2010

THE CANADIAN PHYTOPATHOLOGICAL SOCIETY

CANADIAN PLANT DISEASE SURVEY

DISEASE HIGHLIGHTS

SOCIÉTÉ CANADIENNE DE PHYTOPATHOLOGIE

INVENTAIRE DES MALADIES DES PLANTES AU CANADA

APERÇU DES MALADIES

The Society recognizes the continuing need to publish plant disease surveys to document plant pathology in Canada and to benefit federal, provincial and other agencies in planning research and development on disease control.

La Société estime qu'il est nécessaire de publier régulièrement les résultats d'études sur l'état des maladies au Canada afin qu'ils soient disponibles aux phytopathologistes et qu'ils aident les organismes fédéraux, provinciaux et privés à planifier la recherche et le développement en lutte contre les maladies.

NATIONAL COORDINATOR/ COORDINATEUR NATIONAL

Prof. Robin A. A. Morrall

Department of Biology, University of Saskatchewan
Saskatoon, Saskatchewan S7N 5E2

Tel. (306) 966-4410
Fax (306) 966-4461
Email: Robin.Morrall@usask.ca

Canadian Plant Disease Survey

CPDS Volume 90: 1 – 166 (2010)
March, 2010

Inventaire des maladies des plantes au Canada

IMPC Volume 90: 1 - 166 (2010)
Mars 2010

Contents: **DISEASE HIGHLIGHTS** - 2009 GROWING SEASON
(+ earlier years for historical significance)

The *Canadian Plant Disease Survey* is a periodical of information and record on the occurrence and severity of plant diseases in Canada and the estimated losses from diseases.

Authors who wish to publish articles and notes on other aspects of plant pathology are encouraged to submit this material to the scientific journal of their choice, such as the Canadian Journal of Plant Pathology or Phytoprotection

L'Inventaire des maladies des plantes au Canada est un périodique d'information sur la fréquence des maladies des plantes au Canada, leur gravité et les pertes qu'elles occasionnent.

Les auteurs qui veulent publier des articles et des notes sur d'autres aspects de la phytopathologie sont invités à soumettre leurs textes à la revue scientifique de leur choix, par exemple à la Revue canadienne de phytopathologie ou à Phytoprotection.

Angie O'Shea, Compiler
530 Hogg Crescent
Saskatoon, Saskatchewan, S7N 3V6
Tel. (306) 249-3269
Email: aoshea@sasktel.net

Angie O'Shea, Compilateur
530 Hogg Crescent
Saskatoon, Saskatchewan, S7N 3V6
Tel. (306) 249-3269
Email: aoshea@sasktel.net

2010 CPDS SECTION EDITORS AND ADDRESSES

SECTION	EDITORS AND ADDRESSES
DIAGNOSTIC LABORATORIES /LABORATOIRES DIAGNOSTIQUES	Ms.Marilyn Dykstra Pest Management Centre Agriculture and Agri-Food Canada Building 57, 960 Carling Ave Ottawa, ON K1A 0C6 Tel: (613) 759-7430 Fax: (613) 759-1400 Email: marilyn.dykstra@agr.gc.ca
CEREALS / CÉRÉALES	Dr. Andy Tekauz Agriculture and Agri-Food Canada Cereal Research Centre 195 Dafoe Road Winnipeg, Manitoba R3T 2M9 Tel: (204) 983-0944 Fax: (204) 983-4604 Email: andy.tekauz@agr.gc.ca
FORAGES/ PLANTES FOURRAGÈRES	Dr. Bruce D. Gossen Agriculture and Agri-Food Canada Research Centre 107 Science Place Saskatoon, Saskatchewan S7N 0X2 Tel: (306) 956-7529 Fax: (306) 956-7247 Email: bruce.gossen@agr.gc.ca
OILSEEDS AND SPECIAL CROPS /OLÉAGINEUX ET CULTURES SPÉCIALES	Prof. Robin A.A. Morrall Department of Biology University of Saskatchewan 112 Science Place Saskatoon, Saskatchewan S7N 5E2 Tel: (306) 966-4410 Fax: (306) 966-4461 Email: Robin.Morrall@usask.ca
VEGETABLES /LÉGUMES	Dr. Jill Thomson Department of Plant Sciences University of Saskatchewan 51 Campus Drive Saskatoon, Saskatchewan S7N 5A8 Tel: (306) 966-5862 Fax: (306) 966-5015 Email: Jill.Thomson@usask.ca
FRUIT, NUTS AND BERRIES, ORNAMENTALS AND TURFGRASS /FRUITS, FRUITS À ÉCALE ET BAIES, PLANTES ORNEMENTALES ET GAZON	Dr. Paul Hildebrand Agriculture and Agri-Food Canada Kentville Research Centre Kentville, Nova Scotia B4N 1J5 Tel: (902) 678-2171 Fax: (902) 679-2311 Email: paul.hildebrand@agr.gc.ca
FOREST TREES/ ARBRES FORESTIERS	Dr. Jean Bérubé Service canadien des forêts Centre de foresterie des Laurentides Ressources Naturelles Canada Gouvernement du Canada 1055 rue du P.E.P.S., C.P. 10380 Sainte-Foy (Québec), G1V 4C7 Tél: (418) 648-7174 Facs: (418) 648-5849 Email: jean.berube@nrcan-rncan.gc.ca

CANADIAN PLANT DISEASE SURVEY INDEX - AUTHORS AND TITLES

DIAGNOSTIC LABORATORIES / LABORATOIRES DIAGNOSTIQUES

CEREALS / CERÉALES

Diagnostic Laboratories / Laboratoires Diagnostiques

CROPS: Commercial Crops - Diagnostic Laboratory Report
LOCATION: British Columbia

NAME AND AGENCY:
Vippen Joshi, P.Ag. (Plant Diagnostic Pathologist) and Maria Jeffries, P.Ag., (Plant Health Coordinator)
British Columbia Ministry of Agriculture and Lands, Abbotsford Agriculture Centre, 1767 Angus Campbell Road, Abbotsford, BC V3G 2M3
Telephone: (604) 556-3128; **Facsimile:** (604) 556-3154; Email: Vippen.Joshi@gov.bc.ca;
Web page: http://www.al.gov.bc.ca/cropprot/lab.htm

TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BRITISH COLUMBIA MINISTRY OF AGRICULTURE AND LANDS (BCMAL) (PLANT DIAGNOSTIC LABORATORY IN 2009.

METHODS: The British Columbia Ministry of Agriculture and Lands (BCMAL) Plant Diagnostic Laboratory provides diagnoses and disease management information for diseases of commercial agricultural crops in British Columbia caused by fungi, bacteria, viruses, plant parasitic nematodes, insect pests and abiotic factors. The following data reflect samples submitted to the laboratory by ministry staff, growers, agri-businesses, parks boards and master gardeners. Diagnoses were accomplished by microscopic examination, culturing onto artificial media, biochemical identification of bacteria using BIOLOG®, serological testing of viruses, fungi and bacteria with micro-well and membrane-based enzyme linked immunosorbent assay (ELISA). Molecular techniques (PCR – conventional and/or real time) were used for identification of some species specific diagnoses. Some specimens were referred to other laboratories for identification or confirmation of the diagnosis.

RESULTS AND COMMENTS: The year 2009 was a relatively moderate year for most diseases. After an initial wet spring, the weather was dry during the peak cropping season and many fungal and bacterial organisms did not become established and cause significant crop damage. Summaries of the diseases diagnosed and their causal agents from commercial crop samples submitted to the laboratory are presented in Tables 1-13 by crop category. The total number of submissions for each crop category is listed at the bottom of each table. Problems not listed included: abiotic problems such as nutritional stress, pH imbalance, water stress, drought stress, and physiological response to growing conditions as well as genetic abnormalities, environmental and chemical stresses including herbicide damage, fruit abortion due to lack of pollination, poor samples, insect-related injury and damage where no conclusive causal factor was identified.

A new disease – Brown ring patch of turf grass caused by *Waitea circinata* var. *circinata* was detected in a sample obtained from a golf course in Kelowna, B.C. Detection was confirmed by Dr. Tom Hsiang's lab in Guelph, Ontario. Another unique disease – *Fig mosaic virus* was also detected on a fig leaf sample obtained from a local nursery. This is a first record of this disease in Canada. Presence of the virus was confirmed by the Canadian Food Inspection Agency's Laboratory in Sidney, B.C.

