	2
	Black Dot	*Colletotrichum coccoides*	12
	White Mold	*Sclerotinia sclerotiorum*	5
	Seed Piece Decay	*Fusarium* spp.	3
		Erwinia spp.	4
		Rhizoctonia spp.	1

(cont'd)

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO. OF TIMES AGENTS WERE IDENTIFIED
	Black Scurf	*Rhizoctonia solani*	19
	Stem Canker	*Rhizoctonia solani*	12
	Silver Scurf	*Helminthosporium solani*	17
	Tuber Rot	*Botrytis* spp.	4
	Scab	*Streptomyces scabies*	12
		Spongospora subterranea	17
	Pinkeye	*Pseudomonas* spp.	2
	Blackleg	*Erwinia* spp.	6
	Virus	Mosaic	22
		Leafroll	4
	Physiological	Skinning	3
	Disorders	Blackheart	1
		Internal Brown Spot	1
		Low Temperature Injury	10
		Hollow Heart	1
		Chemical Damage	35
		Mechanical Damage	33
		Bruising and Cracking	9
		Stem End Browning	1
		Other	14
Rutabaga	Soft Rot	*Erwinia* spp.	1
		Pseudomonas spp.	1
		Sclerotinia spp.	3
		Botrytis spp.	1
	Damping Off	*Rhizoctonia* sp.	2
	Downy Mildew	*Peronospora parasitica*	1
Tomato	Powdery Mildew	*Erysiphe polygoni*	1
	Wilt	*Fusarium* sp.	1
	Other		1
Zucchini	Other		1
WOODY ORNAMENTALS AND FLOWERING SHRUBS:			
Evening	Damping Off	*Botrytis cinerea*	1
Primrose	Wilt	*Phytophthora* spp.	1
		Pythium spp.	1
	Mildew	*Peronospora* sp.	1
Flowering	Dieback	Other	1
Almond			
Rose	Mechanical Damage		1
Phlox	Leaf Spot	*Erysiphe* sp.	1
Hybrid salix	Other		1
Silver Maple	Powdery Mildew	*Erysiphe* sp.	1
	Other		2
Horse Chesnut	Dieback	*Fusarium* sp.	1
Poplar	Leaf Spot	*Cladosporium* sp.	1
		Other	1
Pear	Fire Blight	*Erwinia amylovora*	1
			TOTAL = 513

CROP: Diagnostic Laboratory Report – Commercial Crops

LOCATION: Quebec

NAME AND AGENCY:
M. Lacroix, G. Gilbert and D. Hamel
Ministere de l'Agriculture, des Pêcheries et de l'Alimentation du Quebec (MAPAQ), Complexe scientifique, 2700, rue Einstein - D.1.200H
Sainte-Foy, Quebec G1P 3W8

TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE MAPAQ DIAGNOSTIC LABORATORY IN 1993

METHODS: The objective of the MAPAQ diagnostic laboratory is to provide diagnosis and control recommendations for disease problems of commercial crops. The following data reflects diagnosis of samples submitted to the laboratory by the extension staff of MAPAQ, by the "Régie des assurances agricoles du Quebec", by the "Institut quebecois pour le développement de l'horticulture ornementale" and by the agricultural industry. Diagnosis is based on visual examination for symptoms and on the use of various laboratory tests to detect and to identify pathogens. The following tests are used in the laboratory; for nematodes, isolation with the Baermann funnel and microscope examination: for fungi, isolation on artificial media, microscope examination and pathogenicity testing; for bacteria, isolation on artificial media, classical biochemical tests including API-20E and Biolog and ELISA; and for virus, Elisa and double stranded RNA analysis.

RESULTS AND COMMENTS: The MAPAQ diagnostic lab received 1549 samples between April 1 and October 31, 1993. The crop distribution of these samples was: vegetable crops 47.2%, small fruits 18.6%, ornamentals 18.1%, fruit trees 4.9%, field crops 3.7% and shrubs and trees 2.2%. Tables 1-5 show a summary of parasitic diseases diagnosed by the lab for the most representative vegetable crops, small fruits, ornamentals, greenhouse vegetables and for apple trees. Non parasitic and unidentified problems appear under the category "other".

ACKNOWLEDGEMENT: The authors gratefully thank Lucie Laverdiere, Marlene Roger, Mario Tésolin and Lise Vezina for technical assistance.

Table 1. Summary of vegetable crop diseases diagnosed by the MAPAQ diagnostic laboratory in 1993.

CROP	CAUSAL AGENT/PLANT PATHOGEN	NO. OF SAMPLES
Bean	*Pseudomonas syringae* (leaf spot)	5
	Pythium crown and root rot	2
	Rhizoctonia crown and root rot	1
	Sclerotinia sclerotiorum	1
	Other	20
Beet	*Streptomyces scabies*	1
	Other	11
Broccoli	*Peronospora parasitica*	2
	Other	11
Carrot	*Cercospora carotae*	1
	Meloidogyne hapla	3
	Pythium (cavity spot)	1
	Other	14

(cont'd)

CROP	CAUSAL AGENT/PLANT PATHOGEN	NO. OF SAMPLES
Cabbage	*Alternaria brassicicola*	2
	Fusarium oxysporum	2
	Pseudomonas marginalis (soft rot)	2
	Potyvirus	1
	Xanthomonas campestris pv. *campestris*	7
	Other	15
Cauliflower	*Alternaria brassicae*	1
	Alternaria brassicicola	2
	Pseudomonas fluorescens IVb + *P. marginalis* (soft rot)	2
	Xanthomonas campestris pv. *campestris*	7
	Other	15
Chinese cabbage	*Alternaria brassicae*	1
	Erwinia carotovora subsp. *carotovora*	1
	Pseudomonas marginalis (soft rot)	1
	Pseudocercosporella (leaf spot)	1
	Other	1
Corn	Fusarium stalk rot	6
	Other	6
Cucumber	*Alternaria alternata* (leaf spot)	6
	Cladosporium cucumerinum	1
	Ulocladium (leaf spot)	1
	Other	18
Eggplant	*Alternaria* (fruit rot)	1
	Botrytis cinerea	2
	Rhizoctonia damping off	1
	Sclerotinia sclerotiorum	1
	Verticillium sp.	3
	Other	6
Leek	*Erwinia carotovora* subsp. *carotovora*	2
	Other	11
Lettuce	*Botrytis cinerea*	3
	Bremia lactucae	1
	CMV	1
	Erwinia carotovora subsp. *carotovora*	1
	Pseudomonas florescens IVb + *P. marginalis* + *P. viridiflava* (soft rot)	7
	Potyvirus	1
	Pythium stunt	1
	Rhizoctonia bottom rot	1
	Sclerotinia sclerotiorum	5
	Xanthomonas campestris pv. *vitians*	8
	Other	14
Melon	CMV	1
	Verticillium sp.	1
	Other	9

(cont'd)

CROP	CAUSAL AGENT/PLANT PATHOGEN	NO. OF SAMPLES
Onion	*Alternaria porri*	1
	Botrytis neck rot	4
	Colletotrichumcircinans	1
	Fusarium oxysporum (basal rot)	1
	Peronospora destructor	1
	Other	17
Pepper	*Alternaria porri* (leaf spot)	2
	Botrytis cinerea	1
	CMV	8
	Fusarium (fruit rot)	3
	PVY	2
	Rhizoctonia damping off	2
	TMV	2
	TSWV-L	2
	Xanthomonas campestris pv. *vesicatoria*	10
	Other	52
Potato	*Alternaria solani* (leaf spot)	1
	Clavibacter michiganensis subsp. *sepedonicum*	16
	Erwinia carotovora subsp. *atroseptica*	4
	Erwinia carotovora subsp. *carotovora*	28
	Fusarium spp. (tuber rot)	14
	Helminthosporium solani	1
	Phytophthora erythroseptica	7
	Phytophthora infestans (tuber)	16
	Pseudomonas fluorescens IVb + *P. marginalis* (soft rot)	11
	PLRV	2
	Potyvirus	1
	Pythium (leak)	1
	Rhizoctonia solani	7
	Streptomyces sp. (common scab)	6
	Spongospora subterranea	3
	Verticillium sp.	8
	Other	90
Rutabaga	*Botrytis cinerea*	2
	Erwinia carotovora subsp. *carotovora*	1
	Pseudomonas fluorescens IVb + *P. marginalis* (soft rot)	3
	Peronospora parasitica	1
	Rhizoctonia crater rot	2
	Other	9
Tomato	*Alternaria solani*	4
	Colletotrichumcoccodes	1
	Clavibacter michiganensis subsp. *michiganensis*	3
	Phytophthora infestans	2
	Pseudomonas syringae pv. *tomato*	5
	Septoria lycopersici	1
	Xanthomonas campestris pv. *vesicatoria*	2
	Other	6

Table 2. Summary of small fruit diseases diagnosed by the MAPAQ diagnostic laboratory in 1993.

CROP	CAUSAL AGENT/PLANT PATHOGEN	NO. OF SAMPLES
Strawberry	*Diplocarpon earliana*	6
	Mycosphaerella fragariae	5
	Meloidogyne sp.	2
	Phytophthora fragariae	40
	Sphaerotheca macularis	1
	Verticillium sp.	7
	Black root	14
	Winter injury	35
	Other	77
Raspberry	*Agrobacferium tumefaciens*	1
	Armillaria mellea	2
	Didymella applanata	5
	Erwinia amylovora	1
	Elsinoe veneta	1
	Pucciniastrum americanum	1
	Phytophthora root rot	27
	Winter injury	28
	Other	46

Table 3. Summary of ornamental diseases diagnosed by the MAPAQ diagnostic laboratory in 1993.

CROP	CAUSAL AGENT/PLANT PATHOGEN	NO. OF SAMPLES
Begonia spp.	TSWV-I	1
	Xanfhomonas campestris pv. *begoniae*	2
	Other	5
Callendula officinalis	Mycoplasma like organism	1
Calluna sp.	Rhizoctonia root and stem rot	1
Celosia sp.	Botrytis stem rot	1
	Pythium root rot	3
	Rhizoctonia root and stem rot	1
	Other	4
Cereus sp.	*Bipolaris cactivora*	2
	Fusarium root and stem rot	1
	Pythium root rot	1
Cyclamen sp.	Botrytis stem rot	1
	Rhizoctonia root and stem rot	1
	Other	2

(cont'd)

CROP	CAUSAL AGENT/PLANT PATHOGEN	NO. OF SAMPLES
Dianthus sp.	Fusarium root and stem rot	1
	Pythium root rot	1
	Other	2
Dracaena sp.	Fusarium leaf spot	1
	Other	4
Euphorbia	Botrytis stem rot	1
pulcherrima	Phytophthora root rot	1
	Other	6
Sinningia	Botrytis stem rot	1
speciosa		
Impatiens spp.	TSWV-I	14
	Rhizoctonia root and stem rot	1
	Other	11
Mammilaria sp.	*Bipolaris cactivora*	1
	Fusarium root and stem rot	1
	Pythium root rot	1
	Rhizoctonia root and stem rot	1
Opuntia sp.	Fusarium root and stem rot	1
Pelargonium x	*Botrytis cinerea*	6
Hortorum	*Puccinia pelargonii zonalis*	1
	Pythium root rot	3
	Verticillium sp.	1
	Other	25
Petunia x	*Botrytis cinerea* (flower)	1
Hybrida	Rhizoctonia root and stem rot	1
	Other	3
hododendron	Pestalotia stem rot	1
	Pestalotia leaf spot	1
	Other	1
Saintpaulia	*Botrytis cinerea*	2
ionantha	Other	1
Schlumbergera sp.		
	Pythium root rot	1
Tagetes sp.	Phytophthora root rot	1
Zinnia sp.	*Bottytis cinerea*	1

Table 4. Summary of apple tree diseases diagnosed by the MAPAQ diagnostic laboratory in 1993.

CROP	CAUSAL AGENT/PLANT PATHOGEN	NO. OF SAMPLES
Apple	Alternaria leaf spot	5
	Cytospora canker	3
	Nectria cinnabarina	2
	Nectria galligena	2
	Venturia inaequalis	8
	Other	44

Table 5. Summary of greenhouse vegetable diseases diagnosed by the MAPAQ diagnostic laboratory in 1993.

CROP	CAUSAL AGENT/PLANT PATHOGENS	NO. OF SAMPLES
Cucumber	CMV	**1**
	Erwinia carotovora subsp. *carotovora*	1
	Pythium crown and root rot	1
	Sclerotinia sclerotiorum	2
	Verticillium sp.	3
	Other	8
Tomato	*Botrytis cinerea*	3
	Colletotrichum sp. (root)	**2**
	Erysiphe sp.	3
	Fulva fulvum	1
	Fusarium oxysporum f. sp. *radicis lycopersici*	8
	Meloidogyne hapla	3
	Phytophthora cinnamomi (root)	1
	Pyrenochaeta lycopersici	18
	PVX	1
	Pythium root rot	6
	Rhizoctonia root and crown rot	**1**
	Septoria lycopersici	1
	Sclerotinia sclerotiorum	1
	Other	63

CROP: Diagnostic Laboratory Report - Commercial Crops

LOCATION: British Columbia

NAME AND AGENCY:
D.M.S. Hsiung and V. Joshi
B.C. Ministry of Agriculture Fisheries and Food, 17720-57th Avenue
Surrey, British Columbia V3S 4P9

TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BRITISH COLUMBIA PLANT DIAGNOSTIC LABORATORY IN 1993

METHODS: The B.C.M.A.F.F. Plant Diagnostic Laboratory provides the diagnosis of, and control recommendations for, diseases of commercial crops. The following data reflects samples submitted to the lab by ministry extension staff, growers, agribusiness, parks departments and Master Gardeners. Diagnoses were accomplished by microscope examination, culturing onto artificial media and ELISA. Assisting with the diagnoses were Leslie MacDonald and David J. Ormrod, Plant Pathologists at the B.C.M.A.F.F.

RESULTS AND COMMENTS: Summaries of diseases diagnosed on crops of each commodity are presented in Tables 1-8. The total number of submissions for each crop category is listed at the bottom of each table. Only diseases of significance are listed in the attached summaries. Problems not listed include: nutritional stress; pH imbalance; water stress; poor sample; physiological responses to growing conditions; chemical damage; insect related damage; and damage where no conclusive disease-causing organism was identified. These submissions are grouped under the heading 'OTHER' at the bottom of each table. Sample numbers are based on submissions received from October 1992 through to November 1993.

Table 1. Summary of diseases diagnosed on greenhouse vegetable crops submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in 1993.

CROP	DISEASE	NO. OF SAMPLES
Cucumber	Botrytis stem rot	1
	Didymella bryoniae	continuing problem
	Crown and root rot	
	Pythium spp. / *P. aphanidermatum*	3
	Stem rot - *Sclerotinia sclerotiorum*	1
Lettuce	Bottom rot - *Sclerotinia sclerotiorum*	1
Pepper	*Botrytis cinerea*	2
	Impatiens necrotic spot virus - (INSV)*	4
	Pythium root rot	1
	Pseudomonas stem rot	1
	Xanthomonas leaf spot	2
Tomato	Fusarium crown and root rot	2
	INSV	1
	Phytophthora infestans	1
	Pythium root rot	3
	Erwinia carotovora	1
OTHER		57
TOTAL		81

* Impatiens necrotic spot virus was previously called Tomato spotted wilt virus strain I (TSWV - I).

Table 2. Summary of diseases diagnosed on floriculture crops submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in 1993.

CROP	DISEASE	NO. OF SAMPLES
Ageratum spp.	Pythium root rot	1
Antirrhinum spp.	*Peronospora antirrhini*	3
Begonia spp.	INSV	1
	Xanthomonas campestris pv. *begoniae*	1
Centauria cineraria	*Albuga trabopogonis*	1

(cont'd)

CROP	DISEASE	NO. OF SAMPLES
Cleome spp.	Leaf rust - *Puccinia* spp.	1
Chrysanthemum x morifolium	*Erwinia chrysanthemii*	1
	*Puccinia horiana***	1
Cyclamen persicum	INSV	2
Dianthus caryophyllus	*Cladosporuim echinulatum*	1
Euphorbia pulcherrima	Pythium root rot	5
Fuchsia x hybrida	Root rot - Phycomycete	2
	Leaf rust - *Pucciniastrum* spp.	1
Gerbera spp.	*Erysiphe cichoracearum*	1
Hedera spp.	Xanthomonas leaf spot	1
Impatiens wallerana	*Erwinia carotovora*	1
	INSV	3
Lavatera spp.	Root rot - Phycomycete	1
Liatris spicata	*Botrytis cinerea*	1
Lilium spp.	*Botrytis elliptica*	2
Narcissus pseudonarcissus	*Botrytis* spp. -smoulder	1
Mizuna spp.	*Plasmodiophora brassicae*	1
Pelargonium x hortorum	*Puccinia pelargonii* pv. *zonalis***	1
	Xanthomonas campestris pv. *pelargonii*	10
P. peltaum	Oedema	3
Phalaenopsis spp.	Root rot -Phycomycete	2
	Rhizoctonia root rot	1
Primula spp.	INSV	1
P. obconica	INSV	1
Ranunculus spp.	INSV	1
Senecia cruentus	INSV	1
Sinningia speciosa	INSV	1
Saintpaulia spp.	*Podosphaera clandestina*	1
Tulipa spp.	*Bottytis tulipae*	2
	Fusarium basal rot	1
Viola spp.	*Bottytis cinerea*	1
	Peronospora viola	1
	Ramularia leaf spot	1
	Thielaviopsis basicola	1
OTHER		62
TOTAL		125

** These samples were submitted by homeowners and a garden club. White rust of chrysanthemum and geranium rust are not present in commercial operations in British Columbia.

Table 3. Summary of diseases diagnosed on small fruit crops submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in **1993.**

CROP	DISEASE	NO. OF SAMPLES
Blueberry	Botrytis blossom blight	1
	Stem canker - *Coryneum* spp.	1
	Godronia cassandrae	**17**
	Monilinia vaccinii-corymbosi	1
	Pseudomonas syringae	**8**
	Winter damage	**3**
Cranberry	Botrytis leaf blight	1
	Phomopsis vaccinii	1
	Pseudomonas syringae	1
Raspberry	*Didymella applanata*	**4**
	Phragmidium leaf rust	1
	Phytophthora root rot	**2**
	Pseudomonas syringae	1
Strawberry	*Verticillium albo-atrum*	1
	Cold damage	**2**
OTHER		**38**
TOTAL		**83**

Table **4.** Summary of diseases diagnosed on specialty crops submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in **1993.**

CROP	DISEASE	NO. OF SAMPLES
Chives	Botrytis leaf blight	**1**
	Pythium root rot	**1**
Dill	Root rot -Phycomycete	**1**
Garlic	*Botrytis cinerea*	**1**
	Sclerotium cepivorum	**1**
	Onion yellow dwarf virus	**1**
Ginseng	*Alternaria panax*	**10**
	Root and crown rot - *Rhizoctonia* spp.	**4**
	Root rot - *Phytophthora* spp./ *P. cactorum*	**8**
Oregano	Root rot - Phycomycete	1
Parsley	Root rot - Phycomycete	1
Polygonum	Root rot - Phycomycete	1
Rosemary	Root rot - Phycomycete	1
Sage	Root rot - Phycomycete	1
OTHER		2
TOTAL		**35**

Table 5. Summary of diseases diagnosed on tree fruit samples submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in 1993.

CROP	DISEASE	NO. OF SAMPLES
Apple	Nectria canker - *Nectria* spp./	
	Nectria galligena	5
	Neofabraea perennans	1
	Pezicula malicottis	7
	Phytophthora crown rot	7
	Venturia inaqualis	2
	Erwinia amylovora	1
Apricot	*Pseudomonas syringae*	1
Cherry	*Pseudomonas syringae*	2
Filbert	*Xanthomonas campestris* pv *corylina*	3
Walnut	Downy leaf spot - *Microstroma juglandis*	1
OTHER		37
TOTAL		67

Table 6. Summary of diseases diagnosed on vegetable crops submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in 1993.

CROP	DISEASE	NO. OF SAMPLES
Brussels sprouts	Watery soft rot-	
	Sclerotinia sclerotiorum	1
	Pseudomonas leaf spot	1
	Xanthomonas campestris pv *campestris*	1
Bok Choy	Rhizoctonia crown rot	1
Cabbage	*Peronospora parasitica*	1
	Sclerotinia sclerotiorum	1
	Xanthomonas campestris pv. *campestris*	1
Carrot	Alternaria foliar blight	1
	Cercospora carotae	1
Cauliflower	Bacterial soft rot - *Erwinia* spp.	1
Celery	Bacterial blight - *Pseudomonas syringae*	4
Cucumber	Bacterial blight - *Pseudomonas syringae*	1
Gai Lan	*Peronospora parasitica*	1
	Plasmodiophora brassicae	1
Lettuce	Downy mildew - *Bremia lactucae*	1
	Anthracnose - *Marssoninia panattoniana*	2
	Rhizoctonia solani	1
Onion	Botrytis blast	3
	Peronospora destructor	2
	Sclerotium cepivorum	2

(cont'd)

CROP	DISEASE	NO. OF SAMPLES
Pea	Pythium root rot	1
Potato	*Helminthosporium solani*	1
	Pink rot - *Phytophthora erythroseptica*	1
	Phytophthora infestans	5
	Pythium storage rot	1
	Rhizoctonia solani	5
	Powdery scab - *Spongospora subterranea*	1
	Streptomyces scabies	2
	Erwinia carotovora	1
	Pink eye - *Pseudomonas fluorescens*	1
	Potato leafroll virus	3
Rutabaga	*Plasmodiphora brassicae*	1
	Streptomyces scabies	1
Spinach	Fusarium wilt	1
	Rhizoctonia root rot	1
Squash	Pythium stem rot	1
Tomato	*Alternaria solani*	1
	Phytophthora infestans	1
	Pseudomonas syringae	1
	Erwinia carotovora	1
OTHER		38
TOTAL		97

Table 7. Summary of diseases diagnosed on herbaceous woody ornamental and herbaceous perennial crops submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in 1993.

CROP	DISEASE	NO. OF SAMPLES
Abies procera	*Rhizosphaera kalkhoffii*	1
A. grandis	Phyllosticta needle blight	1
	Black mildew - *Epipolaeum abietis*	1
Acer spp.	Botryosphaeria dieback	1
	Leaf blister - *Taphrina* spp.	1
	Nectria canker	3
A. palmatum	*Kabatiella apoctypta*	2
	Winter damage	3
Arctostaphylos spp.	Thielaviopsis root rot	1
Artemisia Schmidtiana	Root rot - Phycomycete	1
Chamaecyparis spp.	*Pestalotiopsis funerea*	1
Clematis spp.	Ascochyta stem blight	1
Cotoneaster spp.	Phytophthora root rot	1
Crataegus spp.	*Diplocarpon mespili*	2
Delphinium spp.	Pythium root and crown rot	1

(cont'd)

CROP	DISEASE	NO. OF SAMPLES
Forsythia spp.	Crown gall - *Agrobacterium* spp.	1
Fragaria x 'Pink Panda'	*Cercospora vexans*	1
Goniolimon tataricum	*Botrytis cinerea*	1
	Colletotrichum gloeosporioides	1
Hibiscus spp.	Pythium root rot	1
Hypericum calycinum	Uromyces leaf rust	1
Iberis sempervirens	Crown rot - *Sclerotinia sclerotiorum*	1
Iris spp.	*Mycosphaerella macrospora*	1
I. setosa	Crown rot - Phycomycete	1
Jasminum spp.	Root rot - Phycomycete	1
Juniperus spp.	*Gymnosporangium nelsonii*	1
	Lophodermium juniperi	3
Kalmia latifolia	Pythium root rot	1
Lamium amplexicaule	Downy mildew - *Peronospora* spp.	1
Lavandula angustifolia	Phytophthora root rot	1
Leonurus cardiaca	*Thielaviopsis basicola*	1
Lonicera spp.	*Microsphaera alni*	1
Lunaria annua	*Alternaria brassicae*	1
Malus floribunda	*Phytophthora cactorum*	1
Magnolia **spp.**	*Pseudomonas syringae*	1
Paeonia lactiflora	Rhizoctonia crown rot	2
Penstemon fructicosus	Verticillium wilt and dieback	1
Picea pungens	Root rot - Phycomycete	2
Pinus spp.	Needle cast - *Elytroderma deformans*	1
	Endocronartium harknessii	1
P. contorta	Lophodermium needle cast	1
P. strobus	*Cronartium ribicola*	1
P. sylvestris	Botrytis tip dieback	1
Platanus **spp.**	Anthracnose - *Apiognomonia* spp.	1
Populus alba	Melamspora leaf rust	1
Primula vialii	*Thielaviopsis basicola*	1
Prunus serrulata	Monilinia brown rot	1
Pseudostuga menziesii	Black mildew - *Epipolaeum tsugae*	1
	Needle blight - *Hormonema merioides*	1
	Rhizosphaera kalkhoffii	2
Rhododendron spp.	Phytophthora root rot	3
	Pestalotiopsis leaf blight	1
Rosa spp.	Crown gall - *Agrobacterium* spp.	1
	Peronospora sparsa	1
Thuja spp.	*Kabatina thujae*	1
	Pestalotiopsis twig blight	1
T. occidentalis	*Kabatina thujae*	1
	Seiridium cardinale	3
	Cedar flagging	6

(cont'd)

CROP	DISEASE	NO. OF SAMPLES
Fragaria x *T. plicata*	*Didymascella thujina*	6
	Seiridium cardinale	1
Trifolium repens	Uromyces leaf rust	1
Trillium spp.	Verticillium crown rot	1
Viburnum spp.	Powdery mildew - *Microsphaera* spp.	1
Yucca spp.	Coniothyrium leaf spot	1
OTHER		161
TOTAL		251

Table 8. Summary of diseases diagnosed on turfgrass samples submitted to the B.C.M.A.F.F. Plant Diagnostic Laboratory in 1993.