Table 1.0 Summary of diseases diagnosed on **bulb crop** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Daffodil	Nematode damage	*Pratylenchus* sp.	2
Lily	Bulb rot	Rodent feeding and *Penicillium* sp.	1
	Foliar blight	*Botrytis cinerea*	1

DISEASED SAMPLES	2
ABIOTIC AND OTHER DISORDERS	0
TOTAL SUBMISSIONS	2

Table 2.0 Summary of diseases diagnosed on **Christmas tree** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Abies grandis	Needle blight	*Hormonema* sp.	1
	Needle blight	*Phyllosticta* sp.	1
	Needle blight	*Rhizosphaera kalkhoffii*	1

DISEASED SAMPLES	3
ABIOTIC AND OTHER DISORDERS	2
TOTAL SUBMISSIONS	5

Table 3.0 Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Cucumber	Black root rot	*Phomopsis* sp.	1
	Downy mildew	*Pseudoperonospora cubensis*	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Gummy stem blight	*Didymella bryoniae*	2
	Leaf spot	*Alternaria alternata*	1
	Leaf spot	*Cladosporium cucumerinum*	1
	Root rot	*Pythium* sp.	2
	Root knot	*Meloidogyne* sp.	1
Tomato	Bacterial canker	*Clavibacter michiganensis* subsp. *michiganensis*	1
	Foot rot	*Fusarium solani*	1
	Fruit spot	*Penicillium* sp.	2
	Fruit spot	*Cladosporium* sp.	1

DISEASED SAMPLES	15
ABIOTIC AND OTHER DISORDERS	04
TOTAL SUBMISSIONS	19

Table 4.0 Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Begonia	Basal/stem rot	*Fusarium* sp.	1
	Leaf spot	*Botrytis cinerea*	1
	Necrotic leaf spot	*Impatiens necrotic spot virus*	1
	Vascular wilt	*Verticillium* sp.	1
Campanula	Root rot	*Fusarium* sp.	1
	Stem rot	*Sclerotinia sclerotiorum*	1
Carex	Foliar blight	*Colletotrichum* sp.	1
Cineraria	Leaf spot and necrosis	*Impatiens necrotic spot virus*	1
Clematis	Foliar blight	*Botrytis* sp. and *Cladosporium* sp.	1
	Foliar blight	*Cladosporium* sp.	1
Coleus	Leaf distortion/spotting	*Impatiens necrotic spot virus*	4
Cymbidium	Anthracnose	*Colletotrichum gloeosporioides*	1
	Leaf mosaic	*Arabis mosaic virus*	1
	Leaf mosaic	*Cymbidium mosaic virus/Odontoglossum ringspot virus*	1
Dracaena	Crown / Root rot	*Phytophthora* sp.	1
Echinacea	Crown rot	*Fusarium* sp.	1
Euphorbia pulcherrima	Root rot	*Pythium* sp.	1
Hemerocallis	Leaf spot/streak	*Aureobasidium microstictum*	1
Hosta	Leaf mottling	*Hosta virus X*	4
	Leaf spot	*Alternaria* sp.	1
Lavandula	Foliar blight	*Botrytis* sp.	1
	Bacterial blight	*Pseudomonas syringae*	1
	Bacterial leaf spot	*Xanthomonas campestris*	1
	Root rot	*Thielaviopsis basicola*	2
Oxalis	Ring spots	*Potexvirus*	1
Phlox	Leaf spot	*Ramularia* sp.	1
Rosmarinus	Root rot	*Thielaviopsis basicola*	2
	Stem canker	*Phoma* sp.	1
Salvia	Damping off	Oomycete and *Thielaviopsis* sp.	1
	Leaf and stem spot	*Cylindrocladium* sp.	1

DISEASED SAMPLES	37
ABIOTIC AND OTHER DISORDERS	39
TOTAL SUBMISSIONS	76

Table 5.0 Summary of diseases diagnosed on **mushroom** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Mushroom	Green mold	*Trichoderma aggressivium*	2
	Green mold – non-aggressive	*Trichoderma* sp.	2

DISEASED SAMPLES	4
ABIOTIC AND OTHER DISORDERS	3
TOTAL SUBMISSIONS	7

Table 6.0 Summary of diseases diagnosed on **nut crop** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Hazelnut	Eastern filbert blight	*Anisogramma anomala*	3
	Stem canker (on dead wood)	*Diatrypella* sp.	1

DISEASED SAMPLES	4
ABIOTIC AND OTHER DISORDERS	1
TOTAL SUBMISSIONS	5

Table 7.0 Summary of diseases diagnosed on **herbaceous ornamental** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Carex	Anthracnose	*Colletotrichum* sp.	1
	Leaf blight	*Septoria* sp.	1
Clematis	Leaf spot	*Phyllosticta* sp.	1
Deschampsia	Leaf spot	*Septoria* sp.	1
	Rust	*Uromyces* sp.	1
Erica	Foliar blight	*Rhizoctonia* sp.	1
Geranium	Leaf spot	*Aphelenchoides* sp.	1
	Leaf spot	*Alternaria* sp., *Phyllosticta* sp. *and Botrytis* sp.	1
Helleborus	Leaf spot	*Coniothyrium hellebori*	1
	Root rot	Oomycete	1
Hosta	Leaf mottling and puckering	*Hosta virus* X	1
Rosmarinus	Root rot	*Fusarium* sp.	1
	Root rot	Oomycete	1
Vinca	Leaf spot	*Cylindrocladium* sp.	1
Yucca	Cercospora leaf spot	*Cercospora* sp.	1

DISEASED SAMPLES	15
ABIOTIC AND OTHER DISORDERS	09
TOTAL SUBMISSIONS	24

Table 8.0 Summary of diseases diagnosed on **specialty crop** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Ginseng	Foliar blight	*Alternaria panax*	1
	Root rot	*Fusarium* sp.	1
Wasabi	Crown and stem rot	*Rhizoctonia solani*	1
	White rust	*Albugo wasabiae*	1

DISEASED SAMPLES	4
ABIOTIC AND OTHER DISORDERS	1
TOTAL SUBMISSIONS	5

Table 9.0 Summary of diseases diagnosed on **small fruit** crop samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Blackberry	Nematode contribution	*Pratylenchus* sp.	1
	Spur blight	*Didymella applanata*	1
Blueberry	Anthracnose	*Colletotrichum acutatum*	1
	Bacterial blight	*Pseudomonas syringae*	5
	Blueberry mosaic	*Blueberry mosaic virus*	2
	Blueberry scorch	*Blueberry scorch virus*	1
	Blueberry shock	*Blueberry shock virus*	2
	Crown and root rot	*Phytophthora* sp.	1
	Crown rot	*Phytophthora* sp.	1
	Foliar blight	*Botrytis cinerea*	2
	Fruit rot	*Botrytis cinerea*	1
	Fruit rot	*Colletotrichum acutatum*	1
	Godronia canker	*Godronia cassandrae*	4
	Leaf spot	*Alternaria* sp.	1
	Leaf spot	*Colletotrichum acutatum*	1
	Mummy berry	*Monilinia vaccinii-corymbosi*	1
	Nematode contribution	*Pratylenchus* sp.	1
	Root rot	*Armillaria* sp.	1
	Root rot	Oomycete	2
	Root rot	*Phytophthora* sp.	2
	Stem and bud infection	*Godronia cassandrae*	2
	Stem canker	*Phomopsis* sp.	1
	Twig and bud blight	*Phomopsis* sp.	1
	Twig blight	*Phomopsis* sp.	1
	Twig canker	*Phomopsis* sp.	1
	Twig die back	*Botrytis cinerea*	1
	Twig die back	*Phomopsis* sp.	1
Cranberry	Twig blight	*Godronia cassandrae*	1
	Twig blight and leaf spot	*Allantophomopsis cytisporea*	1
	Upright dieback	*Phomopsis vaccinii*	2
Raspberry	Crumbled fruit	*Tomato ring spot virus*	1
	Nematode contribution	*Pratylenchus* sp.	14
	Nematode contribution	*Pratylenchus* sp. and *Xiphinema* sp.	7
	Nematode contribution	*Xiphinema* sp.	1
	Root rot	Oomycete	16
	Root rot	*Phytophthora* sp.	1
Strawberry	Black root rot	*Rhizoctonia* sp. and *Cylindrocarpon* sp.	1
	Crown / Root rot	*Rhizoctonia* sp. and *Pratylenchus* sp.	1
	Crown and root damage	Oomycete	1
	Nematode contribution	*Pratylenchus* sp.	3
	Vascular wilt	*Verticillium* sp.	1

DISEASED SAMPLES	98
ABIOTIC AND OTHER DISORDERS	161
TOTAL SUBMISSIONS	259

Table 10.0 Summary of diseases diagnosed on **golf green, lawn and sod** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Green	Black layer	Algae	1
	Anthracnose	*Colletotrichum graminicola*	4
	Ascochyta blight	*Ascochyta* sp.	3
	Brown patch	*Rhizoctonia solani*	1
	Dollar spot	*Sclerotinia* sp.	2
	Downy mildew	*Sclerophthora* sp.	2
	Foliar blight	*Curvularia* sp.	1
	Fusarium patch	*Microdochium nivale*	3
	Nematode damage	*Helicotylenchus* sp.	1
	Nematode damage	*Helicotylenchus* sp. and *Meloidogyne* sp.	9
	Nematode damage	*Helicotylenchus* sp. and *Pratylenchus* sp.	1
	Nematode damage	*Meloidogyne* sp.	1
	Nematode damage	*Pratylenchus* sp. and *Meloidogyne* sp.	1
	Nematode damage	*Tylenchorhynchus* sp.	1
	Root rot	*Pythium* sp.	2
	Yellow patch	*Rhizoctonia cerealis*	1
Lawn	Anthracnose	*Colletotrichum graminicola*	4
	Foliar blight	*Curvularia* sp.	1
	Foliar blight	*Drechslera* sp. and *Curvularia* sp.	1
	Localized dry spot	Basidiomycete	1
	Foliar damage	*Fusarium* sp.	1
Sod	Nematode damage	*Subanguina radicicola* and *Tylenchorhynchus* sp.	2
	Basal anthracnose	*Colletotrichum* sp.	1
	Foliar blight	*Leptosphaerulina sp.*	4
	Nematode contribution	*Tylenchorhynchus* sp.	1
	Nematode damage	*Tylenchorhynchus* sp., *Subanguina* sp., *Paratrichodorus* sp. and *Ditylenchus* sp.	1
	Nematode damage	*Tylenchorhynchus* sp., *Subanguina* sp., *Criconemella* sp. and *Ditylenchus* sp.	1
Turf grass	Anthracnose	*Colletotrichum graminicola*	3
	Brown patch	*Rhizoctonia solani*	2
	Brown ring patch*	*Waitea circinata* var. *circinata**	1
	Fairy ring	Basidiomycete	1
	Fusarium patch	*Microdochium nivale*	1
	Leaf blight	*Ascochyta* sp.	1
	Leaf blight	*Leptosphaerulina* sp.	2
	Leaf spot	*Septoria* sp.	1
	Nematode contribution	*Helicotylenchus* sp.	1
	Nematode contribution	*Subanguina radicicola*	4
	Nematode contribution	*Subanguina radicicola* and *Tylenchorhynchus* sp.	14
	Nematode damage	*Helicotylenchus* sp.	2
	Root rot	*Pythium* sp.	1

***New for B.C.**

DISEASED SAMPLES	79
ABIOTIC AND OTHER DISORDERS	06
TOTAL SUBMISSIONS	85

Table 11.0 Summary of diseases diagnosed on **tree fruit and grape crop** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Apple	Cytospora canker	*Cytospora* sp.	1
	Fire blight	*Erwinia amylovora*	1
	Leaf blotch	*Alternaria* sp.	1
	Twig canker	*Nectria cinnabarina*	1
Apricot	Fruit blemish	*Alternaria alternata*	1
	Root rot	Oomycete	1
Cherry	Small fruit	*Little cherry virus*	1
Grape	Berry rot	*Alternaria alternata*	1
	Berry rot	*Penicillium* sp., *Alternaria* sp. and *Stemphylium* sp.	1
	Black rot	*Phyllosticta* sp.	1
	Bunch rot and blight	*Botrytis cinerea*	1
	Vine decline	Parasitic nematodes (*Meloidogyne* sp., *Pratylenchus* sp., *Mesocriconema* sp. and *Paratylenchus* sp.) and Oomycete	1
Nectarine	Bud death	*Cylindrocarpon* sp.	1
Peach	Twig death (storage)	*Cylindrocarpon* sp. and *Fusarium* sp.	1
Plum	Twig death (storage)	*Cylindrocarpon* sp. and *Fusarium* sp.	1
	Plum rust	*Tranzschelia pruni-spinosae*	1

DISEASED SAMPLES	18
ABIOTIC AND OTHER DISORDERS	13
TOTAL SUBMISSIONS	31

Table 12. 0 Summary of diseases diagnosed on **field vegetable** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Belgian endive	Nematode damage	*Pratylenchus* sp. and *Fusarium* sp.	1
Carrot	Nematode damage	*Pratylenchus* sp.	1
Corn	Common smut	*Ustilago maydis*	1
Cucumber	Verticillium wilt	*Verticillium dahliae*	1
Diakon	Bacterial soft rot	*Erwinia carotovora*	1
Garlic	Botrytis neck rot	*Botrytis allii*	1
	Bulb rot	*Sclerotinia* sp. and *Penicillium* sp.	1
	Nematode contribution	*Ditylenchus* sp., *Aphelenchoides* sp., *Rotylenchus* sp. and *Tylenchus* sp.	1
	White rot	*Sclerotium cepivorum*	4
Onion	Blue mold	*Penicillium* sp.	1
Potato	Black scurf	*Rhizoctonia solani*	4
	Brown spot	*Alternaria alternata*	1
	Common scab	*Streptomyces scabies*	3
	Early blight	*Alternaria solani*	1
	Fusarium dry rot	*Fusarium* sp.	2
	Late blight	*Phytophthora infestans*	1
	Pythium leak	*Pythium ultimum*	2
	Silver scurf	*Helminthosporium solani*	1
	Soft rot	*Erwinia carotovora*	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Potato	Stem canker	*Rhizoctonia solani*	1
	Verticillium wilt	*Verticillium* sp.	1
Rhubarb	Crown damage	*Cylindrocarpon destructans* and parasitic nematodes	1
	Leaf mottle and stunting	*Turnip mosaic virus*	1
	Poor growth	*Pratylenchus* sp. and *Paratylenchus* sp.	1
	Poor growth	*Pratylenchus* sp., *Aphelenchoides* sp. and *Cylindrocarpon destructans*	1
Sprouts	Damping off	*Fusarium* sp.	1
Squash	Black rot	*Phoma cucurbitacearum*	
Tomato	Fruit rot	*Rhizopus stolonifer*	1
	Leaf blight	*Alternaria alternata*	1
	Root rot	*Rhizoctonia solani*	1
	Root knot nematode	*Meloidogyne* sp.	1
	Stem canker and root rot	*Rhizoctonia solani*	2
	Stem rot	*Pyhium* sp.	1
Wasabi	White rust	*Albugo wasabiae*	1

DISEASED SAMPLES	47
ABIOTIC AND OTHER DISORDERS	21
TOTAL SUBMISSIONS	68

Table 13.0 Summary of diseases diagnosed on **woody ornamental** samples submitted to the BCMAL Plant Diagnostic Laboratory in 2009 (Nov. 2008 – Oct. 2009).