DISEASE	GOLF COURSE GREENS	SOD FARM	LAWN	PARKS & RECREATION
Root rot - *Pythium* spp. and *P. graminicola*	10†+19*	2+4*	2	2*
Gaeumannomyces graminis var *avenae*	5*	4*	2	
Ascochyta leaf blight	1*		3	
Microdochium nivale	3†	1+1*		1*
Colletotrichum graminicola		2		
Limonomyces roseipellis and *Laetisaria fuciformis*	1†+1*	2		1*
Curvularia spp. and *Drechslera* spp.			2	
Typhula ishikariensis	1†			
Coprinus spp.		1*		
Puccinia spp.		1		
Phyllosticta spp.	2*			
Algae	1*			
OTHER	44†	4	3	4
TOTAL	57	20	14	8

* Indicates the number of bentgrass samples.

† Refers to bentgrass and/or *Poa annua* or an undetermined mix. Unstarred numbers refer to mixes of fescues, ryegrass, Kentucky bluegrass and *Poa annua*.

CROP: Diagnostic Laboratory Report - Forage Crops

LOCATION: Alberta

NAME AND AGENCY:
J.D. Holley[1] and J.C. Calpas[2]
[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6
[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON FORAGE CROP SAMPLES SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORY AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on samples of forage crops submitted by district agriculturalists, chemical and fertilizer company representatives and from farmers from January 1 to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on samples of forage crops in 1993 have been pooled and are summarized in Table 1.

Table 1. Summary of diseases diagnosed on forage crop samples submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in 1993.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Alfalfa	Crown/root rot	*Fusarium* spp.
		Pythium spp.
	Chlorosis	Frost/cold injury
	Leaf discoloration	Nutritional deficiency
	Leaf spot	*Phoma medicaginis*
		Pseudopeziza medicaginis
	Stem spot	*Phoma medicaginis*
	Wilt	*Verticillium albo-atrum*
Orchard grass	Leaf spot	Physiological stress
	Root rot	*Fusarium* spp.
Red clover	Northern anthracnose	*Kabatiella caulivora*
Timothy	Leaf shatter	Wind damage
grass	Purple leaf spot	*Cladosporium phlei*

CROP: Diagnostic Laboratory Report - Fruit Crops

LOCATION: Alberta

NAME AND AGENCY:

J.D. Holley[1] and J.C. Calpas[2]

[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON FRUIT CROPS SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORY AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on fruit crop samples submitted by district agriculturalists, farmers, market gardeners and greenhouse growers from January 1 to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on fruit crops in 1993 have been pooled and are summarized in Table 1.

Table 1. Summary of diseases diagnosed on fruit crop samples submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in 1993.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Apple	Canker	*Cytospora* spp.
		Erwinia amylovora
		Mechanical damage
	Chlorosis	Iron deficiency
		Nitrogen deficiency
		Physiological stress
	Crown rot	Cold temperature injury
	Dieback	Winter drought injury
	Fireblight	*Erwinia amylovora*
	Leaf blackening	Frost
	Leaf burn	Physiological stress
		Spray drift injury
	Leaf distortion	Frost
		Phenoxy herbicide injury
	Shot-hole	*Coccomyces hiemalis*
	Stem blackening	Frost
	Stem distortion	Frost
Blueberry	Storage rot	*Apergillus* spp.
		Penicillium spp.

(cont'd)

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Crabapple	Bacterial blight	*Pseudomonas syringae*
	Fireblight	*Erwinia amylovora*
	Leaf distortion	Physiological stress
		Spray drift injury
Currant	Coral spot	*Nectria cinnabarina*
Kiwi	Leaf spot	Low light
Pear	Fireblight	*Erwinia amylovora*
	Leaf blackening	Frost
Raspberry	Bacterial blight	*Pseudomonas syringae*
	Chlorosis	Iron deficiency
		Pseudomonas syringae
	Leaf distortion	Phenoxy herbicides
	Spur blight	*Didymella applanata*
Rhubarb	Crown rot	*Erwinia rhapentici*
Saskatoon	Bacterial blight	*Pseudomonas syringae*
	Blackleaf	*Apiosporina collinsii*
	Canker	*Cytospora* spp.
	Crown rot	Cold temperature injury
	Fireblight	*Erwinia amylovora*
	Fruit abortion	*Pseudomonas syringae*
	Leaf distortion	Spray drift injury
	Rust	*Gymnosporangium nelsonni*
	Storage rot	*Penicillium* spp.
Strawberry	Crown/root rot	*Fusarium* spp.
	Fruit rot	*Botrytis cinerea*
	Leaf spot	*Botrytis cinerea*
		Mycosphaerella fragariae
Tangerine	Brown spot	*Alternaria citri*

CROP: Diagnostic Laboratory Report - Greenhouse Crops

LOCATION: Alberta

NAME AND AGENCY:

J.D. Holley[1] and J.C. Calpas'

[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON GREENHOUSE CROPS SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORY AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on greenhouse grown ornamental and vegetable crops submitted by district agriculturalists, extension specialists, florists, or greenhouse growers from January *1* to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on greenhouse crops in 1993 have been pooled and are summarized in Table 1.

Table 1. Summary of diseases diagnosed on greenhouse crop samples submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in 1993.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Alyssum	Chlorosis	Nutritional deficiency
	Leaf spot	Spray drift injury
Begonia	Marginal leaf burn	High soil salinity
Chrysanthemum	Crown/root rot	*Pythium* spp.
		Fusarium spp.
	Leaf spot	Spray drift injury
	Oedema	Overwatering/high humidity

(cont'd)

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Cucumber	Chlorosis	Overwatering
		Nutritional deficiency
	Crown/root rot	*Fusarium* spp.
		Pythium spp.
	Leaf spot	*Bottytis cinerea*
		Cladosporium cucumerinum
		Nutritional deficiency
		Manganese toxicity
		Physiological stress
		Spray drift injury
	Marginal leaf burn	High soil salinity
		Manganese toxicity
	Soft rot	*Erwinia carotovora*
		subsp. *carotovora*
	Storage rot	*Fusarium* spp.
		Penicillium spp.
	Wilt	*Verticillium* spp.
Coleus	Stunting	Poor soil aeration
Cyclamen	Leaf spot	Spray drift injury
Dracena	Leaf spot	*Botrytis cinerea*
Fababean	Leaf spot	TSWV
Geranium	Bacterial blight/	*Xanthomonas campestris*
	Bacterial canker	subsp. *pelargonii*
	Blackleg	*Pythium* spp.
	Chlorosis	Physiological stress
	Crown/root rot	*Fusarium* spp.
		Pythium spp.
	Flower distortion	Genetic anomaly
	Leaf burn	High soil salinity
		Spray drift injury
	Leaf discoloration	Phosphorous deficiency
	Leaf distortion	Physiological stress
	Oedema	Overwatering/high humidity
	Stunting	Poor soil aeration
Gloxinia	Leaf distortion	INSV (TSWV-I)*
	Leaf spot	INSV (TSWV-I)
Godetia	Canker	*Fusarium* spp.
		Physiological stress
		Pythium spp.
Gypsophila	Leaf spot	Physiological stress
Lavaterra	Leaf spot	INSV (TSWV-I)
Lily	Crown/root rot	*Fusarium* spp.
	Leaf spot	*Botrytis cinerea*
	Marginal leaf burn	High soil salinity
	Stunting	Low light/low temperature
		Nutritional deficiency

(cont'd)

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Marigold	Leaf distortion	Spray drift injury
	Leaf mottling	Chilling injury
Pansy	Stunting	High soil salinity
Pepper	Crown gall	*Agrobacterium* spp.
	Storage rot	*Penicillium* spp.
Petunia	Stunting	Low light/low temperature
Podocarpus	Leaf burn	Low light
Poinsettia	Crown/root rot	*Rhizoctonia solani*
Rose	Leaf spot	*Botrytis cinerea*
		Physiological stress
	Marginal leaf burn	High soil salinity
	Oedema	High humidity
	Powdery mildew	*Sphaerotheca pannosa*
	Wilt (Cut flowers)	Bacteria in holding water
	Wilt	*Verticillium albo-atrum*
Statice	Leaf discoloration	Phosphorous deficiency
Tomato	Canker	*Erwinia carotovora*
		Sclerotinia sclerotiorum
	Chlorosis	Nutritional deficiency
		Physiological stress
	Chimaera	Genetic anomaly
	Crown/root rot	*Fusarium oxysporum*
		Pythium spp.
	Ghost spot	*Botrytis cinerea*
	Leaf discoloration	Phosphorous deficiency
	Leaf distortion	Physiological stress
		Spray drift injury
	Leaf spot	*Botrytis cinerea*
		Chemical in soil mixture
		Nutritional deficiency
		Physiological stress
		Spray drift injury
	Stem mottling	Nutritional deficiency
	Stunting	Chemical in potting mixture
		Poor soil aeration
	Wilt	*Fusarium oxysporum*
		Physiological stress

* Strains of TSWV listed above were identified with strain specific antisera using the ELISA technique.

CROP: Diagnostic Laboratory Report - Herbaceous and Woody Ornamentals

LOCATION: Alberta

NAME AND AGENCY:

J.D. Holley[1] and J.C. Calpas[2]

[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON HERBACEOUS AND WOODY ORNAMENTALS SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORIES AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on samples of herbaceous and woody ornamental plants submitted by district agriculturalists, extension specialists, florists, landscaping companies, municipal parks and recreation staff and the general public from January 1 to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on herbaceous and woody ornamental plants in 1993 have been pooled and are summarized in Table 1.

Table 1. Summary of diseases diagnosed on herbaceous and woody ornamental plants submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in 1993.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Ash	Anthracnose	*Gloeosporium aridum*
	Canker	*Cytospora* spp.
	Chlorosis	Iron deficiency
	Leaf distortion	Phenoxy herbicide injury
	Slime flux	Various bacteria
Aspen	Dieback	Winter drought injury
	Leaf burn	Physiological stress
Blue spruce	Needle browning	Winter drought injury
	Needle cast	Physiological stress
	Needle distortion	Frost
		Spray drift injury
Birch	Canker	*Cytospora* spp.
		Mechanical damage
	Dieback	Winter drought injury
	Leaf burn	Dimethoate injury
		High soil salinity
		Spray drift injury
	Wilt	Moisture stress

(cont'd)

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Caragana	Leaf burn	Spray drift injury
	Marginal leaf burn	High soil salinity
Cedar	Needle browning	Winter drought injury
Coriander	Blight	*Alternaria* spp.
Cotoneaster	Coral spot	*Nectria cinnabarina*
	Fireblight	*Erwinia amylovora*
	Leaf distortion	Phenoxy herbicide injury
Crabapple	Bacterial blight	*Pseudomonas syringae*
	Fireblight	*Erwinia amylovora*
	Leaf distortion	Frost
		Spray drift injury
Dogwood	Bacterial blight	*Pseudomonas syringae*
	Leaf spot	*Septoria canadensis*
English Ivy	Crown/root rot	*Fusarium* spp.
		Pythium spp.
Flowering Cherry	Powdery Mildew	*Podosphaera clandestina*
Gladiolus	Basal bulb rot	*Erwinia carotovora* subsp. *carotovora*
Hibiscus	Leaf spot	Low light
Hollyhock	Crown/root rot	*Pythium* spp.
		Rhizoctonia solani
Iris	Crown/root rot	*Erwinia carotovora* subsp. *carotovora*
		Fusarium oxysporum
Lilac	Bacterial blight	*Pseudomonas syringae*
	Fasciation	Genetic anomaly
	Leaf distortion	Phenoxy herbicide injury
	Marginal leaf burn	High soil salinity
	Stunting	Nutritional deficiency
Linden	Canker	*Nectria galligena*
	Leaf spot	Physiological stress
Maple	Canker	*Cytospora* spp.
	Marginal leaf burn	High soil salinity
		Moisture stress
	Leaf distortion	Phenoxy herbicide injury
	Tar spot	*Rhytisma acerinum*
Marigold	Leaf distortion	Spray drift injury
Mayday	Bacterial blight	*Pseudomonas syringae*
	Black knot	*Dibotryon morbosum*
	Canker	*Cytospora* spp.
	Leaf blackening	Frost
	Leaf distortion	Frost
	Marginal leaf burn	High soil salinity
	Shot-hole	*Coccomyces hiemalis*
Mountain ash	Bacterial blight	*Pseudomonas syringae*
	Fireblight	*Erwinia amylovora*

(cont'd)

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Peony	Measles	*Cladosporium paeoniae*
	Stunting	Nutritional deficiency
	Wilt	*Verticilliumalbo-atrum*
Pine	Bud distortion	Frost
	Needle blight	*Scirrhia aecicola*
	Needle browning	Winter drought injury
Poplar	Canker	*Cytospora* spp.
		Frost/sunscald
		Mechanical damage
	Dieback	Winter drought injury
	Leaf distortion	Frost
		Phenoxy herbicide injury
	Leaf shatter	Wind injury
	Leaf spot	*Marssonina populi*
		Physiological stress
	Slime flux	Various bacteria
	Twig blight	*Venturia macularis*
POPPY	Leaf discoloration	Phosphorous deficiency
Rose	Fireblight	*Erwinia amylovora*
	Rust	*Phragmidium* spp.
Russian olive	Wilt	*Verticilliumalbo-atrum*
Willow	Canker	Frost/sunscald
	Dieback	Cold temperature injury
		Winter drought injury
	Leaf blackening	Frost
	Leaf burn	Moisture stress
		Spray drift injury
	Witches broom	*Venturia saliciperda*

CROP: Diagnostic Laboratory Report - Lentils

LOCATION: Manitoba

NAME AND AGENCY:
R.G. Platford
Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent
Winnipeg, Manitoba R3T 5S6

TITLE: DISEASES DIAGNOSED ON LENTIL CROPS BY THE MANITOBA AGRICULTURE CROP DIAGNOSTIC CENTRE IN 1993

METHODS: The Manitoba Agriculture Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by Manitoba agriculture extension staff, farmers, agri-business and the general public. Diagnosis is based on visual examination for symptoms and culturing onto artificial media.

RESULTS AND COMMENTS: Results are based on 42 samples of lentils submitted to the Crop Diagnostic Centre. A summary of disease diagnoses is presented in Table 1. The most commonly encountered diseases were ascochyta, anthracnose and Sclerotinia white mold. Root rot was detected in five samples. Environmental stress, particularly excess moisture, caused extensive crop loss in the Red River Valley.

Table 1. Diseases diagnosed on lentil submitted to the Manitoba Agriculture Crop Diagnostic Centre in 1993.

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Ascochyta blight	*Ascochyta fabae* pv. *lentis*	11
Anthracnose	*Colletotrichum truncatum*	10
Sclerotinia stem rot	*Sclerotinia sclerotiorum*	8
Root rot	*Fusarium* spp.	5
Environmental stress	Deep seeding excess moisture	4
Nutrient Deficiency		4

Sclerotinia was the most serious problem affecting lentils in Manitoba in 1993. Areas of high incidence and severe damage occurred near Portage and McGregor in central Manitoba and in the southern Red River Valley. The cool weather delayed the onset of anthracnose but some fields showed heavy development in August. Cool wet weather promoted the development of a dense plant stand. Maturity was also delayed several weeks by the weather. Anthracnose was common in many fields in the southern Red River Valley area but it was difficult to separate loss due to anthracnose and loss attributed to excess **soil,** water and root rot.

CROP: Diagnostic Laboratory Report - Oilseed and Special Field Crops

LOCATION: Alberta

NAME AND AGENCY:
J.D. Holley[1] and J.C. Calpas[2]
[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6
[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON OILSEED AND SPECIAL FIELD CROPS SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORY AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on oilseed and special field crop samples submitted by district agriculturalists, extension specialists and farmers from January 1 to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on oilseed and special field crops in 1993 have been pooled and are summarized in Table 1.

Table 1. Summary of diseases diagnosed on oilseed and special field crop samples submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in 1993.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Canola	Chlorosis	Frost
	Prematurity blight	*Fusarium* spp.
	Staghead	*Albugo candida*
Ginseng	Crown/root rot	*Rhizoctonia solani*
	Damping-off	*Pythium* spp.
	Leaf spot	Physiological stress
Lentil	Crown/root rot	*Fusarium* spp.
	Leaf spot	*Botrytis cinerea*
Spearmint	Crown/root rot	Cold temperature injury
		Fusarium spp.
	Storage rot	*Alternaria* spp.
		Penicillium spp.
		Rhizopus stolonifera

CROP: Diagnostic Laboratory Report - Potato

LOCATION: Manitoba

NAME AND AGENCY:
R.G. Platford
Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent
Winnipeg, Manitoba R3T 5S6

TITLE: DISEASES DIAGNOSED ON POTATO CROPS BY THE MANITOBA AGRICULTURE CROP DIAGNOSTIC CENTRE IN 1993

METHODS: The Manitoba Agriculture Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by Manitoba agriculture extension staff, farmers, agri-business and the general public. Diagnosis is based on visual examination for symptoms and culturing onto artificial media. Forty samples of potato plants and 81 tuber samples from potatoes harvested in 1992 were analysed for disease.

RESULTS AND COMMENTS: Results of potato submissions are shown in Table 1. Unseasonably cool weather favoured the development of late blight in Carman, Portage and Steinbach. Growers averted serious damage by using a spray program of mancozeb and metalaxyl. Wet weather in August resulted in severe drownout of potatoes in the Winkler area, in the Eastern region near Selkirk and some fields in the Central region west of Portage. Early blight was not as prominent as late blight in 1993. Very little of the early dying complex involving Verticillium, Fusarium and Colletotrichum was observed. Loss in storage from late blight occurred particularly in potatoes from fields that had not been sprayed. Fusarium dry rot was the most common cause of storage decay (Table 2).

Table 1. Disease diagnosed on potatoes submitted to the Manitoba Agriculture Crop Diagnostic Centre in 1993.

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Early blight	*Alternaria solani*	6
Fusarium root rot	*Fusarium* sp.	5
Late blight	*Phytophthora infestans*	5
Blackleg	*Erwinia carotovora* var. *atroseptica*	1
Verticillium wilt	*Verticillium dahliae*	1
Environmental stress	Excess water, black heart	22

Table 2. Tuber survey results (1992 harvested potatoes).

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Fusarium dry rot	*Fusarium* spp.	40
Black dot	*Colletotrichum* spp.	29
Soft rot	*Erwinia caratovora* var. *carotovora*	5
Late blight	*Phytophthora infestans*	3
Black scurf	*Rhizoctonia solani*	2
Verticillium wilt	*Verticillium dahliae*	2

CROP: Diagnostic Laboratory Report - Turf

LOCATION: Alberta

NAME AND AGENCY:
J.D. Holley[1] and J.C. Calpas[2]
[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6
[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON TURF SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORY AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on samples of turf submitted by golf course supervisors and by the general public from January 1 to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on turf samples in 1993 have been pooled and are summarized in Table 1.

Table 1. Summary of diseases diagnosed on samples of turf submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in 1993.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Turf	Brown patch	*Rhizoctonia solani*
	Crown/root rot	*Fusarium* spp.
		Pythium spp.
	Damping-off	*Pythium* spp.
	Gerlachia patch	*Gerlachia nivalis*
	Leaf spot	*Drechslera poae*
	Melting out	*Drechslera poae*

CROP: Diagnostic Laboratory Report - Turf

LOCATION: Manitoba

NAME AND AGENCY:
R.G. Platford
Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent
Winnipeg, Manitoba R3T 5S6

TITLE: DISEASES DIAGNOSED ON TURFGRASS SUBMITTED TO THE MANITOBA AGRICULTURE CROP DIAGNOSTIC CENTRE IN 1993

METHODS: The Manitoba Agriculture Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by Manitoba agriculture extension staff, farmers, agri-business and the general public. Diagnosis is based on visual examination for symptoms and culturing onto artificial media.

RESULTS AND COMMENTS: The results of lawn and amenity turf submissions are shown in Table. 1. Leaf diseases, notably Septoria, Anthracnose and melting out were the most common problems encountered. Cool, wet weather conditions prevented the normal appearance of the summer decline disease complex. However the wet weather was very favourable for fairy ring and in a few instances red thread.

Table 1. Diseases diagnosed on lawn and turf samples submitted to the Manitoba Agriculture Crop Diagnostic Centre in 1993.

DISEASE	SCIENTIFIC NAME	NUMBER OF SAMPLES
Septoria leaf spot	*Septoria* spp.	8
Anthracnose	*Colletotrichumgraminicola*	5
Melting out	*Drechslera* spp.	5
Rhizoctonia	*Rhizoctonia solani*	5
Fusarium patch	*Fusarium* spp.	3
Slime mould	Unidentified	3
Ascochyta leaf blight	*Ascochyta* spp.	1
Fairy ring	*Marasmius* sp.	2
Pink snow mould	*Fusarium nivale*	1
Red Thread	*Laetisaria fuciformis*	2
Root rot	*Pythium* sp.	1
Environmental stress		2
Herbicide injury		1

Cool moist weather prevented the normal appearance of the summer decline disease complex. Conditions were very favourable for fairy ring and a few cases of red thread were detected. Leaf diseases were not a major problem in 1993.

CROP: Diagnostic Laboratory Report - Vegetable Crops

LOCATION: Alberta

NAME AND AGENCY:

J.D. Holley[1] and J.C. Calpas[2]

[1] Regional Crop Laboratory, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

[2] Brooks Diagnostics Limited, Alberta Special Crops and Horticultural Research Centre, Brooks, Alberta T1R 1E6

TITLE: DISEASES DIAGNOSED ON VEGETABLE CROPS SUBMITTED TO THE SOUTHERN ALBERTA REGIONAL CROP LABORATORY AND BROOKS DIAGNOSTICS LIMITED IN 1993

METHODS: The Regional Crop Laboratory (RCL) at the Alberta Special Crops and Horticultural Research Center (ASCHRC) diagnosed diseases on samples of field grown vegetable crops submitted by district agriculturalists, extension specialists, market gardeners, farmers and the general public from January 1 to June 30, 1993. Brooks Diagnostics Limited (BDL), a private diagnostic clinic, moved into the RCL's facilities and assumed responsibility for identifying plant diseases in southern Alberta on July 1, 1993. Each diagnosis listed in the table below was made by carefully examining symptoms expressed on host plants or by isolating primary pathogens from diseased tissues.

RESULTS: All of the disease identifications made by the RCL and BDL on field grown vegetable crops in 1993 have been pooled and are summarized in Table 1.

Table 1. Summary of diseases diagnosed on field grown vegetable crops submitted to the southern Alberta Regional Crop Laboratory and Brooks Diagnostics Limited in 1993.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Bean	Bacterial brown spot	***Pseudomonas syringae*** subsp. ***syringae***
	Halo blight	***Pseudomonas syringae*** subsp. ***phaseolicola***
Beet	Leaf shatter	Wind injury
Cabbage	Leaf speckle	***Cladosporium*** spp.
Carrot	Cavity spot	***Pythium*** spp.
	Storage rot	***Botrytis cinerea*** ***Sclerotinia sclerotiorum***
	Root rot	***Rhizoctonia solani***
Corn	Leaf distortion	Physiological stress
	Stalk rot	***Erwinia carotovora*** subsp. ***carotovora***
		Excessive irrigation
Garlic	Storage rot	***Penicillium*** spp.
Onion	Bulb spot	Physiological stress

(cont'd)

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Pea	Blight	*Mycosphaerella pinodes*
	Chlorosis	Nitrogen deficiency
	Crown/root rot	*Fusarium* spp.
		Ascochyta pinodella
	Leaf distortion	Phenoxy herbicide injury
	Oedema	Physiological stress
Pepper	Fruit speckle	*Alternaria* spp.
	Stem rot	*Sclerotinia sclerotiorum*
Potato	Bacterial ring rot	*Clavibacter michiganensis* subsp. *sepedonicum*
	Black dot	*Colletotrichum atramentarium*
	Black heart	Low oxygen in storage
	Blackleg	*Erwinia carotovora* subsp. *atroseptica*
	Black scurf	*Rhizoctonia solani*
	Canker	*Rhizoctonia solani*
	Chlorosis	Mosaic viruses
		Nitrogen deficiency
	Damping-off	*Rhizoctonia solani*
	Dry rot	*Fusarium* spp.
	Early blight	*Alternaria solani*
	Fiddlehead	Tordon residue in the soil
	Hollow heart	Physiological stress
	Late blight	*Phytophthora infestans*
	Leaf blackening	Frost
	Leaf burn	Spray drift injury
	Leak	*Pythium debaryanum*
	Mahogany browning	Chilling injury
	Net necrosis	Chilling injury
		PLRV
	Oedema	Physiological stress
	Pink rot	*Phytophthora erythroseptica*
	Seed piece decay	*Erwinia carotovora* subsp. *carotovora*
		Fusarium spp.
	Silver scurf	*Helminthosporium solani*
	Sunscald	Exposure to light
	Stunting/stem cracking	Dragging soil off hills late in the season
	Vein chlorosis	metribuzin injury
	Wilt	*Fusarium oxysporum*
		Moisture stress
	Wilt	*Verticilliumdahliae*
		Verticilliumalbo-atrum

(cont'd)

CROP	SYMPTOM/DISEASE	CAUSAL AGENT/PLANT PATHOGEN
Tomato	Bacterial speck	*Pseudomonas tomato*
	Chlorosis	Nutritional deficiency
		Physiological stress
	Early blight	*Alternaria solani*
	Ghost spot	*Botrytis cinerea*
	Late blight	*Phytophthora infestans*
	Leaf distortion	Phenoxy herbicide injury

Forage legumes / Legumineuses fourrageres

CROP: Alfalfa

LOCATION: Southern Alberta

NAME AND AGENCY:
H.C. Huang and R.S. Erickson
Agriculture Canada, Research Station, P.O. Box 3000 Main
Lethbridge, Alberta T1J 4B1

TITLE: SURVEY OF VERTICILLIUM WILT OF ALFALFA IN SOUTHERN ALBERTA IN 1993

METHODS: Ten irrigated alfalfa fields in the municipal districts of Pincher Creek and Taber and the counties of Lethbridge and Forty Mile, Alberta were surveyed for verticillium wilt (*Verticillium albo-atrum*) in late August 1993. Alfalfa was surveyed by entering each field at a corner, walking 200 paces toward the middle of the field, and exiting the field perpendicular to one side of the field (Huang *et al*, 1988). Diseased plants were identified by generalized wilting, inward curling of leaves, and the presence of V-shaped lesions on leaf tips. Severity of disease was then visually estimated according to the following scale: 1, none (0% of plants infected); 2, trace (<1%); 3, light (1-10%); 4, moderate (11-25%); 5, severe (26-50%); and 6, very severe (>50%).

RESULTS: Verticillium wilt was found in seven of the ten alfalfa fields surveyed in southern Alberta (Table 1). Of the seven diseased fields, the incidence was light in four fields and was moderately severe in three fields. The disease was found in all the areas surveyed, from Pincher Creek to Bow Island.

Table 1. Verticillium wilt of alfalfa in southern Alberta in 1993.

SEVERITY	INCIDENCE (%)	NO. OF FIELDS
None	0	3
Trace	<1	0
Light	1-10	4
Moderate	11-25	3
Severe	26-50	0
Very Severe	>50	0

REFERENCES

1. Huang, H.C., L.M. Phillippe, R.J. Howard and E.R. Moskaluk. 1988. Survey of verticillium wilt of alfalfa in Southern Alberta. Can. Plant Dis. Survey 68:63-64.

Cereals/Céréales

CROP: Barley, *Hordeum vulgare* L.

LOCATION: Manitoba

NAME AND AGENCY:
A. Tekauz, **J.** Gilbert and E. Mueller
Agriculture Canada, Research Station, 195 Dafoe Road, Winnipeg R3T 2M9
Tel: (204) 983-0944; Fax: (204) 983-4604

TITLE: BARLEY FOLIAR DISEASES IN MANITOBA IN 1993

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

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

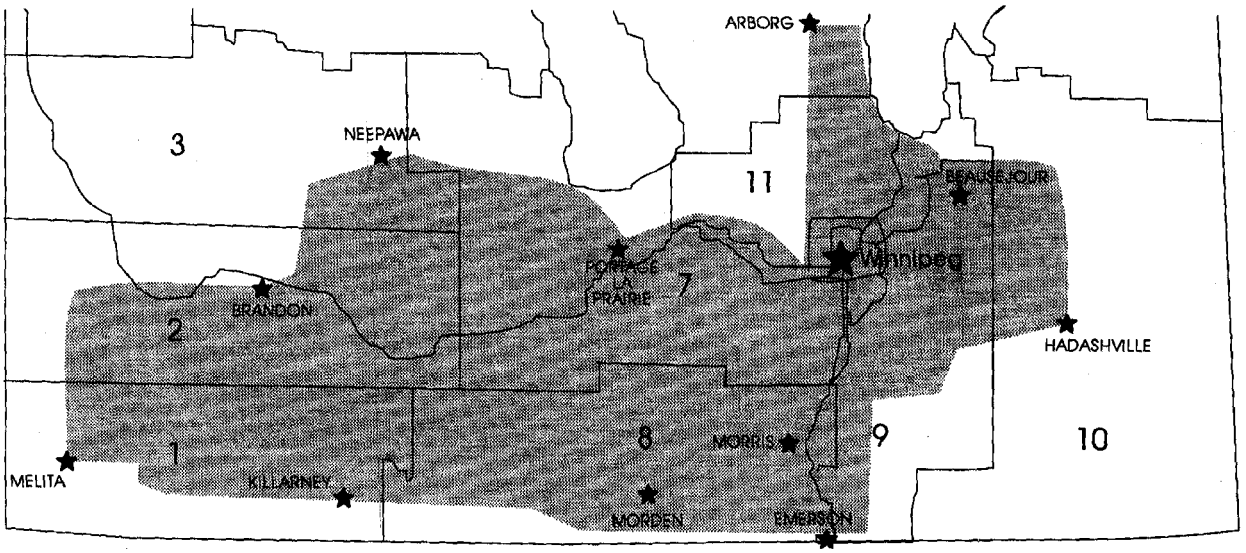


Figure 1. Area of southern Manitoba surveyed in 1993 for foliar diseases of barley.

CROP: Barley, *Hordeum vulgare* L.

LOCATION: Saskatchewan and Central Alberta

NAME AND AGENCY:
K.L. Bailey[1], L.J. Duczek[1], L. Jones-Flory[1], R. Kutcher[1], M.R. Fernandez[2], G.R. Hughes[3], D. Kaminski[4], C. Kirkham[5], K. Mortensen[6], S. Boyetchko[1], P. Burnett[7] and D. Orr[7]
[1] Agriculture Canada Research Station, 107 Science Place, Saskatoon S7N 0X2
[2] Agriculture Canada Research Station, P.O. Box 1030, Swift Current S9H 3X2
[3] Dept. of Crop Science & Plant Ecology, Univ. of Sask., Saskatoon S7N 0W0
[4] Saskatchewan Agriculture and Food, Soils and Crops Branch, Regina S4S 0B1
[5] Agriculture Canada Research Station, P.O. Box 1240, Melfort SOE 1A0
[6] Agriculture Canada Research Station, P.O. Box 440, Regina S4P 3A2
[7] Agriculture Canada Research Station, Bag Service 5000, Lacombe TOC 1SO

TITLE: SASKATCHEWAN/CENTRAL ALBERTA BARLEY DISEASE SURVEY, 1993

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

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

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

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

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

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

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

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

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

REFERENCES

1. Couture, L. 1980. Assessment of severity of foliage diseases of cereals in cooperative evaluation tests. Can. Plant Dis. Surv. 60:8-10.

2. Juhnke, M.E., D.E. Mathre and D.C. Sands. 1984. A Selective medium for *Gaeummanomyces graminis* var. *tritici*. Plant Dis. 68:223-236.

3. McFadden, W. 1991. Etiology and epidemiology of leaf-spotting diseases in winter wheat in Saskatchewan. Ph.D. Thesis, University of Saskatchewan, Saskatoon. 151 pp.

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

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

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

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

Crop District	Row Type	No. Fields	Net blotch	Scald	CRR %	Smut %
SASKATCHEWAN						
1	2	4	8.2/4*	TR/1	3614	TR/1
	6	0				
2	2	4	7.314	511	2113	TR/1
	6	0				
3	2	7	6.917	7.014	1515	017
	6	0				
4	2	2	9.011	7.011	3012	TR/1
	6	0				
5	2	7	6.517	6.517	2716	016
	6	5	8.715	8.715	3514	TR/1
6	2	12	9.411 1	9.5/10	2719	111
	6	6	8.314	8.415	2016	016
7	2	7	9.5/6	8.713	2017	017
	6	0				
8	2	16	6.6116	5.6116	20112	0116
	6	13	5.1/13	3.9110	16/10	0113
9	2	5	10.515	10.515	5713	015
	6	3	8.513	8.513	2512	013
Average or total	2	64	8.2164	7.5151	28/51	0.314
	6	27	7.7126	7.4123	24122	TR/1
ALBERTA						
8	2	11	8.119	4.8110	20111	0111
	6	32	7.1/27	5.6116	40132	TR/12

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

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

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

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

CROP: Barley and Wheat

LOCATION: Manitoba

NAME AND AGENCY:

S. Haber[1], D.J.S. Barr[2] and G. Platford[3]
[1] Agriculture Canada Research Station, 195 Dafoe Road, Winnipeg MB R3T 2M9
[2] Centre for Land and Biological Resources Central Experimental Farm, Ottawa, Ontario K1A 0C6
[3] Manitoba Agriculture Research Plant Pathology Laboratory
201-545 University Cres, Winnipeg, Manitoba R3T 5S6
A81
Tel: 204-983-1467; Fax: 204-983-4604

TITLE: FLAME CHLOROSIS IN MANITOBA IN 1993

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

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

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

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

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

REFERENCES

1. Haber, S., W. Kim, R. Gillespie and A. Tekauz. 1990. Flame Chlorosis: a new soil-borne, virus-like disease of barley in Manitoba, Canada. Can. J. Phytopathol. 129(3):245-256.

2. 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):241-246

3. Haber, S. and D.E. Harder. 1992. Green Foxtail (*Setaria viridis*) and barnyard grass (*Echinochloa crusgalli*) - new hosts of the virus-like agent causing flame chlorosis in cereals. Can. J. Plant Pathol. 14(4):278-280.

4. Haber, S., S. Prashar and G. Murray. 1992. Triticale confirmed as host of the viruslike agent causing flame chlorosis in cereals. Plant Dis. 77:536.

5. Haber, S., D.A. Wakarchuk, S.E. Cvitkovitch and G. Murray. 1991. Diagnosis of flame chlorosis, a novel, viruslike disease of cereals by detection of disease-specific double-stranded RNA with digoxigenin-labelled RNA probes. Plant Dis. 76:590-594.

6. Haber, S., D.J.S. Barr, **J.** Chong, A. Tekauz, and W. Kim. 1993. Flame chlorosis is linked to *Pythium* spp. Pages 115-118 *in* Proceedings, 2nd Symposium of the international Working Group on Plant Viruses with Fungal Vectors, Montreal, Canada, July 25-27, 1993. 156 pp..

7. Haber, S., R.G. Platford, L. Duczek, and K. Bailey. 1993. 1992 Survey of flame chlorosis in Manitoba and eastern Saskatchewan. Can. Plant. Dis. Surv. 73:(1)74-75.

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

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

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

** (-)...no detectable hybridization; (+/-)...borderlinedetection
(+)...faintsignal; (++++)....verystrong signal, ca. 1000x (+).

CROP: Barley, Oat, and Wheat

LOCATION: Maritime Provinces

NAME AND AGENCY:
H.W. Johnston and R.A. Martin
Agriculture Canada Research Station, Charlottetown C1A 7M8
Tel: (902) 566-6800, Fax: (902) 566-6821

TITLE: DISEASES OF CEREALS IN THE MARITIME PROVINCES, 1993

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

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

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

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

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

CROP: Barley, Oat and Wheat

LOCATION: Manitoba and Saskatchewan

NAME AND AGENCY:
P.L. Thomas
Agriculture Canada, Research Station, 195 Dafoe Road, Winnipeg R3T 2M9
Tel: (204) 983-1464; Fax: (204) 983-4604

TITLE: CEREAL SMUT SURVEY, 1993

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

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

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

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

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

* tr = less than 0.1%

CROP: Barley, Oat and Wheat

LOCATION: Manitoba and Eastern Saskatchewan

NAME AND AGENCY:
D.E. Harder
Agriculture Canada, Research Station, 195 Dafoe Road, Winnipeg R3T 2M9
Tel: (204) 983-1142; Fax: (204) 983-4604

TITLE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 1993

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

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

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

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

LOCATION: Quebec

NAME AND AGENCY:
L. Couture and L. Levesque
Agriculture Canada, Station de recherches
2560, boulevard Hochelaga, Sainte-Foy (Quebec) G1V 2J3
Tel: (418) 657-7980 Fax: (418) 648-2402

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

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

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

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

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

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

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

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

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

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

LOCATION: Manitoba and Eastern Saskatchewan

NAME AND AGENCY:
J. Chong
Agriculture Canada, Research Station, 195 Dafoe Road, Winnipeg R3T 2M9
Tel: (204) 983-0932; Fax: (204) 983-4604

TITLE: CROWN RUST OF OAT IN WESTERN CANADA IN 1993

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

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

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

CROP: Wheat

LOCATION: Quebec

NAME AND AGENCY:
A. Devaux
Service de phytotechnie, de Saint-Hyacinthe, MAPAQ
3300, rue Sicotte, C.P. 480, Saint-Hyacinthe (Quebec)
Tel: (514) 778-6522 Fax: (514) 778-6539

TITLE: DISEASES OF WHEAT IN QUEBEC IN 1993

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

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

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

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

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

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

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

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

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

CROP: Wheat, *Triticum aestivum* L.

LOCATION: Manitoba

NAME AND AGENCY:
J. Gilbert, A. Tekauz, E. Mueller and U. Kromer
Agriculture Canada, Research Station, 195 Dafoe Road, Winnipeg **R3T** 2M9
Tel: (204) 983-0891 Fax: (204) 983-4604

TITLE: FOLIAR DISEASES OF SPRING WHEAT IN MANITOBA IN 1993

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

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

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

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

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

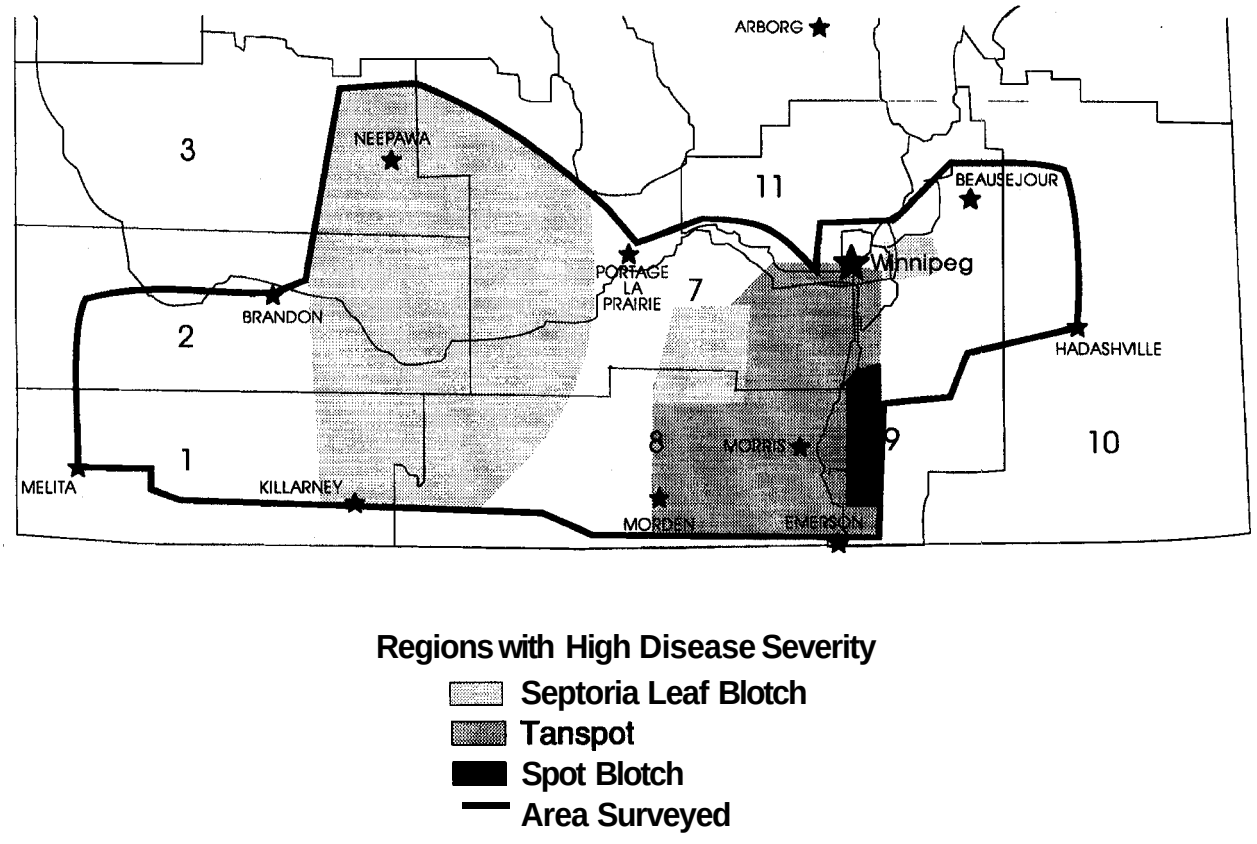


Figure 1. Crop districts surveyed and distribution of foliar pathogens in 1993.

CROP: Wheat, *Triticum aestivum* L.

LOCATION: Manitoba

NAME AND AGENCY:
J. Gilbert, A. Tekauz, E. Mueller and U. Kromer
Agriculture Canada, Research Station, 195 Dafoe Road, Winnipeg R3T 2M9
Tel: (204) 983-0891, Fax: (204) 983-4604

TITLE: OCCURRENCE OF FUSARIUM HEAD BLIGHT IN MANITOBA IN 1993

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

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

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

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

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

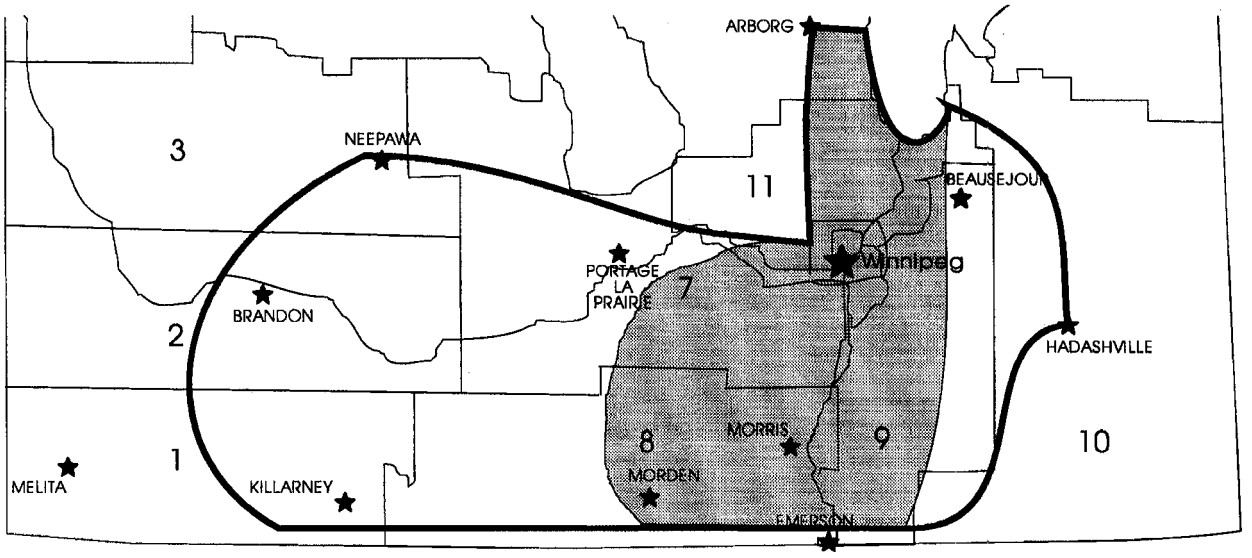


Figure 1. Crop districts surveyed for fusarium head blight in 1993.

CROP: Wheat, *Triticum aestivum* L.

LOCATION: Eastern Prairies

NAME AND AGENCY:
J.A. Kolmer
Agriculture Canada, Research Station, 195 Dafoe Road, Winnipeg R3T 2M9
Tel: (204) 983-0771; Fax: (204) 983-4604

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

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

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

CROP: Wheat, *Triticumaestivum* L.

LOCATION: Saskatchewan and Central Alberta

NAME AND AGENCY:
K.L. Bailey[1], L.J. Duczek[1], L. Jones-Flory[1], R. Kutcher[1], M.R. Fernandez[2], G.R. Hughes[3], D. Kaminski[4], C. Kirkham[1], K. Mortensen[6], S. Boyetchko[1], P. Burnett[7], and D. Orr[7]
[1] Agriculture Canada Research Station, 107 Science Place, Saskatoon S7N 0X2
[2] Agriculture Canada Research Station, P.O. Box 1030, Swift Current S9H 3X2
[3] Dept. of Crop Science & Plant Ecology, Univ. of Sask., Saskatoon S7N 0W0
[4] Saskatchewan Agriculture and Food, Soils and Crops Branch, Regina S4S 0B1
[5] Agriculture Canada Research Station, P.O. Box 1240, Melfort SOE 1A0
[6] Agriculture Canada Research Station, P.O. Box 440, Regina S4P 3A2
[7] Agriculture Canada Research Station, Bag Service 5000, Lacombe TOC 1SO

TITLE: SASKATCHEWAN/CENTRAL ALBERTA WHEAT DISEASE SURVEY, 1993

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

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

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

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

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

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

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

REFERENCES

1. Couture, L. 1980. Assessment of severity of foliage diseases of cereals in cooperative evaluation tests. Can. Plant Dis. Surv. 60:8-10.

2. Juhnke, M.E., D.E. Mathre and D.C. Sands. 1984. A Selective medium for *Gaeummanomyces graminis* var. *tritici.* Plant Dis. 68:223-236.

3. McFadden, **W. 1991.** Etiology and epidemiology of leaf-spotting diseases in winter wheat in Saskatchewan. Ph.D. Thesis, University of Saskatchewan, Saskatoon. 151 pp.