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Abies	Needle cast	*Rhizosphaera kalkhoffii*	1
Abies grandis	Foliar blight	*Hormonema* sp.	1
	Needle blight	*Phyllosticta* sp. and *Botrytis* sp.	1
	Needle blight	*Phyllosticta* sp. and *Hormonema* sp.	1
Acer	Speckled tar spot	*Rhytisma punctatum*	1
	Powdery mildew	*Uncinula* sp.	1
	Verticillium wilt	*Verticillium* sp.	1
Acer japonica	Bacterial blight	*Pseudomonas syringae*	1
Acer palmatum	Verticillium wilt	*Verticillium* sp.	1
Acer rubrum	Powdery mildew	*Microsphaera aceris*	1
	Stem canker	*Botryosphaeria dothidea*	1
Aesculus	Seed infection	*Verticillium* sp., *Fusarium* sp. and *Torula* sp.	1
Amelanchier	Foliar blight	*Phytophthora* sp.	1
Betula	Anthracnose	*Gloeosporium* sp.	1
Buxus	Twig blight	*Volutella* sp.	1
	Stem canker	*Fusarium* sp.	
Caragana	Leaf spot	*Septoria* sp.	1
Catalpa	Powdery mildew	*Microsphaera* sp.	1
	Root rot	Oomycete	1
Cercidiphylum japonicum	Twig canker	*Phomopsis* sp.	1
Clematis	Foliar blight	*Botrytis cinerea*	2
	Leaf spot/stem canker	*Ascochyta clematidina*	2
Cornus	Stem dieback/ leaf spot	Phomopsis sp.	1
Cotoneaster	Bacterial blight	*Pseudomonas syringae*	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No.
Cotoneaster	Twig canker	*Tubercularia* sp. *(Nectria cinnabarina)*	1
Crataegus	Fire blight	*Erwinia amylovora*	1
Cryptomeria japonica	Leaf spot	*Phyllosticta* sp.	1
Davidia involucrata	Root rot	Oomycete	1
Eucalyptus	Stem canker	*Colletotrichum* sp.	1
	Stem canker	*Phomopsis* sp.	1
Fagus	Fig mosaic	*Fig mosaic virus**	1
Forsythia	Leaf spot	*Pseudomonas syringae*	1
Fraxinus	Stem canker	*Fusicoccum* sp.	1
Hydrangea	Leaf mosaic and rings	*Tobacco mosaic virus and Tobacco ring spot virus*	1
Juniperus	Root rot	Oomycete	1
Laurus	Twig dieback	*Botryosphaeria* sp.	
Malus	Anthracnose	*Sphaeceloma* sp.	1
	Apple scab	*Venturia inaequalis*	1
	Fire blight	*Erwinia amylovora*	1
	Leaf blotch	*Alternaria* sp.	5
	Leaf spot	*Pseudomonas syringae*	1
Photinia	Leaf spot	Physiological stress and *Phyllosticta* sp.	1
Picea glauca var. *albertiana*	Root rot	*Phytophthora* sp.	1
Pinus	Root rot	*Cylindrocarpon* sp. and *Fusarium* sp.	1
	Root rot	Oomycete	1
Populus	Rust	*Melamspora* sp.	1
	Stem canker	*Cytospora* sp. and *Phomopsis* sp.	1
Prunus	Stem canker	*Tubercularia* sp. *(Nectria cinnabarina)*	1
Pyrus	Bacterial canker	*Pseudomonas syringae* pv. *syringae*	1
Pyrus calleryana	Pear trellis rust	*Gymnosporangium fuscum*	1
Quercus	Anthracnose	*Apiognomonia* sp.	1
Quercus palustris	Anthracnose	*Discula quercina*	1
Rhododendron	Twig dieback	*Botryosphaeria (Diplodia)* sp.	1
	Twig dieback	*Phomopsis* sp.	1
	Leaf spot	*Coryneum* sp.	1
	Leaf spot	*Phyllosticta* sp.	1
Robinia	Stem canker	*Cytospora* sp., *Nectria* sp. and *Coniothyrium* sp.	1
Sambucus	Verticillium wilt	*Verticillium* sp.	1
Sequoiadendron giganteum	Needle blight	*Pestalotiopsis* sp.	1
Syringa	Leaf spot	*Pseudomonas syringae*	2
Taxus	Anthracnose	*Colletotrichum gloeosporioides*	1
	Root rot	Oomycete	1
Thuja	Seiridium blight	*Seiridium cardinale*	1
Vaccinium	Root rot	Oomycete	1

***New record for Canada.**

DISEASED SAMPLES	69
ABIOTIC AND OTHER DISORDERS	70
TOTAL SUBMISSIONS	139

CROPS: Commercial crops – Diagnostic Laboratory Report
LOCATION: Saskatchewan

NAMES AND AGENCIES:

P.R. Northover[1], F. Dokken-Bouchard[2] and C. N. Weitzel[1]
[1]Crop Protection Laboratory, Crops Branch, Saskatchewan Ministry of Agriculture,
346 McDonald St., Regina SK S4N 6P6
Telephone: (306) 798-0100; **Facsimile:** (306) 787-8803; **E-mail:** Philip.Northover@gov.sk.ca
[2]Saskatchewan Ministry of Agriculture, Crops Branch, 3085 Albert St., Regina SK, S4S 0B1

TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED TO THE SASKATCHEWAN MINISTRY OF AGRICULTURE CROP PROTECTION LABORATORY IN 2009

METHODS: The Crop Protection Laboratory of the Saskatchewan Ministry of Agriculture provides diagnostic services to the agricultural industry and recommendations for crop health problems. Services include disease, insect and weed identification, as well as testing of weed seeds for herbicide resistance. The Crop Protection Laboratory also provides a Dutch elm disease (DED) service to the general public, under which American elm (*Ulmus americana*) samples are tested for DED. Samples are submitted to the Crop Protection Laboratory by personnel from the Saskatchewan Ministry of Agriculture, the Saskatchewan Ministry of Environment, individual growers, crop insurance adjustors, agribusiness representatives and market/home gardeners. Disease diagnoses are accomplished by naked eye and microscopic visual examination and culturing on artificial media.

RESULTS: From April 1 to November 30, 2009, the Crop Protection Laboratory received a total of 604 samples for disease/disorder diagnoses, 63% (378 samples) of which were American elm samples submitted for DED testing. Categories and percentage of samples received (excluding DED samples) were: special crops (36%), cereals (28%), oilseeds (16%), woody ornamentals (8%), vegetables (4%), fruit (3%) and forages (3%). The remaining two percent were attributed to herbaceous perennial and other samples such as mulches for which no diagnoses were made. Samples which were submitted for disease identification, but were diagnosed with insect damage, are not included in this report. Summaries of diseases and causal agents diagnosed on crop samples submitted to the Crop Protection Laboratory in 2009 are presented in Tables 1-8 by crop category.

Table 1: Diseases of **fruit crops** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Fire blight	*Erwinia amylovora*	1
Cherry	Root rot	*Pythium,Fusarium,*and *Rhizoctonia* spp	1
Grape	Chemical injury		1
Raspberry	Cane blight	*Coniothyrium fuckelii*	1
	Spur blight	*Didymella applanata*	1

Table 2: Diseases of **cereal crops** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Barley	Head blight	*Fusarium* spp	1
	Common root rot	*Cochliobolus sativus*	2
	Root rot	*Bipolaris sorokiniana*	1
	Possible aster yellows	*Aster Yellows Phytoplasma*	1
	Seed mold	*Fusarium* spp.	1
	Chemical injury		4
Durum wheat	Head blight	*Fusarium* spp.	1
	Root rot	*Fusarium* spp.	1
	Tan spot	*Dreschlera tritici-repentis*	2
	Common root rot	*Bipolaris sorokiniana*	1
	Spot blotch	*Bipolaris sorokiniana*	1
	Seed mold	*Rhizopus stolonifera*	1
	Seed mold	*Trichoderma* spp.	1
	Stem melanosis	*Pseudomonas cichorii*	1
	Loose smut	*Ustilago tritici*	1
	Environmental injury		3
	Chemical Injury		3
Oat	Halo/bacterial blight	*Pseudomonas syringae* pv. *coronafaciens*	1
	Chemical injury		1
Wheat	Black mold	*Alternaria* spp.	2
	Tan spot	*Drechslera tritici-repentis*	2
	Septoria leaf blotch	*Stagonospora nodorum*	1
	Glume blotch	*Stagonospora* spp.	1
	Bacterial stripe/ black chaff	*Xanthomonas campestris* pv. *translucens*	1
	Seedling blight	*Pythium* spp.	1
	Root rot	*Fusarium* spp.	1
	Root rot	*Pythium* spp.	1
	Root rot	*Rhizoctonia* spp.	1
	Environmental injury		5
	Chemical injury		6