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

Crop District	No. Fields	Leaf spot	Leaf rust	CRR %	Powdery mildew	Glume blotch	Ergot %	Smut %	Take-all %	BYDV %	Head blight %	WSMV (%)
SASKATCHEWAN												
1A	4	5.8/4	5MR/3	2514	014	TR-214	1.0/1	014	TR/1	014	014	TR/2
1B	7	5.7/7	2MR/2	2717	0/7	OR	0/7	TR/2	TR/5	0/7	Off	TR/1
2A	10	7.0/9	2MR-5MS/8	2715	0110	1014	TR/1	TW2	TR/1	0110	TR/2	0110
2B	11	7.7/9	0111	3613	0111	TR/5	0111	TR/2	1-7512	0/11	211	0111
3A	3	6.4/3	15M/1	013	013	013	013	111	013	013	013	013
3B	36	9.7136	1MR-5MS/6	17/28	0136	1.2131	TR/1	TR/1	0136	0136	0136	0136
4A	0											
4B	7	8.5/7	Off	2714	0/7	1.2/4	ON	ON	0/7	0/7	0/7	0/7
5A	18	6.4118	1MR/5	31/14	0118	TR/8	TR/1	TR/2	TR-8111	0118	0118	TR/1
5B	10	8.7/10	TR/2	1714	0110	0.9/8	0110	0110	0110	0110	0110	0110
6A	10	9.1110	0110	1715	0110	4.413	0110	0110	0110	0110	0110	0110
6B	13	10.0113	TR/1	19113	0113	TR/9	0113	0113	0113	0113	0113	0113
7A	0											
7B	11	9.4/11	3MR/2	2019	0111	TR/5	0111	0111	6011	0111	0111	0111
8A	17	5.1/17	1MR-R/1	719	0.812	1.4/11	0117	TR/1	0117	0117	0117	0117
8B	22	7.419	5MR-R/4	21111	0.3/2	1.5115	0122	TR/1	0122	0122	0122	0/22
9A	8	10.018	1MS/1	2918	018	TR/3	018	018	018	018	018	018
9B	3	10.713	TR/2	6013	TR/1	TR/3	013	013	013	013	013	013
Average or total	190	8.0/174	1MR-5MS /56	251127	0.615	1.7 /113	TR/4	TR/12	TR-75 /21	01190	1.1/3	TR/4
ALBERTA												
8	22	8.8122	4MR/2	60119	2.615	1.0/1	TR/1	TR/2	TR/14	0122	0122	0122

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

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

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

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

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

CROP: Winter Wheat

LOCATION: British Columbia

NAME AND AGENCY:
G.D. Jesperson
B.C. Ministry of Agriculture, Fisheries and Food, 200-1690 Powick Road
Kelowna, British Columbia V1X 7G5
Tel: (604)861-7211; Fax: (604)861-7490

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

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

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

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

Table 1. Dwarf bunt infested fields by location.

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

Oilseeds and Special Crops / Oleagineux et cultures speciales

CROP: Canola

LOCATION: Manitoba

NAME AND AGENCY:

S. Mathur[1] and R.G. Platford[2]

[1] Department of Plant Science, University of Manitoba, Winnipeg, Manitoba R3T 2N2

[2] Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent, Winnipeg, Manitoba R3T 5S6

TITLE: DISTRIBUTION, PREVALENCE AND INCIDENCE OF CANOLA DISEASES IN MANITOBA 1993

METHODS: Two surveys were conducted in Manitoba. During the first week of September 64 crops of *Brassica napus* and seven of *B. rapa* (syn. *B. campestris)* were surveyed in the western and northern crop districts. During the second, 18 crops of *B. napus* were surveyed in the eastern and Interlake crop districts. The presence of various diseases was noted in each field and disease incidence was determined from a sample of 50 plants. The route taken in the surveys is shown in Figure 1. In addition 113 samples of canola were submitted for analysis to the Manitoba Agriculture Crop Diagnostic Centre.

RESULTS AND COMMENTS: Sclerotinia stem rot caused by *Sclerotinia sclerotiorum* was observed in 84 of 89 crops (94.4%). The percentage of infested crops ranged from 81.8% in crop district 11 to 100% in crop districts 1, 2, 4, 6, 7 and 9 (Table 1). Mean disease incidence ranged from 21% in crop district 1 to 41.4% in crop district 5 (Table 2). On an overall province-wide basis the mean incidence of sclerotinia was 29.1% (Table 2). This level of infection would likely result in about a 15% yield loss based on research conducted by Morrall *et al.* The estimated yield loss in 1993 of 15% was higher than the estimated yield loss in 1992 of between 2 and 8% depending on crop region (C. G.J. van den Berg and R.G. Platford, 1993).

Blackleg caused by *Leptosphaeria maculans* was observed in 37 of 89 crops (41.6%) (Table 1). The mean incidence of infected plants ranged from 0 in crop districts 4 and 9 to 17.5% in crop district 8 (Table 2). Blackleg was not found in every crop district surveyed, unlike 1992 (C.G.J. van den Berg and R.G. Platford, 1993). However, the incidence in the districts where it was detected was generally higher in 1993 than in to 1992. The mean incidence of blackleg-infected plants on a province-wide basis was 6.2% (Table 2) which would likely have caused an average yield reduction of less than 3%.

Foot rot was observed in 23 of 89 crops surveyed (25.8%) (Table 1). The mean disease incidence ranged from 0 in crop districts 4 & 5 to 3.5% in crop district 2 and 3.1% in crop district 11 (Table 2). The incidence of foot rot was higher in 1993 than 1992. A contributing factor was the excess soil moisture and below normal temperatures. Another disease detected was staghead (caused by *Albugo candida*) in three crops of *B. rapa* in crop district 3. Black spot (caused by *Alternaria* spp.) was found at trace to moderate level in almost all crops surveyed. The estimated yield loss from black spot was less than 1%. Aster yellows was observed in the survey but could not be accurately measured as most crops surveyed were already swathed. Grey stem caused by *Pseudocercosporella capsellae* was observed in five crops of *B. rapa* in crop districts 3, 4, 5 and 6 but was not considered to have caused any loss in yield.

In Manitoba, the 1993 growing season was cooler than normal, as in 1992, and most regions except the extreme southwest received a higher than normal amount of precipitation. Several fields in crop districts 8 & 11 were observed to have high levels of plants that died prematurely due to suffocation from excessively high soil moisture levels.

Despite the disease loss, notably from sclerotinia stem rot, canola yields on a province wide basis were close to normal and most of the crop graded No. 1. The cool, wet weather favoured the growth of canola and improved growth compensated somewhat for disease loss.

Of the 113 samples submitted to the Manitoba Agriculture Crop Diagnostic Centre, 18 showed sclerotinia stem rot, 11 showed root rot, six showed downy mildew, four showed blackspot, four showed blackleg and one showed staghead. In addition to diseases, 46 samples showed evidence of herbicide injury, 18 of sulphur deficiency and five environmental stress, primarily from excess water. Several samples of seedlings were affected by a severe late May frost.

REFERENCES

1. Morrall, R.A.A., J. Dueck and P.R. Verma. 1982. Yield losses due to sclerotinia stem rot in western Canadian rapeseed. Can. J. Plant Pathol. 6:265 [Abstr.].

2. van den Berg, C.G.J. and R.G. Platford. 1993. Distribution, prevalence and incidence of canola diseases in 1992. Can. Plant Dis. Surv. 73:81-82.

Table 1. Prevalence of diseases of canola in Manitoba - 1993.

CROP DISTRICT	NO. OF CROPS	PERCENT CROPS INFECTED			
		SCLEROTINIA	BLACKLEG	FOOT ROT	STAGHEAD
1	4	100	100	50	
2	4	100	100	50	
3	13	92	39	31	15
4	6	100			
5	12	92	58		
6	10	100	30	30	
7	8	100	25	38	
8	14	93	71	36	
9	7	100		14	
11	11	82	18	27	
Manitoba Average	89	94	42	26	2

Table 2. Mean percentage incidence of diseases of canola in Manitoba in 1993.

CROP DISTRICT	SCLEROTINIA	BLACKLEG	FOOT ROT
1	21.0	13.0	1.5
2	25.5	10.0	3.5
3	26.8	4.6	1.7
4	34.7	0	0
5	41.4	4.4	0
6	34.0	1.6	1.8
7	27.0	6.5	1.0
8	30.9	17.5	2.9
9	28.6	0	0.6
11	21.6	4.5	3.1
Manitoba Average	29.1	6.2	1.7

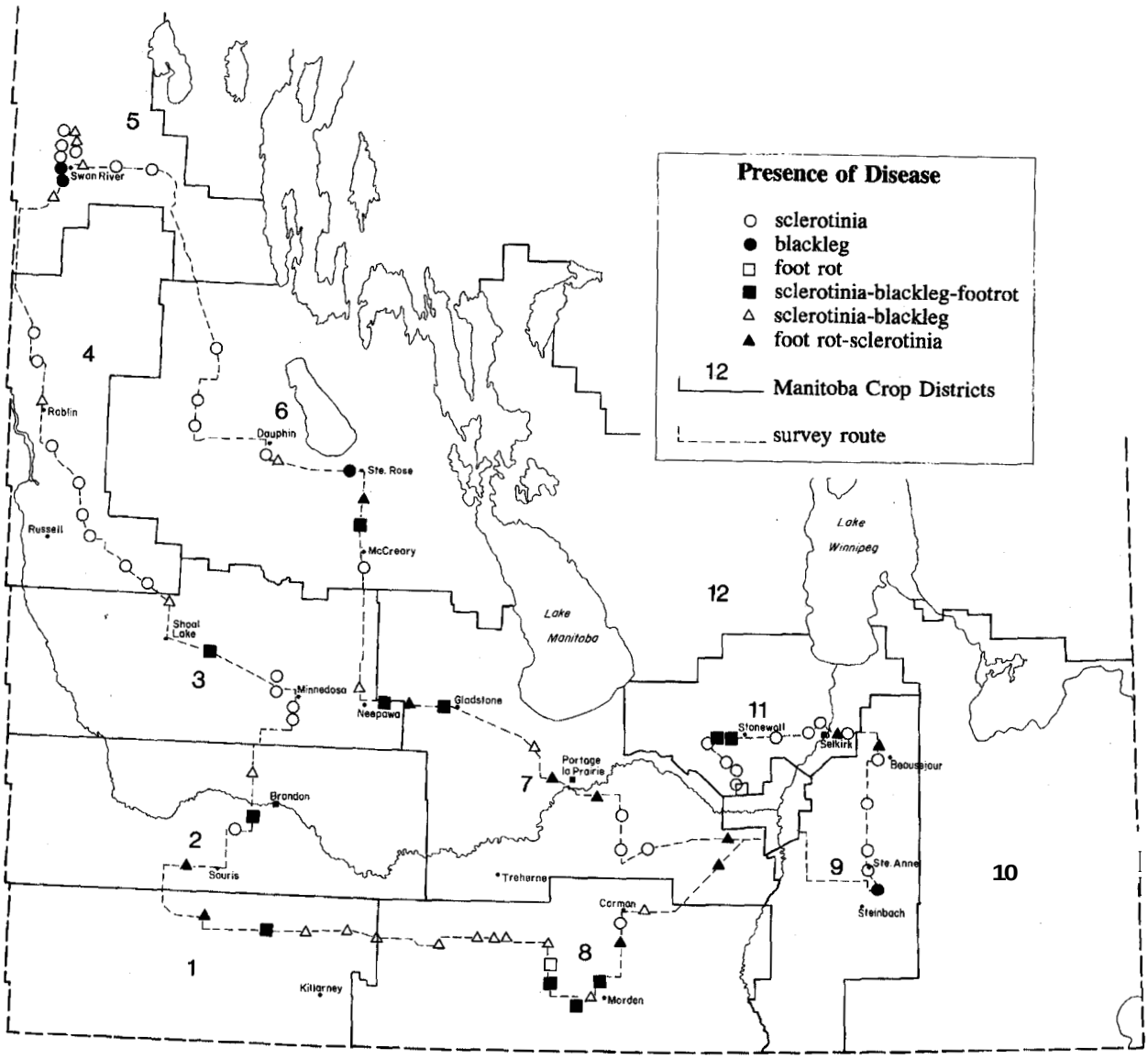


Figure 1. Distribution of fields included in Manitoba canola survey, 1993.

CROP: Canola
LOCATION: Central Saskatchewan

NAME AND AGENCY:
G.A. Petrie, Research Station, Agriculture Canada, 107 Science Place, Saskatoon S7N 0X2

TITLE: CHANGES IN BLACKLEG INCIDENCE, 1991-93, WITH NOTES ON OTHER DISEASES

METHODS: Eleven rural municipalities (RM's) around Saskatoon (Fig. 1) were visited in 1991, 1992, and 1993, and standing stubble from at least five canola (*Brassica napus* [BN] or *B. rapa* [BR]) crops sampled annually in each one. Seventy crops were sampled in 1991, 55 in 1992, and 73 in 1993. Results of a 1991 survey of 25 crops in five RM's in the Prince Albert area, and some of the other 1991 data, were part of an earlier report (3). In 1993, an additional survey of 10 crops was conducted in the Watrous area, 100 km S.E. of Saskatoon (Fig. 1). This survey was principally in RM's 281 and 310. In 1993, the 83 crops surveyed were identified to species using swathed material or small groups of standing plants that had been missed during harvesting operations. There were 59 fields of BN and 24 of BR.

All the surveys were primarily for blackleg (*Leptosphaeria* maculans), but disease incidence (DI) and severity also were recorded for other pathogens. Records were made of overall blackleg incidence (any infections on the stubble) and of severe cankers. The latter were those that visibly weakened or destroyed the structural integrity of tissues at the stem base. Methods of sampling and identifying strains of *L.* maculans were as previously described (3).

RESULTS AND DISCUSSION: The virulent strain of *L.* maculans was the predominant one in central Saskatchewan in all three years. Mean DI in the 11 RM's in 1991, 1992, and 1993, was 97, 32, and 75%, respectively. Mean incidence of severe basal stem canker was 12% in 1991; it was 1% or less in each of the other two years (Table 1). Mean DI in the Watrous area in 1993 was 58%. In 1993 the highest concentrations of BR were in the northeastern RM's 401, 403, and 431 (Fig. 1). Mean DI in the 24 BR fields over seven RM's was 83%. Twenty BN crops from the same seven RM's had a mean DI of 73%; that in the remaining 39 BN crops was 67%. Mean DI in four BR crops near Watrous was 78%, whereas that for four BN crops in the same two RM's was 43%.

June is the critical month for ascospore discharge and infection of young canola plants by *L.* maculans (Petrie, unpublished data). June precipitation at Saskatoon totalled 136, 15 and 58 mm in 1991, 1992, and 1993, respectively (Table 2). Average precipitation for the 11 RM's from late May to early July, 1991-93, was 159, 24, and 168 mm (Table 1). Low rainfall in June was a major factor contributing to low blackleg levels in 1992. Temperature also has a profound effect on the rate of blackleg development in infected plants (1). In 1992 and 1993, cool, wet conditions in July and August (Table 2) favored prolonged flowering and vegetative growth of canola. In both years, the "latent" (symptomless) phase of the disease (2) was also prolonged. External stem symptoms developed slowly, and stem lesions often remained small in late September. Conversely, above normal temperatures in August, 1991 (Table 2), promoted conspicuous premature ripening of many canola plants infected at the stem base.

Improved blackleg resistance in currently grown *B. napus* cultivars also reduced the blackleg severity level. In 1991, the highly susceptible cultivar, Westar, made up 17.5% of the canola hectarage in Saskatchewan, or 243, 667 ha. In 1992, Westar took up only 3.7% of the hectarage, or 50,911 ha. (Data from 1991 and 1992 Prairie Grain Variety Surveys prepared by the three Prairie Wheat Pools.) Lenghtened rotations out of canola also contributed to the reduced blackleg incidences. Despite very high incidence of blackleg in 1991, the average basal stem canker incidence was 12%. Four percent of the 1991 fields had an incidence of severe stem canker of 50% or higher, and 13% had an incidence of 25% or higher. The relatively high stem canker levels in RM's 373 and 402 (Table 1) were directly related to short intervals between canola crops in some of the fields sampled.

OTHER DISEASES: In May, 1992, snow mould (*Typhula* sp.) was observed in several canola stubble fields, particularly between Grandora and Vanscoy in RM 345. Stubble-born *Typhula* sclerotia were especially noticeable in a field of the BN cultivar Global near Grandora that had long stubble and considerable snow retention in the winter of 1991-92. Sclerotinia stem rot *(Sclerotinia sclerotiorum*) was prevalent only in 1993. The mean stem rot DI varied from 1% in RM 344 to 9% in RM's 345 and 373. The average for the 11 RM's was 5%. Thirty percent of the plants in one field in RM 345 were infected, and 39% in a field in RM 373. Stubble crops of BR were often discolored by grey stem (*Pseudocercosporella capsellae*) in 1993, particularly in RM 401. Also in 1993, high incidences of alternaria black spot (*A. brassicae* and *A. raphani*) were observed on swathed plants in many fields throughout the area. Pod spotting was general, but surface area affected rarely exceeded 5%.

REFERENCES

1. McGee, D.C. and G.A. Petrie. 1979. Seasonal patterns of ascospore discharge by *Leptosphaeria maculans* in relation to blackleg of oilseed rape. Phytopathology 69:586-589.

2. Nathaniels, N.Q.R. and G.S. Taylor. 1983. Latent infection of winter oilseed rape by *Leptosphaeria maculans.* Plant Pathol. 32:23-31.

3. Petrie, G.A. 1993. Post-harvest surveys of blackleg on stubble of rapeseed/canola crops in Saskatchewan, 1981-1991. Can. Plant Dis. Surv. 73:123-128.

Table 1. Blackleg infection on stubble of canola crops in eleven rural municipalities in central Saskatchewan, 1991-93.*

Rural municipality	Av. % incidence & range of stem infections			Av. % incidence of severe basal stem cankers			Total rainfall (mm)**		
	1991	1992	1993	1991	1992	1993	1991	1992	1993
343 Blucher	100	20 (2-55)	63 (53-76)	12 (0-44)	0.0	0.3	156	21	148
344 Corman Park	80 (40-100)	72 (0-97)	80 (59-100)	4 (0-12)	1.6	0.9	150	11	221
345 Vanscoy	99 (91-100)	51 (26-74)	70 (8-100)	18 (3-60)	0.0	1.6	215	26	121
372 Grant	99 (96-100)	25 (4-49)	85 (63-100)	10 (0-26)	0.0	2.1	232	30	150
373 Aberdeen	97 (93-100)	22 (4-48)	62 (52-78)	29 (6-75)	0.0	0.0	173	36	124
401 Hoodoo	100 (99-100)	40 (7-67)	81 (67-90)	15 (0-63)	0.0	0.0	154	6	187
402 Fish Creek	100	6 (2-8)	89 (85-92)	23 (1-46)	0.0	0.3	157	38	157
403 Rosthern	98 (86-100)	25 (2-87)	80 (54-100)	4 (0-24)	0.7	2.8	128	26	168
404 Laird	100	56 (5-89)	68 (58-77)	9 (0-24)	0.7	0.9	139	14	210
405 Great Bend	98 (92-100)	29 (2-56)	57 (32-80)	7 (1-16)	0.0	0.3	123	22	171
431 St. Louis	100	7 (2-21)	85 (63-97)	3 (0-16)	0.0	0.0	125	38	189
Averages (ranges)	97 (40-100)	32 (0-97)	75 (8-100)	12 (0-75)	0.3	0.8	159	24	168

* Blackleg was assessed on 50 stubble plants from each of 5-7 fields per rural municipality per year.

** Precipitation data (late May to early July annually) from weekly Crop and Weather Report, Saskatchewan Agriculture and Food, Statistics Branch, Regina, Sask.

Table 2. Total monthly precipitation and monthly mean temperature at Saskatoon, May-August, 1991-93.*

Year	Precipitation (mm)				Mean temperature (°C)			
	May	June	July	August	May	June	July	August
Normal**	44.2	59.0	54.2	36.8	11.5	15.7	18.5	17.4
1991	72.4	136.0	49.2	14.0	11.7	16.7	18.7	21.0
1992	46.6	14.6	66.2	47.4	10.4	15.1	16.8	15.5
1993	36.8	58.4	75.3	64.3	11.3	13.7	15.2	15.9

* From Environment Canada, Atmospheric Environment Service, Monthly Meteorological Summary, Saskatoon 'A', Saskatchewan.

** Averages determined by Environment Canada.

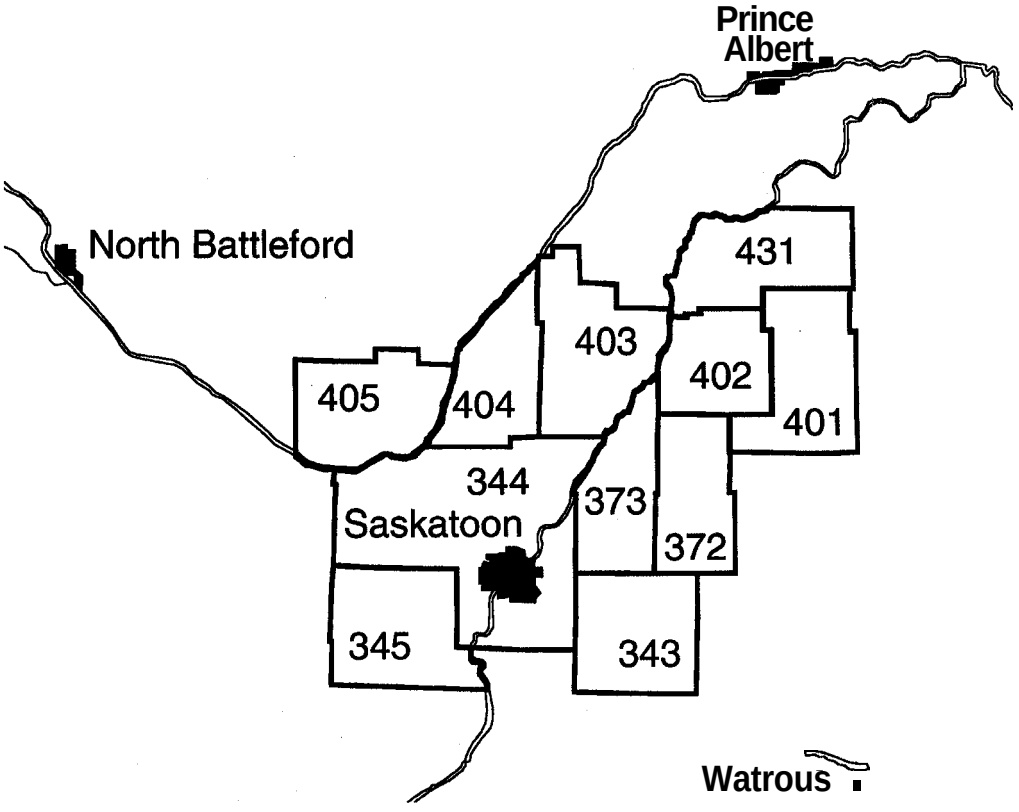


Figure 1. Eleven Saskatchewan rural municipalities in which blackleg surveys were conducted in canola stubble crops, 1991-93.

CROP: Canola

LOCATION: Alberta

NAME AND AGENCY:

I.R. Evans[1], P.D. Kharbanda[2], L. Harrison[3], and J. Calpas[4]

[1] Plant Industry Division, Alberta Agriculture, Food and Rural Development, Edmonton, Alberta

[2] Alberta Environmental Centre, Vegreville, Alberta

[3] Regional Crop Laboratory, Alberta Agriculture, Food and Rural Development, Fairview, Alberta

[4] Brooks Diagnostics Ltd., Brooks, Alberta

TITLE: BLACKLEG OF CANOLA SURVEY IN ALBERTA - 1993

INTRODUCTION AND METHODS: A province-wide survey, now in its sixth year, was carried out for virulent blackleg of canola (*Leptosphaeria maculans*). The cooperative survey was done by fieldmen in each of Alberta's 67 municipalities. In addition Agriculture Canada seed inspectors reported on the presence of virulent blackleg in seed crops in the province during their annual inspections in July. Diagnostic confirmation for the disease was available in laboratories at Fairview, Brooks, and at the Environmental Centre in Vegreville.

The survey by the fieldman was based on inspecting one crop of canola for every 2,000 ha of canola grown in each municipality. Fieldmen randomly checked crops for virulent blackleg, particularly in areas or regions where they suspected shortened crop rotations, i.e., continuous canola or canola every second year. Crops were sampled as previously described (1, 3).

RESULTS AND COMMENTS: In the east and east-central regions of Alberta, canola yields were at record levels. Nevertheless virulent blackleg was diagnosed in a third of all crops surveyed. Infection levels were usually less than 5% but a few exceptions were as high as 100%. In the Peace Region of Alberta comprising almost one third of the provincial canola acreage, infestation levels went from one crop in 1992 to 102 crops with virulent blackleg in 1993. A detailed report has been published in this issue of the *Can. Plant Dis. Surv.* (2). The virulent blackleg infestation level represents around 8% of the crops surveyed in this region.

Agriculture Canada seed inspectors reported 36 crops and plots totalling 800 ha with trace levels of virulent blackleg in the Vermilion region. Infections were all on lower leaves implicating ascospores from infected stubble in nearby fields as the likely source. One 14 ha seed crop of Horizon canola at Grande Prairie was also confirmed with a trace leaf infection of this disease. The seed inspectors surveyed 494 crops for a total of 9,892 ha province wide.

Testing of Alberta canola seed up to April 1993 by private laboratories demonstrated 13 instances of blackleg infected lots out of 1,315 *seed* lots examined. Infestation levels in the seed samples were usually at 0.1 to 0.2% of seeds examined.

Virulent blackleg was not detected in crops in Census Divisions divisions 1 and 2, in southern Alberta where 20% of the provincial canola acreage was grown this year. In total not including seed crops 1770 crops were inspected province-wide, and 192 were found to be positive for virulent blackleg, giving an average percent infestation level of 10.8% of crops surveyed.

REFERENCES

1. Evans, I.R., P. Kharbanda, L. Harrison and J. Holley, **1993.** Blackleg of canola survey in Alberta - **1992.** Can. Plant. Dis. Surv. 73:86-87.

2. Harrison, L.M., and P.D. Kharbanda. **1994.** The first report on extensive spread and distribution of virulent blackleg of canola in the Peace River region of Alberta, **1993.** Can. Plant Dis. Surv. 74:/ (In press).

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.

CROP: Canola

LOCATION: Alberta

NAME AND AGENCY:

L.M. Harrison[1] and P.D. Kharbanda[2]

[1] Alberta Agriculture Food and Rural Development, Fairview, Alberta

[2] Alberta Environmental Centre, Vegreville, Alberta

TITLE: THE FIRST REPORT ON EXTENSIVE SPREAD AND DISTRIBUTION OF VIRULENT BLACKLEG OF CANOLA IN THE PEACE RIVER REGION OF ALBERTA, 1993

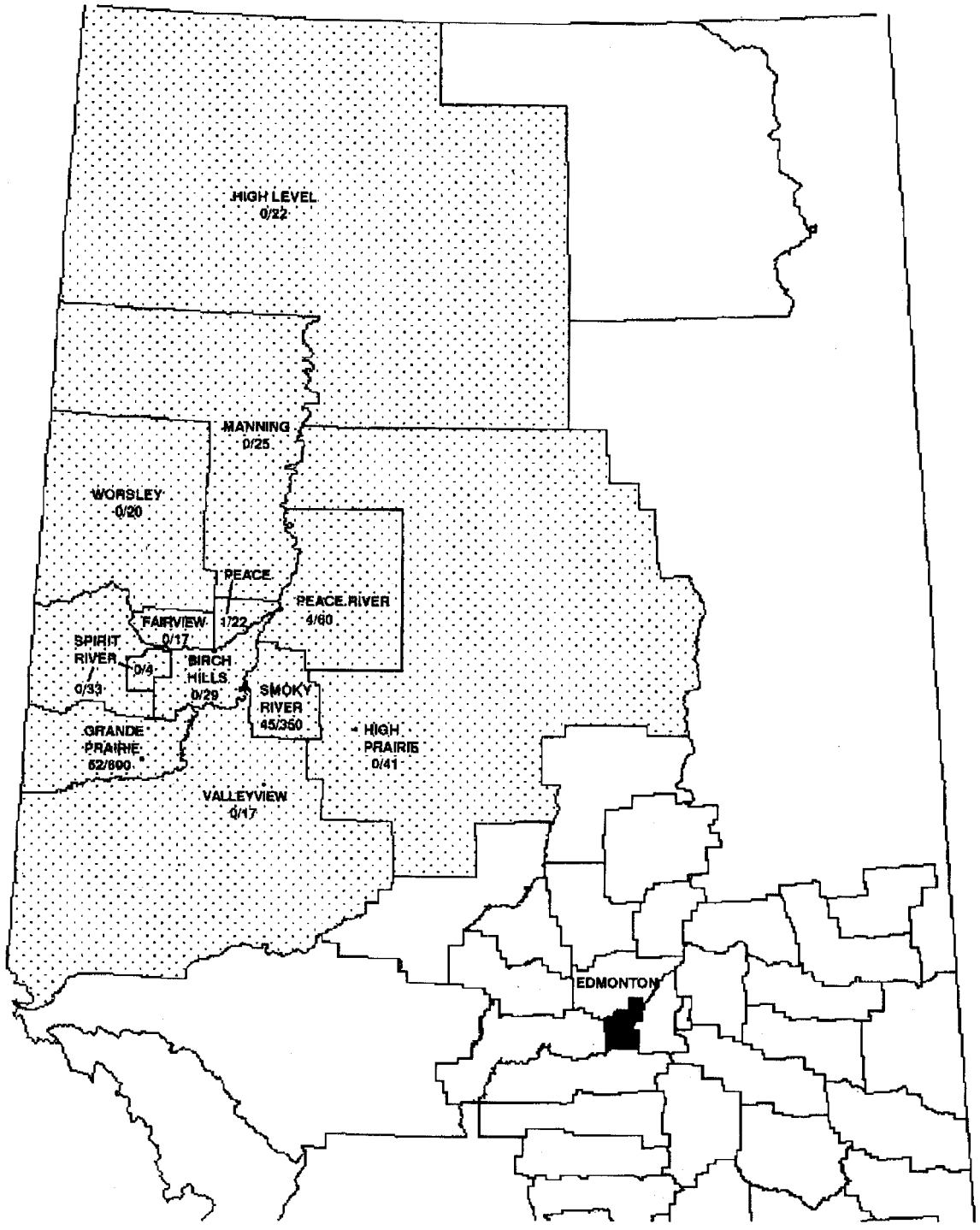
INTRODUCTIONAND METHODS: The annual survey for virulent blackleg (*Leptosphaeria maculans*) of canola in the Peace River region of Alberta was conducted in July and August, 1993 with the cooperation of agricultural fieldmen in all 13 provincial municipalities. Canola crops were randomly selected; however, fields with shortened or no crop rotation were given priority. All canola crops within an 8 km radius of one field in the Municipal District (MD) of Smoky River where Alto canola (*Brassica napus*) was confirmed with trace levels of virulent blackleg in 1992 (1), were included in the survey. Combined with other canola crops randomly selected, a total of 350 crops were surveyed in the MD of Smoky River. In the County of Grande Prairie, over 600 crops were checked. All samples were tested to confirm virulent blackleg at the Regional Crops Laboratory, Fairview or the Pest Diagnostic Clinic, Alberta Environmental Centre, Vegreville (3). Crops were sampled as previously described (4).

RESULTS AND COMMENTS: A total of 1273 crops was surveyed in the Peace region (Figure 1). Of the 600 surveyed in the County of Grande Prairie, and 350 surveyed in the MD of Smoky River, 52 and 45, respectively, were confirmed with virulent blackleg. There were 5 other crops in two other municipalities where virulent blackleg was confirmed. The Regional Crops Laboratory in Fairview received canola specimens from 241 locations and confirmed 54 with virulent blackleg. The Diagnostic Clinic in Vegreville received canola specimens from 162 locations and identified 48 with positive virulent blackleg. Most of the canola crops had disease incidence at low or trace levels. Several had higher levels, ranging from 20-44%. One of the crops in the county of Grande Prairie was found to have infestation levels as high as 84% at some spots (2). Some of the cultivars surveyed were *B. napus* cvs, Alto, Excel, and Westar, and *B. rapa* cvs, Horizon, Parkland and Tobin which are all susceptible to blackleg. In all cases where a high disease incidence was recorded, farmers had grown canola in the same field more than once in the past four years, and several of them had grown it in both 1992 and 1993.

ACKNOWLEDGEMENTS: Thanks to the agricultural fieldmen and weed inspectors involved in surveying the fields, to the Canola Council of Canada agronomist, Brad Dowell for support and participation in the survey, to Rita Stevens, senior technician, Alberta Environmental Centre, Vegreville, and Ellen Dalke and JoAnne Loland, laboratory assistants, Regional Crops Laboratory, Fairview for their assistance with isolating and testing for virulence of blackleg from canola specimens.

REFERENCES

1. Evans, I.R., P.D. Kharbanda, L. Harrison and J. Holley. 1993. Blackleg of canola survey in Alberta - 1992. Can. Plant Dis. Surv. 73:86-87.
2. Turkington, T.K. and L.M. Harrison. 1994. Survey of canola diseases in the Peace River region of Alberta, 1993. Can. Plant Dis. Surv. (In press).
3. McGee, D.C. and G.A. Petrie. 1978. Variability of *Leptosphaeria maculans* in relation to blackleg of oilseed rape. Phytopathology 68:625-630.
4. Evans, I.R., P.D. Kharbanda, L. Harrison and D. Kaminski. 1990. Blackleg of canola survey in Alberta - 1989. Can. Plant. Dis. Surv. 70:63-64.



Numbers in municipalities indicate Blackleg infested crops over number **of** crops surveyed.

Figure 1. Prevalence of virulent blackleg of canola in Peace River region of Alberta in 1993.

CROP: Canola

LOCATION: Alberta

NAME AND AGENCY:

T.K. Turkington[1] and L.M. Harrison[2]

[1] Research Station, Research Branch, Agriculture Canada, P.O. Box 29, Beaverlodge, Alberta TOH OCO

[2] Alberta Agriculture, Food and Rural Development, Regional Crops Laboratory, P.O. Box 159, Fairview, Alberta TOH 1LO

TITLE: SURVEY OF CANOLA DISEASES IN THE PEACE RIVER REGION OF ALBERTA, 1993

METHODS: Commercial crops of canola were surveyed in the Beaverlodge and Fairview areas of the Peace River region of Alberta. In July and early August 12 canola crops (growth stage 4.3-4.4[1]) were sampled for brown girdling root rot (BGRR, *Rhizoctonia solani*, *Fusarium* spp., *Pythium* spp.) in the Beaverlodge area. Five plants were collected nonselectively at each of five sites per crop for a total of 25 plants per crop. The sampling sites were at least 25 m from the edge of the crop and >50 m apart. At Fairview, in mid August, 18 crops (growth stage 5.1-5.2 [1]) were sampled by nonselectively collecting ten plants at each of five sites along a W-shaped path, normally for a total of 50 plants per crop. However, in two crops only 45 plants were collected. The first site was 100 paces from the edge of each crop. Plants collected in both areas were assessed for BGRR using a 0-4 scale, where 0 = no lesions on the taproot, 1 = light brown lesions on taproot but no girdling, 2 = coalesced brown lesions on taproot but no girdling, 3 = dark brown lesions girdling taproot above main laterals (wirestem appearance), 4 = severe necrotic lesions on taproots, roots roted off and plant dead. The incidence of sclerotinia stem rot *(Sclerotinia sclerotiorum*), staghead (*Albugo candida*), and black spot (*Alternaria* spp.) recorded were also from samples collected in the Fairview area.

RESULTS AND COMMENTS: In 1993, BGRR remained the most common canola disease in the crops surveyed (Table 1). All crops were affected by BGRR; average incidence and severity of BGRR were slightly higher at Beaverlodge than in the Fairview area. Black spot and staghead were present in over 60% of the crops surveyed. However, the average incidence of black spot was higher than the average incidence of staghead. Sclerotinia stem rot was the least prevalent of the diseases surveyed at Fairview. The highest incidence of stem rot was 14%. Thus, for all crops stem rot remained below the level at which fungicide application would have been justified.

In three crops at Beaverlodge plants sampled for the assessment of BGRR were suspected to be infected with virulent blackleg (*Leptosphaeria maculans*). Plant samples were collected and sent to either the Alberta Environmental Centre at Vegreville, the Alberta Agriculture Regional Crops Laboratory at Fairview, or to the Agriculture Canada Research Station at Saskatoon to be tested. Plant samples from all three crops were confirmed to be infected with virulent blackleg. Trace levels of virulent blackleg were found in two crops. In the third crop the incidence ranged from 34-84%, based on a total of 10 sites distributed throughout the entire crop. At each site, disease incidence was assessed by starting on one side of a 1 m^2 quadrat placed on the soil surface, counting a total of 50 plants, and recording the number that were infected with blackleg. Disease severity was not assessed; however, severe basal stem cankers were present and resulted in significant premature ripening and crop lodging. This is the first report of significant levels of virulent blackleg in the County of Grande-Prairie.

ACKNOWLEDGEMENTS: The authors would like to thank P.D. Kharbanda and R. Stevens, Alberta Environmental Centre, Vegreville, Alberta, and R.K. Gugel and G.A. Petrie, Agriculture Canada Research Station, Saskatoon, Sask. for their assistance with the isolation and identification of virulent blackleg from plant samples.

REFERENCES

1. Harper, F.R., and B. Berkenkamp. 1975. Revised growth-stage key for *Brassica campestris* and *B. napus*. Can. J. Plant Sci. 55:657-658.

Table 1. Survey data for various canola diseases, Beaverlodge and Fairview, Alberta, 1993.

AREA & DISEASE	PREVALENCE (% OF CROPS INFECTED)	MEAN DISEASE INCIDENCE (%)			MEAN DISEASE SEVERITY		
		AVG	MIN	MAX	AVG	MIN	MAX
Beaverlodge							
BGRR*	100	98	92	100	1.9	1.1	2.6
Fairview							
BGRR	100	86	38	100	1.8	0.4	2.9
Sclerotinia	44	3	0	14			
Staghead	61	8	0	38			
Black spot	67	37	0	100			

* BGRR = brown girdling root rot.

CROP: Canola

LOCATION: British Columbia

NAME AND AGENCY:
G.D. Jesperson
B.C. Min. of Agriculture Fisheries & Food, 200-1690 Powick Road,
Kelowna, British Columbia V1X 7G5

TITLE: 1993 CANOLA BLACKLEG SURVEY IN THE BRITISH COLUMBIA PEACE RIVER REGION

METHODS: The purpose of the survey was to determine whether the virulent strain of blackleg (*Leptosphaeria maculans*) had been introduced into the Peace River region of British Columbia. The survey was conducted from September 20 to 23, 1993 by 14 B.C.M.A.F.F. staff and one Canola Council representative. Every *Brassica napus* and every second *B. campestris* crop encountered was surveyed. Crops were sampled in an inverted W pattern starting 30 m from the field entry point. Ten plants were pulled and examined for blackleg every 30 m for a total of 50 stems per crop. A minimum of 50 additional plants were also examined for blackleg along the edge of the field. Stems with blackleg-like lesions or pycnidia were collected and retained for culturing at the provincial plant diagnostic lab. Blackleg cultures were forwarded to Dr. P. Ellis, Agriculture Canada Research Station, Vancouver, for ELISA testing using monoclonal antibodies.

RESULTS AND COMMENTS: Virulent blackleg was not detected in this survey. A total of 178 crops was surveyed comprising 11,525 ha out of 44,500 ha grown in 1993. Only three crops of *B. napus* were found. Samples from 56 crops were retained for culturing and ELISA testing. None of the samples had girdling lesions, and very few had basal stem cankers. Non-virulent blackleg was detected on samples from 50 crops. Virulent blackleg has not yet been detected in British Columbia.

ACKNOWLEDGEMENTS: Many thanks to the following for assisting with the survey: L. MacDonald, K. Murphy, K. Nickel, G. Carter, J. Dobb, J. Forbes, L. Bowd, K. Tosczak, A. Blair, T. Pittman, J. Moore, D. Coates, B. Greenhalgh, D. Scott, V. Joshi, B. Dowell.

CROP: Field Bean

LOCATION: Ontario

NAME AND AGENCY:
J.C. Tu
Agriculture Canada, Research Station, Harrow, Ontario NOR 1GO

TITLE: RECURRENCE OF ANTHRACNOSE DISEASE ON FIELD BEAN IN SOUTHWESTERN ONTARIO IN 1993

METHODS: In 1993, the field trials of field beans organized by the Ontario Pulse Committee were inspected by committee members on August 25 and a subsequent visit was made a week later. Forty-two lines of white beans and 39 lines of coloured beans at all nine locations (i.e. Ailsa Craig, Brussels, Elora, Exeter, Kippen, Mitchell, Shetland and Kemptville) were inspected for anthracnose. Disease samples were collected and sent to Harrow for examination, isolation and tests of pathogenicity.

RESULTS AND COMMENTS: Anthracnose was found in samples from six of nine Ontario field trial locations in southwestern Ontario. This was the first time since 1983 that anthracnose had been observed in Ontario. The six fields where anthracnose was present were at Kippen, Mitchell, Woodstock, Shetland, Exeter and Brussels. The three fields with no anthracnose were at Ailsa Craig, Elora and Kemptville. On August 25, several bean lines, including those carrying the Are gene (i.e. cvs. Centralia, OAC Sprint and Shetland), showed signs of the disease.

Examination of disease samples indicated the presence of anthracnose spores. Ten isolations were made from 12 plant samples collected from the six locations. The 10 pure cultures were inoculated on susceptible bean plants. Koch's postulates were fulfilled and the isolates were positively identified as *Colletotrichum lindemuthianum.*

Ontario field bean has been free of anthracnose for the past 10 years because of a strict program of seed treatment with benzimidazoles, a pedigree seed program and a breeding program which transferred a resistance gene (Are) to major commercial cultivars.

The occurrence of anthracnose in bean lines carrying the Are gene indicates two possibilities. One is that the Are lines are not homogenous and are segregating and the other is that the causal agent may be a new race of *C. lindemuthianum.* At present, an intensive investigation is being undertaken to resolve these questions.

CROP: Field Bean and Field Pea

LOCATION: MANITOBA

NAME AND AGENCY:
K.Y. Rashid[1], T. Warkentin[1], and R.G. Platford[2]
[1] Agriculture Canada Research Station, Unit 100-101 Route 100, Morden R6M 1Y5
[2] Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent, Winnipeg, Manitoba R3T 5S6

TITLE: DISEASES OF FIELD PEA AND FIELD BEAN IN MANITOBA IN 1993 FIELD PEA

METHODS: A total of 21 crops were surveyed in the principal pea growing area in southern Manitoba in 1993. The survey was conducted during the last week of August. Crops were selected at random in different regions. Each crop was sampled by one person walking 100 m 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, 27 samples of field pea were submitted for analysis to the Manitoba Agriculture Crop Diagnostic Centre by agricultural representatives and growers.

RESULTS AND COMMENTS: Crop emergence was good and stand was excellent in most of the crops surveyed. The above normal rainfall resulted in high soil moisture contents and excellent crop vigour. Such conditions created favourable microclimates for high levels of infection by *Mycosphaerella pinodes* and other foliar pathogens. A combination of unfavourable growing conditions due to excess soil moisture, various levels of flooding, and the high incidence of mycosphaerella blight weakened the root systems and resulted in premature ripening and severe losses, particularly in eastern and central Manitoba.

Mycosphaerella blight was observed as early as the middle of July and progressed very rapidly. By the last week in August, mycosphaerella blight was widespread on leaves, stems and pods in all the crops surveyed. The severity ranges were 20-80% leaf area infected, 5-50% stem area infected, and 10-40% pods infected in most crops surveyed.

Anthracnose (*Colletotrichum* spp.) was observed at trace levels in some crops. Traces of bacterial blight infections were observed early in the season but did not develop into high levels of severity later in the season. Powdery mildew (*Erysiphe polygoni*) was not observed until the last week in August, at the time when the crop was prematurely ripening, and the severity of this disease remained at low levels. Traces to 1% of downy mildew (*Peronospora viciae*) infections were observed in most crops surveyed.

Root rot (*Fusarium* spp.) was common in most crops surveyed and resulted in complete loss of several crops in the Carman Area. The excess soil moisture contributed to the root rot complex. Infections by *Sclerotinia sclerotiorum* were observed in most crops especially if they were heavily lodged and severity ranged from trace to 5% infected plants.

Of the 27 samples submitted to the Manitoba Agriculture Crop Diagnostic Centre, 11 showed mycosphaerella blight, four rhizoctonia and pythium seedling blight, two each bacterial blight downy mildew, or root rot (*Fusarium* spp.), and one each powdery mildew, anthracnose or sclerotinia. In addition, three samples were found to be affected by environmental stress and three by herbicide injury.

FIELD BEAN

METHODS: Eight crops of field bean in southern Manitoba were monitored on a weekly basis in 1993, from June 1 to August 31. In addition 26 samples of field bean submitted by agricutlural representatives and growers were examined by the Crop Diagnostic Centre.

RESULTS AND COMMENTS: The lack of heat units due to the exceptionally cool weather throughout the entire growing season delayed growth and reduced the yield in all crops. Bacterial infections including common blight *(Xanthomonas campestris* pv. *phaseoli*), halo blight *(Pseudomonassyringae* pv. *phaseolicola),* and brown spot *(P. syringae* pv. *syringae)* were predominant in July. Excess moisture in August resulted in flooding of fields in the central region causing extensive crop losses. By mid August, white mould (*Sclerotinia sclerotiorum)* was found in all crops surveyed with high disease severity in several crops in the Portage la Prairie area.

Twenty six samples of field bean submitted by agricultural representatives and growers were examined by the Crop Diagnostic Centre. Bacterial blight infections were identified in 13 samples, fusarium root rot in six, sclerotinia white mould in two, and alternaria leaf spot in one. In addition to diseases five samples were found to be affected by environmental stress and three samples affected by herbicide injury.

CROP: Dry Bean

LOCATION: Southern Alberta

NAME AND AGENCY:
H.C. Huang and R.S. Erickson
Agriculture Canada, Research Station, P.O. Box 3000 Main, Lethbridge T1J 4B1

TITLE: SURVEY OF DISEASES OF DRY BEAN IN SOUTHERN ALBERTA IN 1993

METHODS: Thirty-one irrigated dry bean crops were surveyed during late August 1993 for white mold *(Sclerotiniasclerotiorum),* gray mold (*Botrytis cinerea)* and bacterial blights *(Xanthomonas campestris, Pseudomonas syringae)* in the area surrounding Bow Island, Alberta. Each field was sampled by selecting ten sites in a U-shaped pattern, approximately 20 m apart, with each site consisting of a 3 m long section of row (Howard and Huang, 1983). The number of plants with white mold symptoms, and the number of healthy plants were recorded at each site. The percentage of plants with white mold for the entire field was then calculated as the average of the ten sites. The incidence of gray mold and bacterial blights was estimated visually according to the following scale: (1) none (0% of plants infected), (2) trace (<1%), (3) light (1-10%), (4) moderate (11-25%), (5) severe (26-50%), (6) very severe (>50%).

RESULTS: White mold was present in all of the 31 dry bean crops surveyed (Table 1). The frequency of crops with moderate, severe, and very severe incidence of white mold was 42%, 19%, and 29% respectively. Six crops with very severe disease had more than 82% of plants infected or killed by the pathogen. The disease was widespread in the area surrounding Bow Island (Figure 1).

Gray mold was present in 19 of the 31 crops. The frequency of crops with moderate and severe incidence of gray mold was 16% and 3%, respectively. The disease was found throughout the survey area.

Bacterial blights were present in 24 of the crops. The frequency with moderate, severe, and very severe incidence of bacterial blights was 6%, 6%, and 3%, respectively. All the crops with severe and very severe disease were associated with injury of plants by hail. Bacterial blights were found mainly in the area south and southwest of Bow Island.