Table 3: Diseases of **forage legume and grass crops** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Crown rot	*Phoma* spp. and *Rhizoctonia* spp.	1
	Black stem	*Phoma medicaginis*	1
	Verticillium wilt	*Verticillium albo-atrum*	1
Timothy	Root rot	*Fusarium* spp.	1
	Root rot	*Pythium* spp.	1

Table 4: Diseases of **oilseed crops** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Camelina	Staghead	*Albugo candida*	1
	Downy mildew	*Hyaloperonospora parasitica*	1
Canola	Foot rot	*Rhizoctonia* spp.	3
	Black leg	*Phoma lingam*	1
	Chemical injury	Phenoxy herbicide damage	1
	Chemical injury	Group 2 herbicide	10
	Nutrient deficiency		1
	Physiological injury		1
Flax	Chemical injury		6
	Environmental injury		3
	Boll spot	*Alternaria* spp	1
Mustard	Chemical injury		1
	Wilt	*Fusarium oxysporum*	1

Table 5: Diseases of **ornamental plants** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Amur maple	Tar spot	*Rhytisma acerinum*	1
Cotoneaster	Adjuvant burn		1
Caragana	Chemical injury		1

Table 6: Diseases of **shade trees** submitted to the Crop Protection Laboratory in 2009

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Elm	Dutch Elm Disease	*Ophiostoma novae-ulmi*	216*
	Dothiorella wilt	*Dothiorella ulmi*	30*
Maple	Iron chlorosis		1
Spruce	Rhizosphaera needlecast	*Rhizosphaera kalkoffii*	1
Willow	Willow canker	*Glomerella miyabeana*	1

*the remaining American Elm submissions were negative for known pathogens of elm

Table 7: Diseases of **special crops** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bean	Environmental injury		1
	Chemical injury		1
Canaryseed	Environmental injury Nutrient deficiency		1
Chickpea	Chemical injury		3
Cumin	Root rot	*Fusarium* spp.	1
Lentil	Stemphylium leaf blight	*Stemphylium* spp.	11
	Root rot	*Fusarium* spp.	7
	Root rot	*Cylindrocarpon* spp.	1
	Root rot	*Thielaviopsis* spp.	1
	Root rot	*Rhizoctonia solani*	1
	Stem rot	*Sclerotinia sclerotiorum*	2
	Botrytis pod rot	*Botrytis cinerea*	2
	Anthracnose	*Colletotrichum truncatum*	2
	Chemical injury		14
	Environmental injury		4
Field pea	Chemical injury		10
	Leaf and pod spot	*Ascochyta pisi*	2
	Root rot	*Fusarium solani*	3
	Root rot	*Rhizoctonia* spp.	1
	Environmental		3
	Root Rot	*Thielaviopsis* spp.	1
Soybean	Root Rot	*Rhizoctonia* spp	1

Table 8: Diseases of **vegetable crops** submitted to the Crop Protection Laboratory in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Onion	Downy mildew	*Peronospora destructor*	1
	Stemphylium leaf blight	*Stemphylium vesicarium*	1
Pepper	Chemical injury		1
Pea	Chemical injury		1
Tomato	Late blight	*Phytophthora infestans*	3

CROP: Diagnostic Laboratory Report
LOCATION: Manitoba

NAME AND AGENCY:
M.L. Desjardins[1]
[1]Manitoba Agriculture, Food and Rural Initiatives, Crop Diagnostic Centre, 545 University Crescent, Winnipeg, MB R3T 5S6
Telephone: (204) 945-7707; **Facsimile:** (204) 945-4327; **E-mail:** Mardi.Desjardins@gov.mb.ca

TITLE: 2009 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

METHODS: The Manitoba Agriculture, Food and Rural Initiatives (MAFRI) Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by MAFRI extension staff, farmers, agri-business and the general public. Diagnosis is based on microscopy and visual examination for symptoms, culturing onto artificial media, and ELISA testing for some pathogens.

RESULTS: For the 2009 crop year in Manitoba, three noteworthy occurrences were Goss's wilt in corn, downy mildew on greenhouse-grown coleus and verticillium wilt in stevia. None of these diseases had previously been documented through our laboratory. Summaries of diseases diagnosed on plants in different crop categories are presented in Tables 1-11 and cover the time period from January 1 to November 27, 2009.

Table 1. Summary of diseases diagnosed on **forage legume crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Common leaf spot	*Pseudopeziza medicaginis*	2
	Flower blight	*Botrytis cinerea*	1
	Leaf spot	*Leptosphaerulina briosiana*	1
	Root rot	*Fusarium solani*	1
	Spring black stem and leaf spot	*Phoma medicaginis*	5
	Stem rot	*Sclerotinia sclerotiorum*	1
	Stemphylium leaf spot	*Stemphylium* sp.	2
	Summer black stem	*Cercospora medicaginis*	1
	Yellow leaf blotch	*Leptotrochila medicaginis*	1
	Herbicide injury		1
	Nutrient deficiency		2
Birdsfoot trefoil	Anthracnose	*Colletotrichum* sp.	1
	Flower blight	*Botrytis cinerea*	2
	Stemphylium leaf spot	*Stemphylium* sp.	1
Clover, red	Root rot	*Fusarium oxysporum*	1

Table 2. Summary of diseases diagnosed on **cereal crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Wheat	Bacterial blight	*Pseudomonas syringae*	2
	Black head moulds	*Alternaria* spp., *Cladosporium* spp., *Epicoccum* sp.	1
	Common root rot	*Cochliobolus sativus*	3
	Common bunt	*Tilletia tritici*	1
	Root rot	*Fusarium* spp.	5
	Septoria leaf spot	*Septoria* spp.	4
	Tan spot	*Pyrenophora tritici-repentis*	8
	Wheat streak mosaic	Wheat Streak Mosaic Virus (WSMV)	12
	Physiological disorders	undetermined	16
	Environmental injury		8
	Herbicide injury		16
	Nutrient deficiency		3
Barley	Common root rot	*Cochliobolus sativus*	2
	Fusarium head blight	*Fusarium* sp.	1
	Net blotch	*Drechslera teres*	5
	Root rot	*Fusarium* spp.	2
	Spot blotch	*Cochliobolus sativus*	1
	Environmental injury		5
	Herbicide injury		4
	Nutrient deficiency		1
Oat	Fusarium head blight	*Fusarium avenaceum*	2
	Pyrenophora leaf blotch	*Pyrenophora avenae*	1
	Environmental injury		4
	Herbicide injury		1
Rye	Root rot	*Drechslera* sp.	1
	Nutrient deficiency		1

Table 3. Summary of diseases diagnosed on **greenhouse crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Coleus	Downy mildew	*Peronospora* sp.	1
Cucumber	Root rot	*Fusarium* sp.	1
	Root rot	*Pythium* sp.	1
	Nutrient deficiency		1
Pepper, green bell	Root rot	*Fusarium solani*	1
Tomato	Leaf mould	*Fulvia fulva*	1

Table 4. Summary of diseases diagnosed on **vegetable crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Beet, red	Storage rot	*Phoma betae*	1
Carrot	Alternaria leaf blight	*Alternaria dauci*	1
	Cavity spot	*Pythium* sp.	1
	Root rot	*Fusarium avenaceum*	1
Cucumber	Angular leaf spot	*Pseudomonas lachrymans*	1
	Downy mildew	*Pseudoperonospora cubensis*	1
	Environmental injury		3
Onion	Blue mould	*Penicillium* sp.	2
	Neck rot	*Botrytis allii*	2
	Purple blotch	*Alternaria porri*	1
Parsnip	Environmental injury		1
Pepper, green bell	Leaf blight	*Sclerotinia sclerotiorum*	1
Tomato	Grey mould	*Botrytis cinerea*	1
	Late blight	*Phytophthora infestans*	2
	Septoria leaf spot	*Septoria lycopersici*	4
	Verticillium wilt	*Verticillium dahliae*	1
Watermelon	Environmental injury		1