Table **1.** Diseases of dry bean in southern Alberta in **1993.**

Disease incidence (% of plants infected)	Number of crops		
	White mold	Gray mold	Bacterial blight
None (0%)	*0*	**12**	**7**
Trace (<1%)	*0*	**10**	**12**
Light **(1-10%)**	**3**	**3**	**7**
Moderate **(11-25%)**	**13**	**5**	**2**
Severe **(26-50%)**	**6**	**1**	**2**
Very Severe (>50%)	**9**	*0*	**1**

DISCUSSION: White mold was reported as a serious disease of dry beans in southern Alberta (Huang *et al.*, **1988).** The disease was both widespread and severe in **1993.** The exceptionally high incidence of white mold observed in many crops may be due to extended periods of cool, wet weather during the **1993** growing season. Although gray mold and bacterial blights were widespread, the incidence of these diseases was generally low in most fields in southern Alberta in **1993.**

REFERENCES

1. Howard, R.J. and H.C. Huang. **1983.** Survey of commercial fields of dry beans for white mold disease. pp. 20 In: Studies of pulse crop diseases in southern Alberta in **1982.** AHRC Pamphlet No. **83-5.** Alta. Hort. Res. Cent., Alta. Agric., Brooks, Alberta.

2. Huang, H.C., M.J. Kokko and L.M. Phillippe. **1988.** White mold of dry bean (*Phaseolus vulgaris* ***L.)*** in southern Alberta, 1983-87. Can. Plant Dis. Surv. 68:11-1**3.**

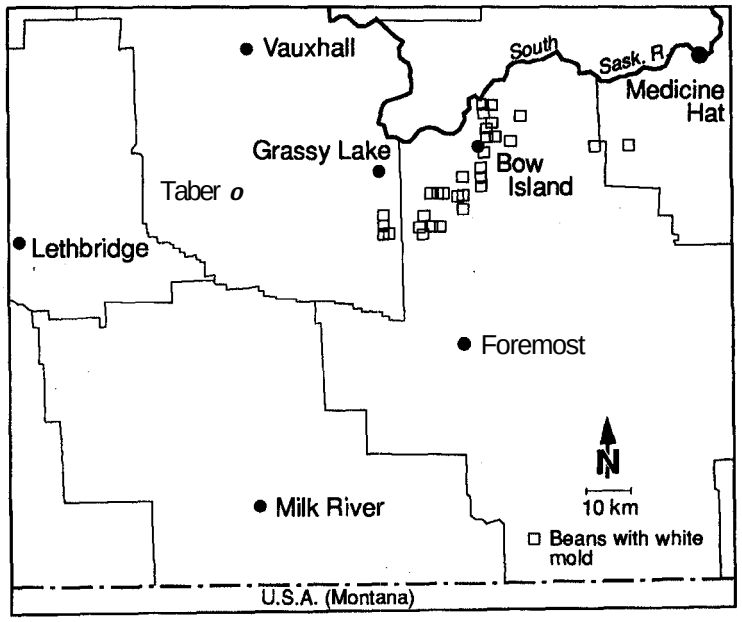


Figure **1.** White mold of dry bean in southern Alberta in **1993.**

CROP: Flax

LOCATION: MANITOBA

NAME AND AGENCY:

K.Y. Rashid[1] and R.G. Platford[2]

[1] Agriculture Canada Research Station, Unit 100-101 Route 100, Morden R6M 1Y5

[2] Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent, Winnipeg, Manitoba R3T 5S6

TITLE: DISEASES OF FLAX IN MANITOBA IN 1993

METHODS: A total of 42 flax crops in Southern Manitoba and 11 in southeastern Saskatchewan were surveyed in 1993. Thirty-eight crops were surveyed on August 23-25, and 15 crops on September 9-10. Crops were selected at random in different regions. Each crop 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 and severity of each disease were recorded. In addition, 12 samples of flax were submitted for analysis to the Manitoba Agriculture Crop Diagnostic Centre by agricultural representatives and growers.

RESULTS AND COMMENTS: Crop emergence was good and stand was excellent in most of the crops surveyed. The above normal rainfall resulted in high soil moisture contents and excellent crop vigour. Such conditions caused various levels of lodging in 12 flax crops thus creating a favourable microclimate for high levels of infection by *Septoria linicola* and other saprophytic fungi.

Pasmo *(Septorialinicola)* was observed in 51 crops (96% of crops surveyed), and the disease developed very rapidly during the month of September (Table 1). The incidence of pasmo ranged from trace to 40% infected plants in crops surveyed in August, and from 30% to 100% infected plants in crops surveyed in September. Similarly, the severity ranged from trace to 50% of stem and leaf area infected in August and from 10-80% stem and leaf area infected in September.

Traces of aster yellows (mycoplasma-like organism) were observed in only four crops. No typical symptoms of fusarium wilt (*Fusarium oxysporum* f.sp. *lini*) were observed in any of the surveyed crops; however, the prolonged high soil moisture conditions must have weakened the root system towards the end of the season. Rust (*Melampsora lini*) was not observed in any of the crops surveyed, nor on the 30 rust differential lines planted at Morden and Portage la Prairie.

Of the 12 samples submitted to the Manitoba Agriculture Crop Diagnostic Centre, three showed pasmo, two alternaria leaf spot, *6* environmental stress, and two nutrient deficiency.

Table 1. Incidence and severity of pasmo on flax in Manitoba in 1993.

NO. OF CROPS	% OF CROPS	INCIDENCE*	SEVERITY**
2	4	0	0
15	28	Trace	1%
7	13	1-5%	1-5%
11	20	5-20%	5-10%
4	8	20-40%	5-20%
3	*6*	20-40%	10-40%
4	8	40-60%	20-50%
7	13	100%	20-50

* Incidence is the percentage of infected plants in each field.

** Severity is estimated as the percentage of stem and leaf area infected.

CROP: Lentil

LOCATION: Saskatchewan

NAME AND AGENCY:

R.A.A. Morrall[1], J. Paisley[2] and M. French[3]

[1] Department of Biology, University of Saskatchewan, Saskatoon S7N 0W0

[2] Newfield's Seeds Limited, Nipawin, Saskatchewan SOE 1EO

[3] Saskatchewan Wheat Pool Lab., Nipawin, Saskatchewan SOE 1EO

TITLE: SEED-BORNE DISEASES OF LENTIL IN SASKATCHEWAN IN 1993

METHODS, RESULTS AND COMMENTS: No organized survey of lentil crops was conducted in Saskatchewan in 1993. However, anecdotal reports and telephone inquiries from farmers and agricultural representatives indicated that foliar diseases were a major problem. The weather was marked by well-below normal temperatures throughout the growing season and above-average precipitation in July and August in most areas of production. This resulted in dense vegetative growth, poor pod set, late maturity, extensive development of ascochyta *(Ascochytafabae* f. sp. *lentis*) and botrytis stem and pod rot *(Botrytis cinerea),* and low yields of very poor quality seed. Although botrytis rots have always been common in lentil crops, die-back was at unprecedented levels in crops and experimental plots in 1993. Farmers reported that extensive clouds of botrytis spores were stirred up from infected tissues by harvesting machinery and they expressed concern about potential allergenic reactions.

Seed-borne *Botrytis* was at record levels in samples from experimental plots at Saskatoon and Melfort. Seed-borne *Botrytis* can cause seedling blight and was responsible for about 20% seedling death in late June in one lentil crop in central Saskatchewan. In view of this, there is concern about seed to be planted in 1994; very little high-quality seed with low levels of seed-borne pathogens is available.

By early December 874 samples of lentil seed had been tested at two commercial laboratories in Saskatchewan. Only about ***6%*** of these samples showed 0% *Ascochyta* infection. The overall mean level of infection was 5.2%. This compares with levels over the previous six years of 2.4% (1987), 1.4% (1988), **1.6%** (1989), 2.1% (1990), 5.0% (1991) and 4.0% (1992) (1, 2). In 175 samples tested for seed-borne *Botrytis*, levels ranged up to 15.3% with a mean of 3.4%.

Anthracnose caused by *Colletotrichum truncatum* was found in samples at only very low levels. This disease is not highly seed-borne (2) and is favored by warm weather.

REFERENCES

1. Morrall R.A.A. 1992. Significance of seed-borne inoculum of lentil pathogens in western Canada. pp. 313-314, ***In:*** Proc. 1st European Conference on Grain Legumes, Angers, France, 1-3 June, 1992.
2. Morrall R.A.A., R. Beaule, S. Ahmed, J.L. Downing and P.G. Pearse. 1992. Anthracnose and ascochyta blight of lentil in central Saskatchewan in 1992. Can. Plant Dis. Surv. 73:91-92.

CROP: Field pea

LOCATION: Central Alberta

NAME AND AGENCY:
A.G. Xue and P.A. Burnett
Agriculture and Agri-Food Canada, Bag Service 5000, Lacombe, Alberta TOC 1SO

TITLE: DISEASES OF FIELD PEA IN CENTRAL ALBERTA IN 1993

METHODS: Thirty-one crops of field pea were surveyed in central Alberta for diseases during the 1993 growing season. Of these crops, 14 were surveyed July 26-28, and 17 were surveyed August 25-27. Five crops were examined in both surveys. The first survey was conducted during flowering and the second survey during pod filling. The crops were distributed across 11 counties (Figure **1).** Incidence and severity of various diseases were determined by rating ten plants at four random sampling sites in each crop. The diseases were identified by symptoms and the severity of each disease was estimated using a scale of 0 (no disease) to 9 (most or all of the plant severely diseased).

RESULTS AND COMMENTS: The results are presented in Table **1.** Seven diseases were observed in each survey. Of these diseases, downy mildew *(Peronosporaviciae*) was the most prominent in the first survey. This disease occurred at trace to moderately severe levels in 12 of 14 crops examined in the first survey. The severity of this disease was reduced three fold and it was observed in only 8 of 22 crops examined during the second survey. Ascochyta blight *(Ascochyta*spp.) was the most severe disease observed in the second survey. **It** was present at moderate to severe levels in all 22 crops examined in this survey. The severity of this disease increased over three fold during the 4-week interval between the two surveys. Sclerotinia stem rot *(Sclerotinia sclerotiorum*) was found at trace to moderate levels and it was ranked as the third or the second most severe disease in the two surveys. Trace amounts of infection by foot rot *(Phoma medicaginis* var. *pinodella*), septoria leaf blotch (*Septoria pisi*) and gray mold (*Botrytis cinerea*) were found in both surveys. Powdery mildew (*Erysiphe polygon4* was observed in one crop in the first survey and bacterial blight (*Pseudomonas pisi*) was observed in one crop in the second survey. The severities of the two diseases were slight.

This is the first time that downy mildew has been reported as the most prominent disease on pea in central Alberta although it was commonly observed during 1992. The abnormally cool and moist weather that occurred throughout the summer of 1993 may have contributed to the levels of downy mildew. The effect of this disease on yield of field pea in Alberta has not been determined. Ascochyta blight and sclerotinia stem rot have been commonly observed on field pea in central Alberta. The severities of these diseases vary from year to year and field to field. Because both diseases may cause great reductions in yield and seed quality, it is important to prevent epidemics of them.

ACKNOWLEDGMENT: Financial support from the Natural Sciences and Engineering Research Council of Canada through Visiting Fellowships in Canadian Government Laboratories is gratefully acknowledged. Thanks are also due to Mr. W.E. Davis for his assistance in locating pea crops.

Table 1. Presence, incidence and severity of field pea diseases in central Alberta in 1993.

DISEAESE	SURVEYED JULY 26-28				SURVEYED AUGUST 25-27			
	NO CROPS SURVEYED	NO CROP AFFECTED	INCIDENCE %	SEVERITY (0-9)	NO CROPS SURVEYED	NO CROPS AFFECTED	INCIDENCE %	SEVERITY (0-9)
Ascochyta blight	14	10	46	1.5	22	22	98	4.6
Sclerotinia stem rot	14	64	3	1.4	22	18	41	1.1
Downy mildew	14	12	75	2.1	22	8	18	0.6
Foot rot	14	2	12	0.5	22	7	13	0.5
Septoria leaf blotch	14	5	50	1.3	22	7	15	0.4
Gray mold	14	1	7	0.3	22	2	7	0.3
Bacterial blight	14	0	0	0.0	22	1	3	0.1
Powdery mildew	14	1	2	0.1	22	0	0	*0.0*

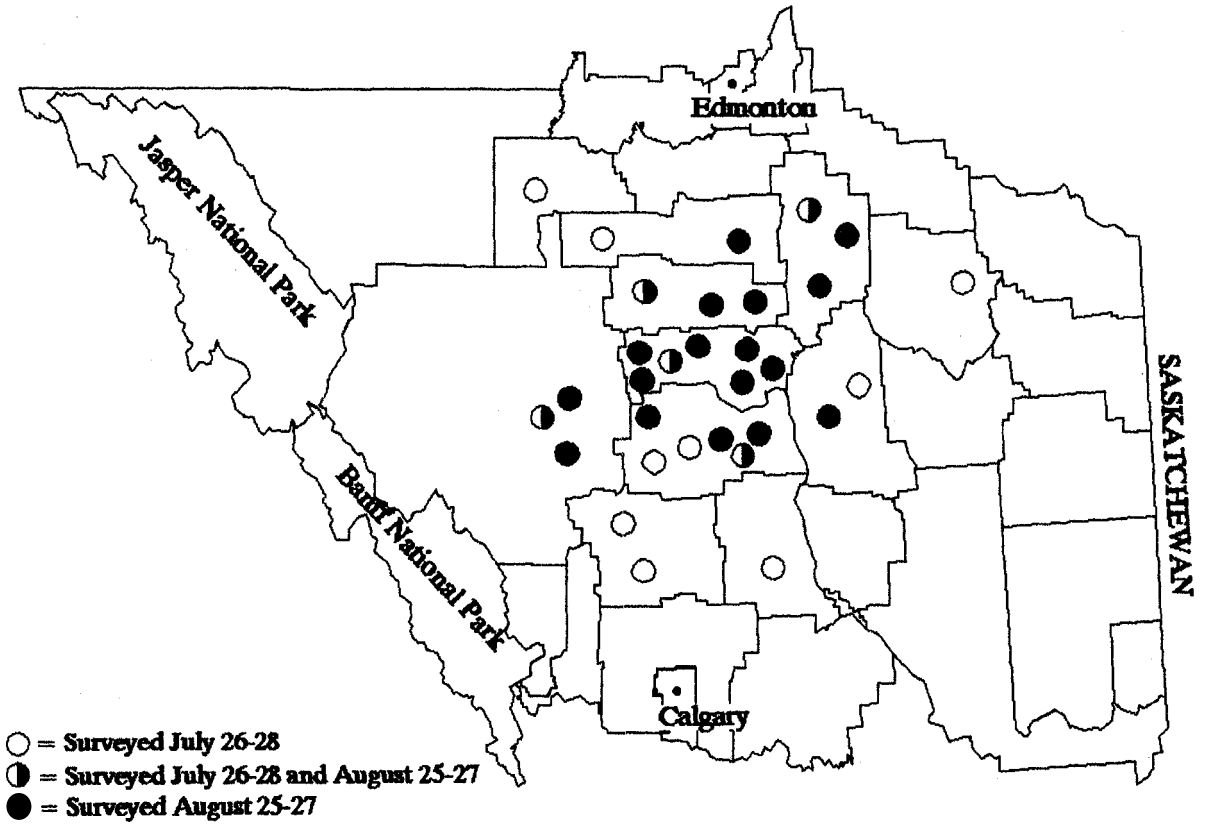


Figure 1. Locations of pea crops surveyed for diseases in central Alberta in 1993.

CROP: Sunflower

LOCATION: Manitoba

NAME AND AGENCY:
K.Y. Rashid[1] and R.G. Platford[2]
[1] Agriculture Canada Research Station, Unit 100-101 Route 100, Morden R6M 1Y5
[2] Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent, Winnipeg, Manitoba R3T **5S6**

TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 1993

METHODS: A total of 50 sunflower crops in southern Manitoba and **6** crops in southeastern Saskatchewan were surveyed in 1993. Twenty-six crops were surveyed on August 23-25, 17 on September 9-10, and 13 on October 5. Crops were selected at random in different regions. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an M pattern (3,4). Diseases were identified by symptoms and the incidence of downy mildew (*Plasmopara halstedii*), sclerotinia wilt or head and stem infections *(Sclerotinia sclerotiorum*), and verticillium wilt (*verticillium dahliae*) were recorded. Disease severity for rust (*Puccinia helianthi*) and leaf spots (*Septoria helianthi* and *Alternaria* spp.) were measured as percent leaf area affected. Disease severity for phoma (*Phoma* spp.) was measured as percent stem area affected. All **56** crops were assessed for sclerotinia wilt, however, only the 30 fields surveyed in September-October were assessed for sclerotinia headrot and mid-stem infections due to the lack of symptoms in crops surveyed early (Table 1). Similarly due to an early frost which killed the leaves, only the 43 crops surveyed up to September 15 were assessed for all other diseases. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1). In addition, 17 samples of sunflower were submitted for analysis to the Manitoba Agriculture Crop Diagnostic Centre by agricultural representatives and growers.

RESULTS AND COMMENTS: The crop conditions were generally good during the first half of the growing season. The above normal rainfall created high soil moisture content and waterlogging in the low spots of many sunflower fields in Manitoba, and that resulted in poor stand and vigour in such spots. The crop was 2-3 weeks later than normal and the early frost must have contributed to low yield and quality at harvest.

Sclerotinia wilt/basal stem infection was prevalent in 68% of all fields surveyed but the incidence was very low and ranged from traces to 5% infected plants. However, the incidence and severity of headrot and mid-stem breakage from ascospore infections were much higher in 1993 than in previous years (1,3,4). Twenty-nine crops, out of 30 surveyed towards the end of the season, showed prevalent headrot/mid-stem infections, with incidence ranging from 5% to 60% infected plants. The ratio of headrot to mid-stem infections varied among fields but was relatively equal in individual crops. Seven of the 13 crops surveyed in October had 40-50% mid-stem infections which resulted in stem breakage and total yield loss in the infected plants.

Verticillium wilt was prevalent in 27 crops (63% of those surveyed in August-September) with incidence ranging from traces to 5% infected plants in oilseed hybrids, and from 5% to 50% in confectionery hybrids. The high disease incidence in confectionery types is due to the lack of resistance to this disease in most of these hybrids.

Downy mildew was observed in 9 crops (21% of those surveyed in August-September) with incidence ranging from trace to 5% in all infested crops.

Rust was the least prevalent disease in 1993, and was observed in *8* crops (19% of craps surveyed in August-September) with disease severity of traces to <1% leaf area affected. The incidence and severity of rust in 1993 in Manitoba were the lowest recorded in the last ten years due to the exceptionally low temperatures during the 1993 growing season (1,2,3,4).

Leaf spots were common in 40% of crops surveyed in August-September with severity ranging from traces to 10% leaf area affected. Stem lesions caused by *Phoma* spp. were observed in 23% of crops with severity ranging from traces to 10% infected plants.

Leaf damage from the sunflower beetle *(Zygogrammaexclamtionis*) was observed in all crops surveyed, with severity ranging from 5% to 50% leaf area consumed by the beetles.

Of the 17 samples submitted to the Manitoba Agriculture Crop Diagnostic Centre, two showed sclerotinia headrot, and one each of fusarium rot and botrytis. In addition to diseases, 14 of the samples were found to be affected by herbicide drift and one affected by insect damage.

REFERENCES

1. Rashid, K.Y. and R.G. Platford. **1991.** Survey of sunflower diseases in Manitoba in **1990.** Can. Plant Dis. Suw. **71**:110-111.
2. Rashid, K.Y. **1991.** Incidence and virulence of *Puccinia helianthi* on sunflower in western Canada during **1988-1990.** Can J. Plant Pathol. 13:356-360.
3. Rashid, K.Y. and R.G. Platford. **1992.** Survey of sunflower diseases in Manitoba in **1991.** Can. Plant Dis. Surv. 72:88-89.
4. Rashid, K.Y. and R.G. Platford. **1993.** Survey of sunflower diseases in Manitoba in **1992.** Can. Plant Dis. Suw. 73:101-102.

Table 1. Prevalence and severity of sunflower diseases in Manitoba and southeastern Saskatchewan in 1993.

DISEASE	NO. AND % OF FIELDS INFESTED*	DISEASE INDEX**	
		MEAN	RANGE
Sclerotinia wilt	38 (68%)	0.6	T-1
Sclerotinia headrot	29 (97%)	2.3	1-4
Sclerotinia mid-stem	29 (97%)	2.2	1-4
Verticillium wilt	27 (63%)	1.0	T-4
Downy mildew	9 (21%)	0.7	T-1
Rust	8 (19%)	0.5	Traces
Leaf spots	17 (40%)	1.1	T-2
Phoma stem lesions	10 (23%)	1.0	T-2
Stand	56	1.3	1-3
Vigour	56	1.6	1-3

* Sclerotinia wilt was assessed on all 56 fields surveyed; sclerotinia headrot/mid-stem infections were assessed on 30 fields surveyed in September-October; while rust, downy mildew, and verticillium wilt were assessed on 43 fields surveyed in August-September.

** 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 leaf spots and rust and percent stem area infected for phoma. Indexes for stand and vigour are based on 1-5 scale (1= very good and 5= very poor).

CROP: Sunola

LOCATION: Saskatchewan

NAME AND AGENCY:
Pearse, **P.G.,** R.A.A. Morrall, and K. Morton
Department of Biology, University of Saskatchewan, Saskatoon S7N 0W0

TITLE: INCIDENCE OF SCLEROTINIA ON SUNOLA IN SASKATCHEWAN IN 1993

INTRODUCTION: Production of sunflower in Saskatchewan increased from 5,400 tonnes (1983-1992 average) to 35,000 tonnes in 1993 (2). The increase can be largely attributed to the production of sunola, a miniature sunflower bred for Saskatchewan's climate (1). Like all sunflowers, sunola is susceptible to *Sclerotinia sclerotiorum*. Symptoms such as bleaching and shattering of the stem base result from myceliogenic germination of sclerotia and invasion of the roots. Upper stem lesions and head rot are caused by air-borne ascospores.

METHODS: Sixty-two sunola crops were surveyed for sclerotinia diseases between September 4 and 27. The majority of the survey was focused on areas of canola production such as Crop Districts (CD) 6B, 8A, 8B, 9A, and 9B (2). Sunola crops in CD 7A, where predominantly cereals are grown, were also surveyed. Crops were sampled at four well-separated sites as in the 1992 survey (1). If 5 % or more of the plants were diseased, 100 plants at each site were scored to determine % disease incidence (DI). If less than 5 % were diseased, DI was recorded as a 'trace'. Disease incidence for basal stem and for aerial (upper stem and head rot) infections were recorded separately. A mean plant density (number plants/m^2) per field was determined by counting the number of plants in a 1 m^2 quadrat at each sample site. Information about crop history and seeding rates was obtained from the growers.

RESULTS AND DISCUSSION: Total DI ranged from zero to 81 % with aerial infection accounting for approximately 75 % of the disease (Table 1). In contrast, in 1992 DI ranged from zero to 14 %, the majority due to basal stem rot (1). The increase in disease, especially aerial infection, was probably due to the above normal precipitation in the 1993 growing season. Most of Saskatchewan received heavy rains beginning in early July and lasting through August (2), making conditions favourable for ascospore production.

Total DI values were greatest in CD 8A, ranging from 20 to 81 % (Table 1). The abundant moisture and inoculum density in this canola-producing area were probably responsible for the high DI. In CD 6B total DI ranged from trace to 27 %, in CD 9B from trace to 26 %, in CD 9A from trace to 19%, and in CD 8B from trace to 17 %. In CD 7A, where only one of the ten fields surveyed had previously been sown to a crop susceptible to S. *sclerotiorum*, DI ranged from absent to trace (Table 1). Aerial infection was evident in all the crops in which the disease occurred, while basal stem rot was evident in only one. In 1992, no sclerotinia diseases were found in CD 7A (1). Above average precipitation in CD 7A probably caused the increase in aerial infection in 1993. Susceptible weeds may have maintained a low inoculum level in previous years or seed containing sclerotia may have been used in 1993.

The mean seeding rate and plant density were similar among CD's and therefore not likely to be a primary factor in determining DI (Table 1). However, the average seeding rate increased from 5.6 kg/ha in 1992 (1) to 10.8 kg/ha in 1993. A higher seeding rate may allow increased contact of roots with sclerotia or a heavier canopy favourable for ascospore production.

In 1992, no correlation was found between DI and crop history (1). In 1993, there was also no significant regression of DI (either total or basal stem rot) on number of years since the previous susceptible crop, although there was a slight trend of less basal stem rot with increasing number of years. Crops with high basal DI occurred in fields with two and three year rotations. However, the majority of crops in CD 9B were in fields with two to four year rotations but showed only trace amounts of basal stem rot.

ACKNOWLEDGEMENTS; The assistance of the sunola growers and **D.S.** Hutcheson is greatly appreciated.

REFERENCES

1. Pearse, P.G. and R.A.A. Morrall. **1992** Incidence of sclerotinia on sunola in Saskatchewan in **1992.** Can. Plant Dis. Surv. **73: 103-104.**

2. Saskatchewan Agriculture and Food. Final Crop Report - No. **30.** Regina, Saskatchewan. **Nov. 4, 1993.**

Table 1. Summary of % disease incidence, seeding rates, plant densities, and crop rotations for 62 sunola crops in Saskatchewan, 1993.

CD*	No. crops surveyed	Mean seeding rate kg/ha	Mean density pl/m^2	Mean (range) % aerial DI	Mean (range) % basal DI	Rotation (years)***
7A	10	10.7	15.4	t(0-t)**	0(0-t)	>6
66	8	10.4	14.1	5(t-16)	4(t-11)	3
8A		11.7	16.6	36(19-60)	8(t-21)	3
8B	8	10.1	16.7	7(t-13)	2(0-10)	4
9A	7	11.1	14.5	3(t-12)	2(0-7)	4
9B	24	11.2	15.6	3(t-23)	2(0-13)	3

* **Crop Districts**

** **t = trace amount** of **disease (< 5 %) Traces were counted as 1 % when calculating mean** DI.

*** **Mean number** of **years between susceptible host crops.**

Vegetables / Legumes

CROP: Corn, *Zea mays* L.

LOCATION: Southern Alberta

NAME AND AGENCY:
R.J. Howard, M.A. Briant and S.M. Sims
Alberta Special Crops and Horticultural Research Center, Brooks, Alberta T1R 1E6
Tel. (403)362-3391; Fax: (403)362-2554

TITLE: SEEDLING DISEASES OF CORN IN SOUTHERN ALBERTA IN 1993

METHODS: Sixty-three irrigated commercial corn fields in four districts (Fig. 1) were surveyed for seedling blight diseases from June 22-30. The districts included the County of Newell (Brooks-Rolling Hills), Municipal District of Taber (Taber-Barnwell-Purple Springs), County of Forty Mile (Bow Island-Burdett), and Municipal District of Cypress (Medicine Hat-Redcliff). Processing, fresh market, grain and silage corn fields were included in the survey. A sample of 30-60 plants was collected from each field. These samples were obtained by entering individual fields at one corner, walking 200 paces toward the center, then stopping at five equidistant points along an exit transect to the nearest edge of the field. All of the plants in a 2m section of row at each point were dug and returned to the laboratory where they were washed and rated for disease.

Seedling blight incidence was determined by counting the number of plants with symptoms of root rot, while severity was estimated visually on the same plants using the following five-point scale: clean (0) = no root rot, slight (1)= 1-25% of the roots rotted, moderate (2)= 26-50% root rot, severe (3)= 51-75% root rot, and very severe (4)= >75% root rot. Samples of diseased roots were surface sterilized and plated out onto acidified potato dextrose agar and onto cornmeal agar amended with penicillin, vancomycin and pimaricin to isolate potential fungal pathogens.

RESULTS: The age and size of the corn plants varied from field to field, but most were at the 5- to 8-leaf stage at the time of sampling. Seedling blight was found in all four corn types surveyed, but not in all fields (Table 1). Over 1735 ha were examined, with about 1695 ha (98%) being infected. The lowest incidence of seedling blight occurred in field corn (grain and silage) and the highest was in sweet corn (processing and fresh market). Overall, the disease severity was rated as slight (<25% roots rotted). Fungi isolated from the roots of affected seedlings collected during the survey included species of *Pythium, Fusarium, Penicillium, Trichoderma, Gliocladium, Rhizopus* and *Bipolaris*. Species identification and pathogenicity testing of these isolates are pending. Three- to five-leaf dieback, a seedling disease caused by *Penicillium* spp. and previously unreported in Alberta, was prevalent in some cultivars of Super Sweet corn in the Taber area.

COMMENTS: Although seedling blight was present in many corn fields in 1993, it was a relatively minor problem in most cases. Cool, wet soil conditions in May and June were unfavorable for germination and emergence of corn, and appeared to favor seedling blight in several of the fields surveyed.

Table 1. Number and area of corn fields surveyed for seedling blight, proportion of fields affected and blight incidence and severity in southern Alberta in June, 1993.

CORN TYPE	NO. FIELDS SURVEYED (HA)	AREA SURVEYED	% AREA SURVEYED WITH SEEDLING BLIGHT	AVG. BLIGHT INCIDENCE (% BLIGHTED SEEDLINGS)	AVG. BLIGHT SEVERITY (0-4)*
Processing	25	894	100	29.3	0.5
Fresh market	27	170	99	23.7	0.4
Grain	7	440	87	15.3	0.2
Silage	4	232	100	12.2	0.1
Total	63	1736			

* **Clean (0) = no root rot, slight (1) = 1-25% of the roots rotted, moderate (2) = 26-50% root rot, severe (3) = 51-75% root rot, and very severe (4) = >75% root rot.**

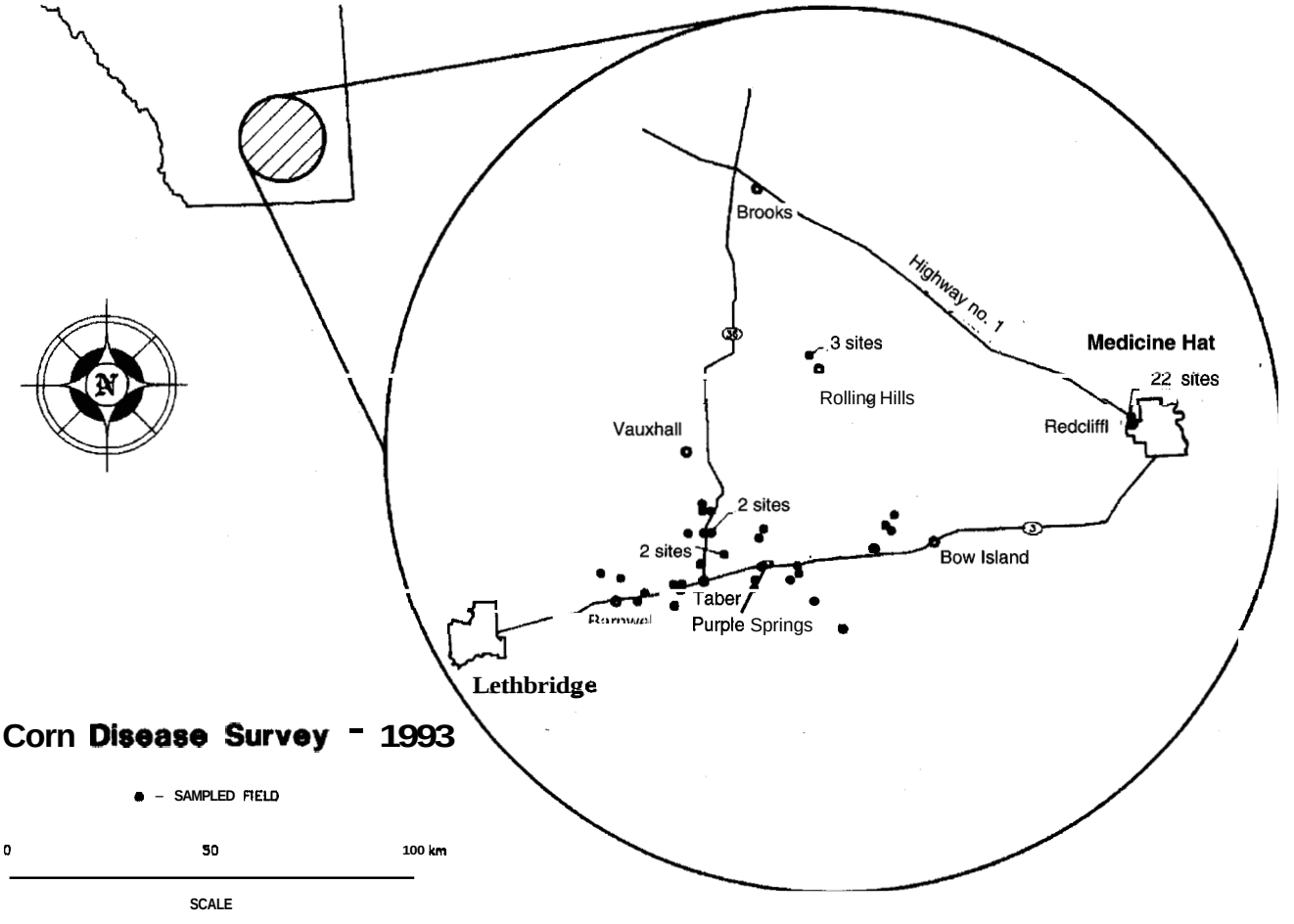


Figure 1. Location of corn fields surveyed for seedling blight in southern Alberta in 1993.

CROP: Cucumber

LOCATION: Central Alberta

NAME AND AGENCY:
K.F. Chang, **W.** Chen, B. Choban and M. Mirza
Alberta Tree Nursery and Horticulture Centre, R.R. 6. Edmonton, Alberta T5B 4K3

TITLE: PYTHIUM ROOT ROT OF FIELD GROWN CUCUMBERS IN CENTRAL ALBERTA IN 1993

INTRODUCTION: Commercial producers of field cucumber crops in central and northern Alberta, experienced above normal Pythium root rot disease in their fields in 1993. Due to cool wet spring weather, the disease quickly destroyed early cucumber plants. Later crop plantings were also affected but not as severely. Fields seeded for mid season markets were surveyed for the disease.

METHODS: Seven cucumber (pickling and slicing) fields were surveyed for Pythium root rot disease in areas surrounding Edmonton in July 1993. The survey procedure consisted of staking a "W" shaped pattern in each field. The areas of the field that lay on each of the five corners of the " W configuration were surveyed for root rot. Each of these areas measured 8 m in length and 10 row crop widths. The percentage of infected cucumber plants was recorded and averaged from each area and from each field. Soil samples were also collected at each location in the field and their populations of *Pythium* spp. determined on PVP medium.

RESULTS AND COMMENTS: Root rot of cucumber was found in all fields (Table 1). One hundred percent disease incidence occurred in some field depressions that had been previously flooded by prolonged rains. The amount of infection ranged from 0.9 to 29.9 percent among the fields. The high disease incidence this year can be attributed to unusually low temperatures and frequent rainy periods occurring in the spring and summer. Approximately 250 Pythium cultures were isolated from the diseased root samples. The average Pythium populations were low (30-230 propagules/g soil) and varied with locations in the same field.

Table 1. Disease incidence of Pythium root rot of field grown cucumber in central Alberta, 1993.

FIELD NO.	CULTIVAR	NO. PLANTS EXAMINED	INFECTION (%)	PYTHIUM POPULATION (PROPAGULE/G SOIL)
1	Fancipak	2,438	0.9	30
2	Comet	1,483	4.6	55
3	Calypso, Royal	2,321	7.8	188
4	Green Spear	3,305	9.8	125
5	Pioneer	1,945	21.8	230
6	Calypso	2,211	27.7	180
7	Victory, Spear-It, Pick-Rite	1,636	29.9	110

CROP: Potato, *Solanum tuberosum* L.

LOCATION: Prince Edward Island

NAME AND AGENCY:
H.W. (Bud) Platt
Potato Program/Pathology
Agriculture Canada, Research Station, P.O Box 1210, Charlottetown C1A 7M8
Tel. (902) 566-6839; FAX (902) 566-6821

TITLE: SURVEY FOR THE PRESENCE OF A2 MATING TYPE AND METALAXYL-INSENSITIVE STRAINS OF THE CAUSAL AGENT OF POTATO LATE BLIGHT

METHODS: *Phytophthora infestans* (Mont.) de Bary, causal agent of late blight of potatoes and tomatoes, was isolated from diseased potato leaves (10-15) that were collected during August from 5-10 commercial fields across Prince Edward Island in 1992 and 1993. Fields were selected on the basis of late blight presence and previous use of metalaxyl (Ridomil MZ, Ciba Geigy Corp.). Fungal isolates cultured on rye grain agar at labs in P.E.I., Ottawa (G. White), Vancouver (Z. Punja), Maryland (K. Deahl), and New York (W. Fry and S. Goodwin). Agar blocks of cultured isolates were transferred to either plates amended with metalaxyl (0 and 1-100 ppm) or plates with a known mating type and examined for mycelial growth and oospore production, respectively.

RESULTS AND COMMENTS: In 1992 and 1993, all isolates of *Phytophthora infestans* collected from Prince Edward Island were of the traditional A1 mating type and were sensitive to metalaxyl. However, new mating types (A1 and A2) and metalaxyl-sensitive strains have been found in British Columbia, Florida, Kentucky, N. Carolina, Tennessee, New York, Maine, Michigan, and California. In addition, Florida, Oregon, and Washington have the A1 mating type and metalaxyl-insensitive strains. These changes to the pathogen populations in the various production areas require monitoring as European data suggests that the new genotypes are often more fit and aggressive. Furthermore, where sexual reproduction occurs, disease control will have to deal with (for the first time) the problem of infested materials as oospores may survive outside of host tissues.

While the immediate solution to these new late blight problems will be a greater adherence to the currently available disease management recommendations, the first issue to be addressed will involve the metalaxyl-insensitive strains. It is important to maintain access to metalaxyl as it is the only systemic fungicide registered for late blight of potatoes in Canada. Therefore, planting healthy seed and destroying culls and volunteer plants infected with these strains of the pathogen will be necessary to prevent introduction or spread of metalaxyl-insensitive strains. Similarly, proper use of the fungicide will be required to avoid development of insensitive strains during the growing season.

CROP: Tomato

LOCATION: Ontario

NAME AND AGENCY:
K.F. Dobinson and G. Lazarovits
Agriculture Canada, Research Centre, 1391 Sandford St., London, Ontario N5V 4T3
Tel: (519)663-3130 Fax: (519)645-4085

TITLE: INCIDENCE OF *VERTICILLIUM DAHLIAE* INFECTION IN PROCESSING TOMATOES IN SOUTHERN ONTARIO

METHODS: The levels of *Verticillium dahliae* (Kleb.) in the soil and the incidence of infection of processing tomato plants, were assessed in five fields near Leamington, ON, in 1993. In May, soil cores were taken from each of 5 sites in approximately 100 m length sections of beds that had been prepared for planting. The soil samples were air dried and plated onto a semi-selective agar medium (SPT agar; soil extract agar containing 0.2% polygalacturonic acid and 0.05% Tergitol NP-10), using an Anderson sampler. On July 15 and on August 10, 60 plants were sampled at random from the same areas that the soil samples had been taken. Two leaves were taken from each plant, the petioles were surface sterilized and cross-sections were plated onto SPT agar. The plates were incubated at 24°C for 10 to 14 days and *V. dahliae* colonies were visualized microscopically. Pure cultures of the fungus were obtained from the soil plates, from trap plants cultivated in growth chambers in the field soil, and from the petiole sections. The isolates were tested for pathogenicity on a susceptible tomato variety (Bonny Best) and a race l-resistant variety (H1350).

RESULTS AND COMMENTS: The levels of *V. dahliae* in the soil and the incidence of infected plants in the five fields are summarized in Table 1. Disease incidence was not reliably predicted by soil inoculum levels. In fields number 1 and number 2, plants from both nonfumigated and fumigated soil showed essentially the same incidence of infection. Forty-seven *V. dahliae* isolates have so far been tested for pathogenicity. Forty-six have been typed as race 2, and only one as race 1, suggesting that race 2 (for which there are no resistant cultivars) has become prevalent in the field. Although race 2 isolates generally produced less severe disease symptoms than race 1 isolates, the pathogenicity tests indicated virulence differences between the race *2* isolates.

ACKNOWLEDGEMENTS: We are grateful to Geraldine Dunn and Sandra Grant for excellent technical support and to Andrew Dick (H.J. Heinz Company of Canada Ltd.) for providing access to and information about the tomato fields. The cooperation of the tomato growers is also appreciated. This work was funded, in part, by a grant from the Southwestern Ontario Agricultural Research Corporation.

Table 1. Incidence of *Verticillium dahliae* in Leamington soil and field-grown tomatoes.

FIELD	FUMIGATION	# *V. DAHLIAE*	% INFECTED PLANTS	
		COLONIES/G SOIL*	JULY	AUGUST
1		36	**42**	67
1	+	ND**	ND	57
2		16	47	62
2	+	9	ND	63
3		**4**	3	17
4		96***	20	**28**
5**		**4**	36	33
5		ND	15	**18**

* Values are the averages from the five sites sampled. 500 mg soil from each site was plated.

** ND, not determined.

*** Soil inoculum levels were determined in July, at the time the first plants were sampled.

**** In field number *5,* plants were sampled from two beds containing different cultivars.

Tree Fruits and Nuts / Arbres fruitiers et noix

CROP: Sweet cherry

LOCATION: Kootenay Valley, British Columbia

NAME AND AGENCY:
K.C. Eastwell and T.S.C. Li
Agriculture Canada, Research Station, Summerland, British Columbia V0H 1Z0
Tel: (604) 494-7711; Fax: (604) 494-0755

TITLE: STATUS OF THE LITTLE CHERRY DISEASE ERADICATION PROGRAM IN THE KOOTENAY VALLEY OF BRITISH COLUMBIA

METHODS: Cherry trees in the southern portion of the Kootenay Valley, encompassing the communities of Creston, Erickson, Canyon, Lister and Wynndel, were inspected by representatives of the Regional District of Central Kootenay during the second week of July. This was followed by an inspection the following week by scientists from the Agriculture Canada Research Station, Summerland. Determination of the little cherry disease-status of cherry trees was based on visual inspection: the characteristic symptoms of little cherry disease include small triangular fruit, insipid flavour and delayed colouration. Budwood was collected from symptomatic trees when the fruit symptoms were mild, or when the little cherry disease symptoms were accompanied by other obvious signs of stress such as winter injury, nutritional deficiency, water deficiency or other virus infections. At least two budsticks were collected from different areas of the tree. Four buds from each tree were T-budded onto individual Canindexl and/or mature fruiting Lambert trees in an orchard at the Summerland Station. Trees were observed for two years for the appearance of little cherry disease symptoms: premature reddening of the Canindexl foliage and typical fruit symptoms of Lambert.

RESULTS AND COMMENTS: Little cherry disease was first reported in the Kootenay Valley in 1933, and rapidly spread throughout much of the valley. This lead to the termination of commercial cherry packing line in 1976. Since the Kootenay Valley is geographically isolated from external sources of little cherry disease inoculum, a trial was initiated to completely eliminate the little cherry disease agent from the Valley. Since its inception in 1982, 3894 infected trees have been removed as part of the eradication program.

The number of infected trees identified in the survey continues to decline (Table 1). The survey conducted in 1992 was the first to emphasize indexing of sour cherries and white fleshed cherry varieties such as Ranier and Royal Ann. The little cherry disease status of sour and white fleshed cherries is extremely difficult to determine on the basis of visual inspection in the field. Of the total of 96 infected trees in the 1992 survey, 12 were white fleshed varieties, and 3 were sour cherries. These results emphasize the importance of these cultivars as significant reservoirs of the little cherry disease agent. In 1993, no trees with symptoms typical of first year infection were observed. Most of the newly reported infections of little cherry disease results from the survey expanding into previously uninspected plantings of cherry, including residential properties.

Table 1. Recent survey results for Little Cherry Disease in the south Kootenay Valley of British Columbia.

		SURVEY RESULTS					
YEAR	TREES INFESTED	TREES INDEXED	TYPICAL FIELD SYMPTOMS	POSITIVE ON CANINDEX1	POSITIVE ON LAMBERT	TOTAL INFECTED[a]	TREES REMOVED
1990	3407	162	54[b]	86	22	148[c]	139
1991	3654	104	35[d,e]	45	19	88	101
1992	3800	200	3[e]	93[f]	2[f]	96	94[g]
1993	4366	160	22	NA[h]	NA	NA	NA

a Since the little cherry disease-status of some trees was determined by more than one method, the total number of infected trees will be lower than the sum of positive samples from each indexing method.

b Of these **54** trees, only **4** had not been identified by a previous survey.

c In addition to **148** infected sweet cherry trees, little cherry disease was also detected in two samples of cherry seedlings and two samples of Prunus emarginata.

d Of these **35** trees, only **13** had not been identified by a previous survey.

e Only one tree showed severe shock symptoms characteristic of the first year of infection.

f First year readings only.

g In addition to **94** little cherry disease-infected trees, **40** derelict trees were removed.

h NA = data not available.

The eradication program is proving highly successful as indicated by the observation of very few trees displaying the severe symptoms associated with first year infections. With the declining spread of little cherry disease, local orchardists have embarked on an extensive replanting program to reestablish commercial production and packing of sweet cherries in the Kootenay Valley.

CROP: Sweet Cherry

LOCATION: British Columbia

NAME AND AGENCY:

G.D. Jesperson[1] and G. Carte:

[1] B.C. Ministry of Agriculture, Fisheries and Food
200-1690 Powick Road, Kelowna, British Columbia V1X 7G5

[2] B.C. Ministry of Agriculture, Fisheries and Food
4607-23 Street, Vernon, British Columbia V1T 4K7

TITLE: LITTLE CHERRY VIRUS SURVEY IN THE OKANAGAN VALLEY OF BRITISH COLUMBIA

METHODS: Cherry trees in the Okanagan Valley of British Columbia were surveyed between July 5 and July 27, 1993 for symptoms of little cherry virus disease. Two employees of the B.C. Ministry of Agriculture, Fisheries and Food, Crop Protection Branch, examined orchards in districts with a history of the disease, including the areas around Penticton, Naramata, Summerland, Westbank, Kelowna and Oyama. Approximately 45 orchards and 25 residential yards were included in the survey. Diagnosis of little cherry disease was based on symptoms, including small, pointed and angular fruit with poor colour and poor flavour. Following diagnosis, tree owners were issued removal notices under the authority of the B.C. Plant Protection Act. Trees with questionable symptoms were indexed at the Agriculture Canada Research Station virus orchard at Summerland, by grafting buds onto indicator cherry trees, variety Canindex 1. Indexing results for the 1993 samples will be available by September, 1994.

RESULTS AND COMMENTS: Twenty-four diseased trees were identified in 1993; seven were identified visually, while seventeen were identified based on indexing results from 1992 samples. Fifteen of these diseased trees were located in Penticton, six in Westbank, two in Kelowna, and one in Naramata. An additional four diseased trees which were identified in 1992 but not removed were located in a Penticton orchard. Budwood samples for indexing were collected in August from an additional thirty-three trees.

The number of little cherry infected trees has remained steady for the past five years. Penticton remains the most affected area.

Small Fruits / Petits fruits

CROP: Raspberry, *Rubus idaeus* var. *strigosus*

LOCATION: Eastern Ontario

NAME AND AGENCY:
K.P. Schooley[1] and R.R. Martin[2]
[1] Ontario Ministry of Agriculture and Food, Kemptville, Ontario
[2] Agriculture Canada, Research Station, Vancouver, British Columbia

TITLE: SURVEY FOR TOMATO RINGSPOT VIRUS IN RASPBERRY PLANTINGS IN EASTERN ONTARIO

METHODS: Leaf tissue from young primocanes of raspberry was randomly selected from blocks of raspberries at 17 farms in eastern Ontario. Leaf samples of weed species known to be hosts of tomato ringspot virus (TomRSV) were also tested. Thirty samples were collected at each farm, each sample consisted of three leaves of raspberry or the weed species tested. Leaves were also taken from wild raspberries adjacent to the planting when available. The samples were collected over a two week period and shipped to Agriculture Canada Research Station in Vancouver for analysis.

Samples were tested by ELISA for TomRSV, raspberry bushy dwarf virus (RBDV) and tobacco steak virus (TSV). In each case the trapping antibody was IgG purified from a rabbit polyclonal antiserum and used at a concentration of 1 ug/ml. For TomRSV and TSV the secondary antibodies were specific monoclonal antibodies which were detected with rabbit antimouse alkaline phosphatase. For RBDV the monoclonal antibody was conjugated with alkaline phosphatase and used at 1 ug/ml. p-nitrophenyl phosphate in diethanolamine buffer was the substrate used and the absorbance values were determined with a 96 well plate reader.