Table 5. Summary of diseases diagnosed on **potato crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bacterial soft rot	*Erwinia carotovora* subsp. *carotovora*	7
Blackleg	*Erwinia carotovora* subsp. *atroseptica*	3
Black dot, on tubers	*Colletotrichum coccodes*	1
Black scurf	*Rhizoctonia solani*	1
Brown spot	*Alternaria alternata*	1
Early blight, foliar	*Alternaria solani*	4
Fusarium dry rot	*Fusarium sambucinum*	3
Fusarium wilt	*Fusarium avenaceum*	1
Grey mould	*Botrytis cinerea*	4
Late blight, foliar	*Phytophthora infestans*	5
Leak	*Pythium* sp.	2
Pink rot	*Phytophthora erythroseptica*	2
Pocket rot	*Phoma exigua*	1
Rhizoctonia stem and stolon canker	*Rhizoctonia solani*	3
Rubbery rot	*Geotrichum candidum*	2
Scab, common	*Streptomyces* spp.	1
Silver scurf	*Helminthosporium solani*	3
Tuber rot	*Fusarium avenaceum*	1
Verticillium wilt	*Verticillium dahliae*	2
Physiological disorders		5
Herbicide injury		4
Environmental injury		1

Table 6. Summary of diseases diagnosed on **grasses** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Perennial ryegrass	Root rot	*Fusarium* spp.	1
Russian wild rye	Brown blight	*Drechslera siccans*	1
Timothy	Choke disease	*Epichloë typhina*	1
Turf grasses	Fusarium blight	*Fusarium* spp.	4
	Powdery mildew	*Blumeria graminis*	1
	Snow mould	*Typhula* sp.	1

Table 7. Summary of diseases diagnosed on **shelterbelt trees** and **woody ornamentals** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Ash (*Fraxinus* sp.)	Anthracnose	*Gloeosporium aridum*	2
	Canker	unidentified	4
	Leaf spot	*Phyllosticta* sp.	1
	Environmental injury		1
	Herbicide injury		4
Caragana	Powdery mildew	*Erysiphe* sp.	1
Chokecherry, Schubert (*Prunus virginiana*)	Black knot	*Apiosporina morbosa*	1
Cotoneaster	Herbicide injury		1
Crabapple	Fireblight	*Erwinia amylovora*	1
Elm, American (*Ulmus americana*)	Canker	*Botryodiplodia* sp.	3
	Canker	undetermined	1
	Dutch elm disease	*Ophiostoma ulmi*	51
	Herbicide injury		1
Elm, Siberian (*Ulmus pumila*)	Dutch elm disease	*Ophiostoma ulmi*	2
Lilac	Bacterial blight	*Pseudomonas syringae*	1
	Leaf spot	*Phyllosticta* sp.	1
	Powdery mildew	*Erysiphe syringae*	1
	Environmental injury		3
	Herbicide injury		1
Maple, Manitoba (*Acer negundo*)	Twig blight	*Colletotrichum* sp.	1
	Environmental injury		2
	Herbicide injury		3
Maple, silver (*Acer saccharinum*)	Iron chlorosis	Nutrient deficiency	1
Mountain ash (*Sorbus* spp.)	Canker	*Botryosphaeria* sp.	1
	Fire blight	*Erwinia amylovora*	1
	Herbicide injury		1
Oak (*Quercus macrocarpa)*	Herbicide injury		1
Pine	Brown spot needle blight	*Lecanosticta acicola*	1
	Dothistroma needle blight	*Dothistroma pini*	1
	Environmental injury		1

Table 7 (contd.)

Poplar (*Populus* spp.)	Anthracnose	*Colletotrichum* sp.	1
	Bronze leaf disease	*Apioplagiostoma populi*	2
	Canker	*Cytospora* sp.	3
	Canker	unidentified	1
	Iron chlorosis	nutrient deficiency	1
	Herbicide injury		2
Spruce	Cytospora canker	*Leucostoma kunzei*	1
	Canker	unidentified	2
	Rhizosphaera needlecast	*Rhizosphaera kalkhoffi*	3
	Stigmina needle blight	*Stigmina lautii*	6
	Environmental injury		2
	Herbicide injury		1
	Nutrient deficiency		1
Willow	Herbicide injury		2

Table 8. Summary of diseases diagnosed on **oilseed crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Blackleg	*Leptosphaeria maculans*	7
	Downy mildew	*Peronospora parasitica*	1
	Root rot	*Fusarium* spp., *Rhizoctonia solani*	2
	Stem rot	*Sclerotinia sclerotiorum*	1
	Environmental injury		7
	Herbicide injury		26
	Nutrient deficiency	sulphur deficiency	6
Flax	Brown stem blight	*Alternaria linicola*	5
	Fusarium wilt	*Fusarium oxysporum*	2
	Pasmo	*Septoria linicola*	1
	Root rot	*Fusarium* sp.	1
	Environmental injury		5
	Herbicide injury		13
	Nutrient deficiency		2
Mustard, yellow	Root rot	*Fusarium* sp.	1
Sunflower	Downy mildew	*Plasmopara halstedii*	1
	Leaf spot	*Alternaria* spp.	3
	Leaf spot	*Phoma* sp.	1
	Rust	*Puccinia helianthi*	3
	Herbicide injury		9

Table 9. Summary of diseases diagnosed on **fruit crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Canker	*Botryosphaeria* sp.	2
	Canker	*Diplodia serriata*	1
	Canker	unidentified	4
	Fire blight	*Erwinia amylovora*	2
	Frogeye leaf spot	*Diplodia seriata**	2
	Nectria twig canker	*Nectria cinnabarina*	1
	Scab	*Venturia inaequalis*	1
	Environmental injury		1
Chokecherry	Leaf puckering	*Taphrina* sp.	1
	Shothole	*Coccomyces lutescens*	1
Pear	Herbicide injury		1
Plum	Plum pockets	*Taphrina communis*	1
Raspberry	Anthracnose	*Elsinoë veneta*	2
	Bacterial blight	*Pseudomonas syringae*	1
Saskatoon	Entomosporium leaf and berry spot	*Entomosporium mespili*	2
	Rust	*Gymnosporangium sp.*	1
	Herbicide injury		1
Sea buckthorn	Verticillium wilt	*Verticillium dahliae*	1
Strawberry	Black root rot	*Fusarium* spp., *Pythium* sp.	1
	Root rot	*Rhizoctonia solani*	1
	Herbicide injury		1
	Nutrient deficiency		1

*known as *Botryosphaeria obtusa* prior to nomenclature changes.

Table 10. Summary of diseases diagnosed on **herbaceous ornamentals** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Iris (*Iris* × *germanica*)	Didymellina leaf spot	*Mycosphaerella macrospora*	1
Lily	Blue mould bulb rot	*Penicillium* sp.	1

Table 11. Summary of diseases diagnosed on **special field crops** submitted to the MAFRI Crop Diagnostic Centre in 2009.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canaryseed	Root rot	*Cochliobolus sativus*	1
	Nutrient deficiency		1
Corn	Fusarium ear rot	*Fusarium subglutinans*	1
	Gibberella ear rot	*Fusarium graminearum*	8
	Goss's wilt	*Corynebacterium michiganensis* subsp. *nebraskensis*	2
	Yellow leaf blight	*Phyllosticta maydis*	1
	Root rot	*Fusarium* sp.	1
	Environmental injury		1
	Herbicide injury		1
	Nutrient deficiency		1
Dill	Leaf spot	*Alternaria* sp.	1
Field bean	Anthracnose	*Colletotrichum lindemuthianum*	1
	Brown spot	*Pseudomonas syringae* pv. *syringae*	3
	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	5
	Halo blight	*Pseudomonas syringae* pv. *phaseolicola*	3
	Root rot	*Rhizoctonia solani*	1
	Nutrient deficiency		2
Field pea	Ascochyta leaf spot	*Ascochyta* sp.	1
	Root rot	*Fusarium* spp.	9
	Root rot	*Rhizoctonia solani*	1
	Septoria blotch	*Septoria pisi*	1
	Environmental injury		2
	Herbicide injury		4
Hemp	Environmental injury		2
Soybean	Anthracnose	*Colletotrichum* sp.	2
	Bacterial blight	undetermined	3
	Downy mildew	*Peronospora manshurica*	1
	Grey mould	*Botrytis cinerea*	1
	Leaf spot	*Phyllosticta* sp.	1
	Root rot	*Fusarium oxysporum*, *F. solani*, *Pythium* spp., *Rhizoctonia solani*	13
	Root rot	*Phytophthora* sp.	9
	Stem rot	*Phomopsis* sp.	2
	Stem rot	*Sclerotinia sclerotiorum*	1
	Environmental injury		2
	Herbicide injury		5
	Nutrient deficiency		4
Stevia	Verticillium wilt	*Verticillium dahliae*	1