RESULTS AND COMMENTS: Of the 17 farms surveyed, 7 **(41%)** tested positive for TomRSV. The virus was not specific to any one cultivar as four different cultivars, including one purple raspberry (Rayalty), tested positive. TomRSV was also found in some of the wild raspberries sampled. Wild raspberries that tested positive were only on farms where cultivated raspberries also tested positive. Most of the plantings that tested positive for TomRSV were greater than eight years old. Broad-leaved plantain, *Plantago major* L. and dandelion, *Taraxacum officinale* Weber were the most commonly sampled weed species, none of which tested positive for TomRSV. Only one sample tested positive for RBDV. The presence of TomRSV in wild raspberries suggests that when replanting these fields inoculum sources from field perimeters must be considered in site selection and preparation.

CROP: Saskatoon and Raspberry

LOCATION: Alberta

NAME AND AGENCY:
J.T. Calpas,' B.J. Penner[1], R.J. Howard[2] and R. Stace-Smith[3]
[1] Brooks Diagnostics Ltd., Brooks, Alberta T1R 1C5
[2] Alberta Special Crops and Horticultural Research Center, Brooks T1R 1E6
[3] Agriculture Canada Research Station, Vancouver, British Columbia V6T 1X2

TITLE: SASKATOON AND RASPBERRY VIRAL DISEASE SURVEY IN ALBERTA

METHODS: A survey for viral diseases in commercial saskatoon and raspberry plantings in Alberta was carried out in August by Brooks Diagnostics Ltd., the Alberta Special Crops and Horticultural Research Center, and the Vancouver Research Station. Laboratory confirmation of the presence or absence of viruses was carried out at the Vancouver Research Station.

Nine raspberry and nine saskatoon fields representing approximately 90% of the total commercial area for both crops were surveyed. Alberta has approximately 50 ha of raspberries and 125 ha of saskatoons in production, with another 250 ha of saskatoons planted but not yet bearing fruit. The fields were surveyed by walking individual rows and whenever a plant displayed characteristic virus-like symptoms, e.g. leaf mosaic, mottling, cupping or puckering, or general stunting, a portion was collected for further study. In the laboratory, the samples were examined to confirm whether or not the symptoms could be due to a viral infection and, if so, which virus or viruses might be responsible. To determine if sap-transmissible viruses were present, extracts of all suspect plants were inoculated onto three indicator hosts, i.e. *Chenopodium quinoa*, cucumber and Xanthi tobacco. These plants were rub-inoculated using a leaf tissue macerate, which was prepared by grinding a small amount of each sample in a 2% nicotine solution. The indicator plants were examined for symptoms of viral infection two weeks after inoculation.

RESULTS AND COMMENTS: Six raspberry and six saskatoon samples were suspected of being infected with viruses. Visual examination of the raspberries suggested that four of the samples had symptoms resembling raspberry leaf curl virus infection. As this virus is reported to be non-sap-transmissible, we did not expect to be able to transmit it to the herbaceous indicator hosts used in this study. Close examination of the saskatoon samples revealed that none exhibited symptoms characteristic of any known fruit crop viral disease. None of the indicators displayed any viral disease symptoms two weeks after inoculation. This suggested that either the symptoms observed were not due to any sap-transmissible viruses or that because the plants were surveyed late in the season, sap-transmissible viruses may not have been recoverable from the samples. These viruses are more readily recovered from young, succulent tissue than from mature plant material collected later in the growing season.

Other diseases and pests noted during the survey were: powdery mildew (*Sphaerotheca macularis*) fire blight (*Erwinia amylovora*), iron deficiency, and spider mites on raspberries; and entomosporium leaf and berry spot (*Entomosporium mespili*), black leaf and witches' broom (*Apiosporina collinsii*), iron chlorosis, spider mites, and pear slugs on saskatoons.

Commercial raspberry and saskatoon plantings in Alberta appear to be relatively free from viral diseases. Further studies into potential viral diseases in commercial fields should be carried out early in the growing season to increase the chances of detecting any sap-transmissible viruses that may be present.

ACKNOWLEDGEMENTS: We gratefully acknowledge the assistance of Ms. Wendy Hale and Ms. Susan Sims for examining orchards and collecting plant samples during this survey.

This project was funded, in part, by the National Research Council of Canada, through the IRAP Technology Enhancement Program.

CROP: Saskatoon, ***Amelanchier alnifolia*** Nutt.

LOCATION: South-Central Alberta

NAME AND AGENCY:
R.J. Howard, M.A. Briant and S.M. Sims
Alberta Special Crops and Horticultural Research Center, Brooks, AB T1R 1E6
Tel: (403) 362-3391; Fax: (403) 362-2554

TITLE: SASKATOON LEAF AND BERRY SPOT IN SOUTH-CENTRAL ALBERTA IN 1993

METHODS: Five commercial saskatoon orchards (Fig. 1) were sampled in mid-July for leaf and berry spot caused by ***Entomosporium mespili.*** The total area surveyed was 33.5 ha. Depending on the size of the orchard, either every row (small plantings) or every 2nd or 4th row (large plantings) was sampled. This procedure consisted of picking leaves and berries from every 20th shrub in each row examined. Single leaves were collected from the upper and lower portion of individual shrubs and, where available, a cluster of berries was picked from the upper and lower portions *of* the same trees. Disease incidence and severity were assessed on all leaves and berries.

Disease incidence was determined by counting the number of leaves and berries with symptoms of entomosporium leaf and berry spot, then calculating the percentage of diseased leaves and berries out of the total number examined. Disease severity was estimated visually on the same samples using the following five-point scale: clean (0) = no lesions on leaves/berries; slight (1) = 1-25% leaf/berry surface lesioned; moderate (2) = 26-50% lesioned; severe (3) = 51-75% lesioned, and very severe (4) = >75% lesioned.

RESULTS: Overall, the average disease incidence was 62% for leaves and 29% for berries (Table 1). Leaves from the lower half of the shrubs generally had a higher incidence of disease than those from upper portions because *E. mespili* usually infects suckers and lower leaves first, then spreads upward. The average disease severity on the leaves and berries at each of the five locations was slight (<25% of leaf/berry surface lesioned). **All** seven of the saskatoon cultivars examined were susceptible to leaf and berry spot.

COMMENTS: Entomosporium leaf and berry spot was prevalent in all five of the saskatoon orchards surveyed in 1993. The cool, rainy growing season favored the spread and development of this disease.

Table 1. Area of saskatoon plantings surveyed for entomosporium leaf and berry spot, and average disease incidence and severity in five commercial saskatoon orchards in south-central Alberta in July, 1993.

Orchard No.	Size (ha)	Cultivar	Avg. age of orchard (yrs)	Avg. disease incidence (%)		Avg. disease severity (0-4)*	
				Leaves	Berries	Leaves	Berries
1	16.8	Northline (field #1)	3-6	81.3	0.0	1.1	0.0
		Smoky (field #1)		71.1	33.3	0.9	0.3
		Northline (field #2)		33.8	25.9	0.4	0.3
		Smoky (field #2)		36.5	16.2	0.4	0.2
2	12.0	Northline	1-22	51.6	0.0	0.5	0.0
		Honeywood		72.7	6.0	0.9	0.1
		Smoky		70.0	64.9	0.8	0.7
		Forestburg/ Pembina		89.7	59.0	1.1	0.7
3	1.1	Smoky	2-10	77.6	70.0	0.8	0.8
		Thiessen		66.0	57.7	0.8	0.6
		Pearson II		81.8	n/a	1.1	n/a
		Northline		88.3	n/a	1.0	n/a
4	0.8	Smoky	12-17	14.3	1.8	0.1	0.0
5	2.8	(A) Smoky, Pembina, Thiessen (mixed)	1-6	58.5	37.4	0.8	0.8
		(B) Smoky, Pembina, Thiessen (mixed)		24.2	2.5	0.3	***0.0***
		(C) Smoky		69.2	n/a	1.2	n/a

* **Clean (0) = No lesions on leaves/berries; slight (1) = 1-25% leaf/berry surface lesioned; moderate (2) = 26-50% lesioned; severe (3) = 51-75% lesioned, and very severe (4) = >75% lesioned.**

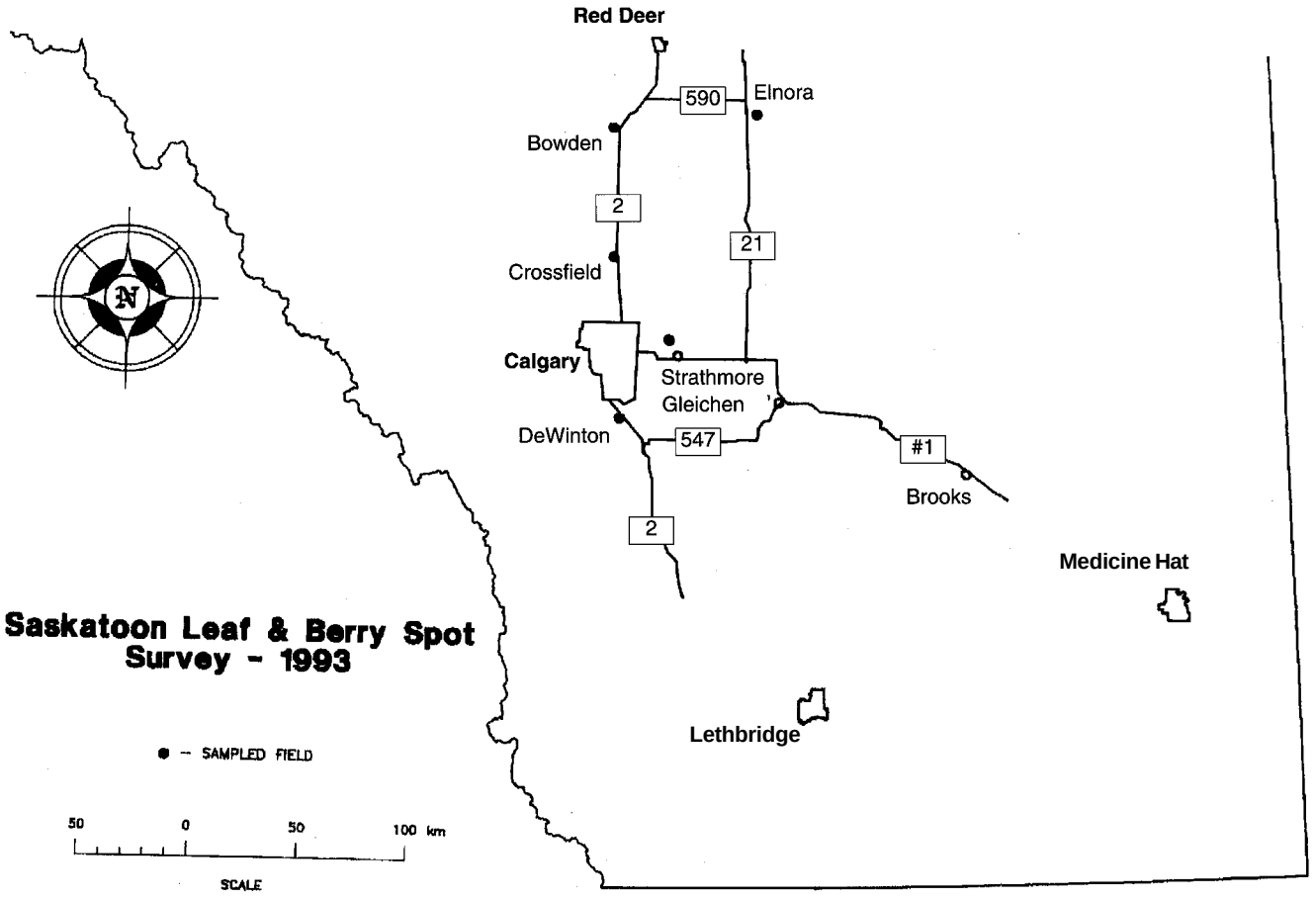


Figure 1. Location of saskatoon orchards surveyed for entomosporium leaf and berry spot in south-central Alberta in 1993.

CROP: Saskatoon, *Amelanchier alnifolia* (Nutt.)

LOCATION: North-central and Peace River regions of Alberta

NAME AND AGENCY:
R.M. Lange and P.S. Bains
Alberta Tree Nursery and Horticulture Centre, Edmonton, Alberta

TITLE: SURVEY OF ENTOMOSPORIUM LEAF AND BERRY SPOT OF SASKATOON IN 1993

METHODS: Four commercial orchards and one wild stand of saskatoon in north-central Alberta were surveyed for entomosporium leaf and berry spot caused by *Entomosporium mespili* (DC ex Duby). Randomly selected samples were taken from 10% of the bushes at each location. Racemes and leaves were taken from the middle and lower portions of each bush sampled, although samples from the bottom of the bushes did not always have berries. Leaves and berries were rated for the percentage of surface area affected by the pathogen: 0 = *0%,* 1 = 1-25%, 2 = 26-50%, 3 = 51-75% and 4 = 76-100%.

In addition, berry samples from 11 commercial orchards in the Peace River region of Alberta were supplied by Peace Country Fruit Growers' Co-operative. Ungraded samples from individual orchards were withdrawn at random intervals from the processing line until approximately 1 litre of berries was collected from each orchard. A subsample of at least 500 berries per orchard was evaluated using the rating scale described above. Microscopic examination of affected berries and leaves was used to confirm the presence of *E. mespili* at all locations. *Entomosporium mespili* cultures were isolated from infected berries.

RESULTS AND COMMENTS: Signs and symptoms of entomosporium leaf and berry spot of saskatoon were observed on each bush at each location surveyed in north-central Alberta (Table 1). Absence of affected berries at a stand of wild plants in the bottom of the North Saskatchewan River valley in Edmonton (Site 5 in Table 1) may be due to a loss of infected berries through picking or fruit drop. Diseased berries were present in all samples from the Peace River region (Table 2). A 100% disease incidence among saskatoon bushes in five orchards in central Alberta was also observed in 1990 (Pesic-van Esbroeck *et al.*, 1991). The results of the previous survey and this study, taken together, indicate that disease incidence is almost 100% in most years.

While disease incidence remained constant when compared with data from the previous central Alberta disease survey (Pesic-van Esbroeck *et al.*, 1991), disease severity appears to have decreased. The rainfall patterns of the 1990 and 1993 growing seasons may explain the differences between the observed disease severities for these years. Weather data collected at the Alberta Tree Nursery and Horticulture Centre indicated that precipitation in spring and summer of 1990 and 1993 was above the long-term average, and 1990 was substantially wetter than 1993. Furthermore, June and July of 1993 were characterised by below-average precipitation, whereas rainfall in amounts nearly two-thirds greater than the long-term average was received during the same months in 1990. The comparatively dry conditions in June of 1993 may have prevented a recurrence of the entomosporium berry and leaf spot epidemic of 1990.

All cultivars appeared to be equally susceptible to the disease; however, the survey revealed some variation in susceptibility to *E. **mespili*** among bushes selected from wild stands. This was particularly apparent at one orchard, where the variation for disease severity among plants transplanted from wild stands was greater than among plants of various commercial cultivars. Genotypes resistant to *E. mespili* selected from wild populations may offer an effective method of disease control.

Table 1. Incidence and severity of entomosporium leaf and berry spot of saskatoon in north-central Alberta in 1993.

SITE	NO. BUSHES SURVEYED	BERRIES (B) OR LEAVES (L)	AFFECTED CLUSTERS*	DISEASE SEVERITY** (% BERRIES AND LEAVES PER CATEGORY) 0	1	2	3	4
1	22	B	90.4	33	39	16	7	5
		L	96.5	25	69	6	0	0
2	72	B	60.8	39	49	12	1	0
		L	***				-	-
3	22	B	83.3	45	34	7	5	9
		L	97.7	31	66	2	1	1
4	95	B	85.7	49	32	7	4	8
		L	94.7	17	74	7	1	1
5	19	B	0	100	0	0	0	0
		L	70.0	70	28	2	0	0

*
** **Racemes with leaves attached.**
*** **Leaves and berries rated according to percentage of surface area affected: 0=0%, 1=1-25%, 2=26-50%, 3=51-75% and 4=76-100%.**
Not collected.

Table 2. Disease severity of entomosporium berry and leaf spot of saskatoon in the Peace River region of Alberta in 1993.

ORCHARD	NO. BERRIES OBSERVED	DISEASE SEVERITY* (% BERRIES PER CATEGORY) 0	1	2	3	4
1	575	19	41	21	14	5
2	520	32	44	15	6	3
3	524	42	38	10	7	3
4	597	18	41	21	10	10
5	608	86	12	2	0	0
6	500	69	30	1	0	0
7	559	37	51	8	3	1
8	513	72	27	1	0	0
9	585	98	2	0	0	0
10	602	84	16	0	0	0
11	577	23	48	22	6	1

* **Berries rated according to percentage of surface area affected: 0 = 0%, 1 = 1-25%, 2 = 26-50%, 3 = 51-75% and 4 = 76-100%.**

REFERENCE

1. Pesic-van Esbroeck, Z., P.S. Bains and **J.A.** Motta. 1991. Survey for common leaf spot, blight and berry spot of saskatoon in central Alberta. Can. Plant Dis. Surv. 71(1):125.

Ornamentals / Plantes ornamentales

CROP: Elm

LOCATION: Manitoba

.NAME AND AGENCY:
R.G. Platford
Manitoba Agriculture, Crop Diagnostic Centre, 201-545 University Crescent, Winnipeg, Manitoba R3T 5S6

TITLE: INCIDENCE OF DUTCH ELM DISEASE IN MANITOBA IN 1993

METHODS: Results are based on samples of American elm, *Ulmus americana* and Siberian elm, *Ulmus pumila* submitted to the Crop Diagnostic Centre from a survey conducted by the City of Winnipeg. Trees were selected for sampling and submissions to the laboratory on the basis of presence of wilted brown leaves and brown staining of the vascular tissues. **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 AND COMMENTS: Dutch elm disease (*Ophiostoma ulmi*) was detected in 945 trees in Winnipeg in 1993. **A** total of 4,217 trees were removed because of suspected Dutch elm disease (DED). Because of budgetary cutbacks by the Department of Natural Resources, only the trees from the City of Winnipeg were culture for DED. Trees from rural Manitoba were field diagnosed and marked for removal on the basis of leaf wilting and presence of stain in the vascular area of branches showing wilt. There were 5,792 trees marked for removal in rural Manitoba on account of being suspected by being affected by DED.

instructionsto authors

The Canadian Plant Disease Survey is published twice a year, presenting articles on the occurrence and severity of plant diseases in Canada. Topics of interest include development of methods of investigation and control, including the evaluation of new materials. Original information, review papers and compilations of practical value to plant pathologists are accepted.

Peer reviewed articles and brief notes are published in English or French. Address the manuscript and all correspondence to Ms. Rosalyn McNeil, Information and Planning Services, Research Branch, Agriculture adn Agri-Food Canada, Ottawa, Ontario K1A 0C6. Signatures of authors and the director of the establishment where the work was carried out should be supplied.

Diskette submission requirements. Please use a 3.5-inch IBM-compatible diskette. The diskette will be returned with author proofs. Send two letter-quality double-spaced printouts of the manuscript and a diskette containing all typed text, tables, figure and photo captions. Save the file, containing a single-spaced version of the article, in Wordperfect, if possible. Alternatively, save the file in ASCII format, instead of in the program's normal format. Consult your software manual for instructions on saving documents as ASCII files (sometimes called DOS files or printer files). Please label your diskette accordingly and indicate the document's full file name, including its extension.

Manuscripts should be concise and consistent in style, spelling, and use of abbreviations. They should be printed double-spaced throughout. Number all pages, including those containing abstract, tables, and legends. For general format and style, refer to recent issues of the Survey and to the *CBE* Style Manual 5th ed., 1983. Whenever possible, give numerical data in metric units (SI). Alternatively, provide the metric equivalents. Use square brackets 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 less than 200 words should accompany each article, and should be provided in both English and French, if possible.

Figures should be planned to fit, after reduction, into one column (maximum 84 x 241 mm) or two columns (maximum 175 x 241). Trim them or add crop marks to show only essential features. Mount figures grouped in a plate tightly together, with no space between them. Provide a duplicate set of unmounted photographs and line drawings. Identify figures by number, author's name, and abbreviated legend.

Tables should be numbered using arabic numerals. Provide a concise title. Do not use vertical rules. Identify footnotes by reference marks (*†§#¶**‡), particularly when they refer 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.

Recommandationsaux auteurs

L'Inventaire des maladies des *plantes au* Canada est publié deux fois par année et contient des articles sur l'incidence et la gravité des maladies des plantes au Canada. Les articles portent surtout sur la mise au point de nouvelles méthodes d'investigation et de lutte comportant l'évaluation de nouveaux matériaux. Nous acceptons aussi des données de premiere main, des comptes rendus critiques de publications et les compilations qui peuvent être utiles aux phytopathologistes.

Les comptes *rendus* critiques et les courts résumés sont publiés en anglais et en français. Adresser le manuscrit et toute la correspondance a mademoiselle Rosalyn McNeil, Service aux programmes de recherches, Services d'information et de planification, Agricultureet Agro-alimentaire Canada, Ottawa (Ontario) K1A 0C6. Vous devez aussi nous faire parvenir la signature des auteurs et du directeur de l'établissement oh le travail a ete effectue.

Exigences pour *la soumission des disquettes.* Veuillez, utiliser une disquette IBM-compatible 3.5 pouces. La disquette vous sera retournee avec les corrections de l'auteur. Envoyer deux copies du manuscrit qualité lettre tapées a double interligne et une disquette contenant tout le texte, les tableaux, les figures et les photos. Sauvegarder le fichier contenant une version de l'article à simple interligne en Wordperfect si possible. Sinon, sauvegarder le fichier en format ASCII au lieu du format normal du programme. Dans votre manuel, voir les instructions de sauvegarde de documents en fichier ASCII (parfois appelés fichiers DOS ou fichiers de l'imprimante). Veuillez etiquetter votre disquette en consequence et indiquer le nom complet du fichier du document incluant sont extension.

Les *Manuscrits* doivent être concis et faire preuve de coherence dans le style, l'orthographe et l'emploi des abréviations. Ils doivent être dactylographiés à double interligne. Numéroter toutes les pages incluant celles du resume, les tableaux et les légendes. Pour plus de renseignements sur le format des feuilles et le style, priere de consulter nos dernières publications de *L'inventaire* et le *CBE* Style Manual 5ième éd., 1983. Dans la mesure du possible, soumettre les données numériques en unités métriques, (SI). Sinon, fournir l'équivalent métrique. Utiliser des crochets pour identifier le nom scientifique d'un pathogene après le nom commun de la maladie dont il est l'agent causal.

Les titres doivent être courts et révélateurs, ainsi que le resume qui les accompagne et les mots clés les plus utiles pour le classement et l'extraction de l'information.

Chaque *résumé* de moins de 200 mots devrait accompagner chaque article et devrait être rédigé en anglais et en français si possible.

Les figures doivent pouvoir, après réduction, entrer dans une colonne (maximum 84 x 241 mm) ou deux colonnes (maximum 175 x 241). Découpez les figures ou indiquez par des lignes quelle est la portion essentielle de la figure. Monter les figures groupées sur une planche côte a côte sans espace entre elles. Fournir un double des photographies non montées et des graphiques. Les figures doivent &re numérotées, porter le nom de l'auteur et une légende abrégée.

Les tableaux doivent être numérotés en chiffres arabes. Fournir un titre concis. Ne pas utiliser de lignes verticales. Identifier les renvois par un signe typographique (*†§#¶**‡), particulièrement lorsqu'on réfère aux nombres.

Les *références bibliographiques* devraient être citées par ordre alphabétique comme dans les livraisons courantes. On peut utiliser le systeme de numeration ou le système nom-et-année. Pour l'abrégé du titre des periodiques, on suivra l'édition la plus recente de *Biosis* List *of* Serials publiée par les Biosciences Information Services of Biological Abstracts ou la NCTWA Word Abbreviation List et l'American National Standards Institute, Standards Committee.