CROP: Vegetable Crops – Diagnostic Laboratory Report
LOCATION: Bradford/Holland Marsh, Ontario

NAMES AND AGENCY:
M.T. Tesfaendrias[1] and M.R. McDonald[2]
[1]Muck Crops Research Station, University of Guelph, 1125 Woodchoppers Lane, RR#1, Kettleby, ON, L0G 1J0
Telephone: (905) 775-3783; **Facsimile:** (905) 775-4546; **E-mail:** mtesaend@uoguelph.ca
[2]Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

TITLE: DISEASES DIAGNOSED ON VEGETABLE CROPS SUBMITTED TO THE MUCK CROPS RESEARCH STATION DIAGNOSTIC LABORATORY IN 2009

METHODS: As part of the integrated pest management (IPM) program, the plant disease diagnostic laboratory of the Muck Crops Research Station (MCRS), University of Guelph, Kettleby, Ontario, provides diagnosis and control recommendations for diseases of vegetable crops to growers in the Bradford/Holland Marsh, Ontario and surrounding area. The program objectives are to scout growers' fields, provide growers with disease and insect forecasting information and to identify and diagnose diseases, insect pests and weeds, as well as the evaluation of pesticides to control diseases, insect pests and weeds. Samples are submitted to the MCRS diagnostic laboratory by IPM scouts, growers, agribusiness representatives and crop insurance agents. Disease diagnoses are based on a combination of visual examination of symptoms, microscopic observation and culturing onto artificial media.

RESULTS AND COMMENTS: Weather conditions in the 2009 growing season were conducive for most pathogens including downy mildews, *Pythium*, *Septoria*, *Sclerotinia, Rhizoctonia, Phytophthora and* bacteria*.* Excessive soil moisture created ideal conditions for soil borne pathogens, particularly *Pythium* on carrot, resulting in a high incidence of root dieback, cavity spot and forking. From January 10 to November 30, 2009, the MCRS diagnostic laboratory received 325 samples. Ninety-one percent were for disease diagnosis. Categories of samples received were: carrot (39.9%), onion (39.5%), lettuce (9.1%), celery (4.7%) and other crops (6.8%). In the 2009 growing season, 16 insect and 13 weed identifications were also completed. A summary of diseases diagnosed and causal agents on crop samples submitted to the MCRS diagnostic laboratory in 2009 is presented in Table 1.

Table 1: Summary of plant diseases diagnosed on crops submitted to the MCRS Diagnostic Laboratory in 2009.

CROP	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Beet	Cercospora leaf spot	*Cercospora beticola*	1
	Environmental injury	Rain damage	1
Carrot	Pythium root dieback	*Pythium* spp.	23
	Cavity spot	*Pythium* spp.	22
	Leaf blight	*Alternaria dauci* and *Cercospora carotae*	23
	Crown gall	*Agrobacterium tumefaciens*	14
	Aster yellows	Phytoplasma	5
	Sclerotinia rot	*Sclerotinia sclerotiorum*	5
	Crown rot	*Rhizoctonia solani*	3
	Crater rot	*Rhizoctonia carotae*	1
	Violet root rot	*Rhizoctonia crocorum*	1
	Fusarium dry rot	*Fusarium* spp.	1
	Root knot nematode	*Meloidogyne hapla*	1
	Growth crack (split)	Fluctuating soil moisture level	12
	Chemical injury		6
	Heat canker	High temperature	1

Table 1 – contd.

Celery	Early blight	*Cercospora apii*	5
	Late blight	*Septoria apiicola*	3
	Bacterial leaf spot	*Pseudomonas syringae*	2
	Chemical injury		1
	Excessive fertilization		2
	Nutrient deficiency		1
Chinese squash	Anthracnose	*Colletotrichum* sp.	1
Cilantro	Nutrient deficiency	Mg and Mn deficiency	1
Fennel	Root and crown rot	*Pythium* spp.	1
Garlic	Grey mould	*Botrytis allii*	2
	Fusarium basal rot	*Fusarium oxysporum*	1
	Stem and bulb nematode	*Ditylenchus dipsaci*	2
	Green mould	*Penicillium* sp.	1
Lettuce	Lettuce drop	*Sclerotinia sclerotiorum* and *S. minor*	9
	Grey mould	*Botrytis cinerea*	4
	Downy mildew	*Bremia lactucae*	3
	Bacterial leaf spot	Bacteria	3
	Rust	*Puccinia dioicae*	2
	Anthracnose	*Microdochium panattonianum*	1
	Chemical injury	Spray drift injury	3
	Tip burn	Ca deficiency	2
Lupine	Downy mildew	*Peronospora trifoliorum*	1
Onion	Downy mildew	*Peronospora destructor*	25
	Purple blotch	*Alternaria porri*	23
	Botrytis leaf blight	*Botrytis squamosa*	21
	Stemphylium leaf blight	*Stemphylium vesicarium*	18
	White rot	*Sclerotium cepivorum*	8
	Smut	*Urocystis cepulae*	2
	Soft rot	*Erwinia carotovora*	2
	Sour skin	*Pseudomonas cepacia*	2
	Neck rot	*Botrytis allii*	1
	Basal rot	*Fusarium oxysporum*	1
	Stem and bulb nematode	*Ditylenchus dipsaci*	1
	Environmental damage	Pelting rain injury	6
	Chemical injury	Herbicide damage	7
Parsley	Alternaria leaf blight	*Alternaria petroselini*	1
Pepper	Bacterial speck	*Pseudomonas syringae*	1
Plum	Black knot	*Dibotryon morbosum*	1
Spinach	Nutrient deficiency		1
	Chemical injury		1
Tomato	Septoria leaf spot	*Septoria lycopersici*	2
	Late blight	*Phytophthora infestans*	1
DISEASED SAMPLES			251
ABIOTIC AND OTHER DISORDERS			45
TOTAL SUBMISSIONS			296

CULTURES : Cultures commerciales reçues au Laboratoire de diagnostic en phytoprotection
RÉGION : Québec

NOMS ET ORGANISME :
G. Gilbert, J. Caron, C. Dallaire, D. Hamel, D. Morais et L. Vézina
Laboratoire de diagnostic en phytoprotection, Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ), Complexe scientifique, 2700, rue Einstein - D.1.200h, Québec (Québec) G1P 3W8
Téléphone : (418) 643-5027 # 2708; **Télécopieur :** (418) 646-6806
Courriel : gerard.gilbert@mapaq.gouv.qc.ca

TITRE: MALADIES DIAGNOSTIQUÉES SUR DES ÉCHANTILLONS DE CULTURES COMMERCIALES SOUMIS AU LABORATOIRE DE DIAGNOSTIC EN PHYTOPROTECTION DU MAPAQ EN 2009

MÉTHODES : Le Laboratoire de diagnostic en phytoprotection du MAPAQ fournit un service d'identification des maladies parasitaires et non parasitaires pour les cultures commerciales produites au Québec. Les données rapportées présentent les maladies identifiées sur les échantillons de plantes soumis par les conseillers agricoles du MAPAQ, de la Financière agricole du Québec, de l'Institut québécois du développement de l'horticulture ornementale (IQDHO) et par ceux de l'industrie. Tous les échantillons font l'objet d'un examen visuel préalable suivi d'un examen à la loupe binoculaire. Selon les symptômes, un ou plusieurs tests diagnostiques sont réalisés dans le but de détecter ou d'identifier l'agent pathogène. Tous les tests de diagnostic utilisés au laboratoire sont issus de protocoles largement reconnus; voici les principaux : les nématodes sont extraits par l'entonnoir de Baermann et identifiés par microscopie; les champignons sont isolés sur les milieux de culture artificiels, identifiés par microscopie et le pouvoir pathogène de certains genres est vérifié; les bactéries sont aussi isolées sur des milieux de culture artificiels (généraux et différentiels) puis identifiées par les tests biochimiques classiques, API-20E, Biolog^{R}, ELISA ou PCR; les phytoplasmes sont détectés par PCR et les virus par le test sérologique ELISA. Les références consultées pour les noms des maladies et des microorganismes sont « Noms des maladies des plantes au Canada », 4e édition (2003) et « Maladies des grandes cultures au Canada », 1re édition (2004).

RÉSULTATS ET DISCUSSION : Les tableaux 1 à 12 présentent le sommaire des maladies identifiées sur les cultures commerciales. Au tableau 1, les maladies des plantes maraîchères de plein champ regroupent aussi les transplants provenant des serres et des pépinières. Toutes les plantes ornementales, peu importe leur provenance, ont été regroupées dans le tableau 11. Du 1er janvier au 30 décembre 2009, 1921 maladies ont été diagnostiquées. Parmi ces maladies, 1254 (71 %) sont d'origine parasitaire; de ce nombre, 1030 sont attribuables aux champignons, 138 aux bactéries et 76 aux virus. Les infections fongiques demeurent toujours très importantes parmi tous les grands groupes de cultures, surtout les infections fongiques racinaires. Plus de problèmes viraux ont été identifiés en 2009, mais moins de problèmes bactériens. Les plantes maraîchères et les petits fruits constituent ensemble 56 % de tous les échantillons. Des nouvelles maladies jamais diagnostiquées au laboratoire sont aussi rapportées. *Valdensinia heterodoxa* causant des taches foliaires sur le bleuetier nain, les taches sur les feuilles et les fruits causées par *Microdochium tabacinum* sur la courgette sont deux exemples.

Les totaux de maladies ne correspondent pas au nombre d'échantillons réellement traités parce que plusieurs maladies peuvent être identifiées sur un même échantillon. De plus, ces totaux ne tiennent pas compte des causes indéterminées, des diagnostics incertains et des échantillons soumis pour une détection spécifique de certains microorganismes ou autres problèmes. Lorsque non précisés, les agents non infectieux regroupent les déséquilibres minéraux, les pH inadéquats, les sols asphyxiants et salins, les insolations, le gel hivernal, le froid et l'excès de chaleur, les polluants atmosphériques, l'intumescence (œdème), les phytotoxicités causées par le mauvais usage des pesticides, l'excès ou le manque d'eau et les désordres génétiques.

REMERCIEMENTS : Les auteurs remercient Marion Berrouard, Andrée-Dominique Baillargeon, Ann-Marie Breton, Carolle Fortin, Audrée Gilbert, Chantal Malenfant, Mario Tésolin et Lise Vézina pour leur assistance technique.

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Ail	*Botrytis* sp.	Pourriture du col	5
	Colletotrichum sp.	Anthracnose	1
	Potyvirus	Anomalie de coloration foliaire	1
Asperge	*Botrytis cinerea*	Moisissure grise	1
	Fusarium moniliforme / F. oxysporum	Pourriture fusarienne	1
	Stemphylium sp.	Tache stemphyllienne	1
Aubergine	*Alternaria alternata*	Alternariose	2
	Botrytis cinerea	Moisissure grise	2
	Colletotrichum sp.	Anthracnose	2
	Fusarium moniliforme	Pourriture de tige	1
	Phoma sp.	Pourriture phoméenne	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Verticillium dahliae	Verticilliose	1
	Phytotoxicité pesticides		2
	Autres agents non infectieux		3
Betterave/ poirée	*Fusarium* sp.	Pourriture fusarienne des racines	1
	Pythium sp.	Pourridié pythien	2
Brocoli	*Alternaria brassicicola*	Tache noire	4
	Pseudomonas marginalis	Pourriture molle bactérienne	1
	Pythium dissotocum, P. polymastum, Pythium spp.	Pourridié pythien	6
	Xanthomonas campestris pv. *armoraciae*	Tache bactérienne	1
	Xanthomonas campestris pv. *campestris*	Nervation noire	4
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Carences minérales		4
	Autres agents non infectieux		5
Cantaloup	*Alternaria* sp.	Alternariose	1
	Fusarium oxysporum	Fusariose vasculaire	3
	Pseudomonas syringae	Tache angulaire	3
	Agents non infectieux		1
Carotte	*Fusarium oxysporum*	Pourriture du collet	3
	Rhizoctonia solani	Rhizoctone	3
	Thielaviopsis basicola	Pourriture noire des racines	1
	Phytotoxicité herbicides		3
	Autres agents non infectieux		6
Céleri	*Septoria apiicola*	Septoriose	3
	Phytotoxicité herbicides		20
	Autres agents non infectieux		2

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Chou / Chou de Bruxelles/ Radis	*Fusarium* spp.	Fusariose vasculaire	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	2
	Peronospora parasitica	Mildiou	1
	Pythium polymastum	Pourriture pythienne	3
	Pythium sp.	Pourriture pythienne	3
	Pseudomonas syringae	Moucheture bactérienne	2
	Rhizoctonia solani	Rhizoctone	2
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Xanthomonas campestris pv. *armoraciae*	Tache bactérienne	1
	Xanthomonas campestris pv. *campestris*	Nervation noire	2
	Désordre physiologique		3
	Stress climatiques		9
	Stress culturaux		3
Chou chinois	*Cercospora* sp.	Tache cercosporéenne	1
	Fusarium sp.	Pourriture de feuille	1
Chou-fleur	*Cladosporium* sp.	Anomalie de coloration des fleurs	2
	Fusarium oxysporum	Fusariose vasculaire	4
	Rhizoctonia solani	Tige noire	2
	Xanthomonas campestris pv. *campestris*	Nervation noire	2
	Stress climatique		5
	Stress culturaux		3
Citrouille	*Alternaria* sp.	Tache foliaire	2
	Botrytis cinerea	Moisissure grise	1
	Cladosporium cucumerinum	Gale	1
	Erwinia tracheiphila	Flétrissement bactérien	8
	Fusarium graminearum, F. oxysporum, Fusarium spp.	Pourriture des racines et collets	16
	Phoma sp.	Pourriture noire	1
	Phytophthora capsici	Pourridié phytophthoréen	10
	Pseudomonas syringae	Tache angulaire	3
	Pythium sp.	Pourridié pythien	6
	Sclerotinia sclerotiorum	Sclérotiniose	3
	Septoria sp.	Tache septorienne	5
	Sphaerotheca sp. (*Oïdium*)	Blanc	3
	Phytotoxicité par herbicides		5
	Stress culturaux		2
Concombre	*Alternaria alternata*	Tache foliaire	5
	Colletotrichum sp.	Anthracnose	1
	Erwinia tracheiphila	Flétrissement bactérien	1
	Fusarium spp.	Pourriture des racines et collet	1
	Potyvirus	Anomalie de coloration foliaire	1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Concombre	*Phytophthora capsici*	Pourriture du fruit	1
	Pseudomonas syringae	Tache angulaire	1
	Pythium aphanidermatum	Pourriture des tiges et du collet	1
	Stress climatiques		1
	Stress culturaux		2
Courge	*Cladosporium* spp.	Gale / tache foliaire	5
	Alternaria alternata	Tache alternarienne	3
	Colletotrichum sp.	Anthracnose	1
	CMV	Mosaïque	1
	Erwinia tracheiphila	Flétrissement bactérien	4
	Fusarium spp.	Pourriture des fruits / racines	4
	Pectobacterium carotovorum	Pourriture molle bactérienne	3
	Phoma cucurbitacearum	Pourriture noire	2
	Phytophthora capsici	Pourriture des fruits	7
	Pseudomonas marginalis / P. viridiflava	Pourriture molle bactérienne	12
	Pseudomonas syringae	Tache angulaire	1
	Pythium ultimum	Pourriture du fruit, des racines et du collet	6
	Rhizoctonia solani	Rhizoctone	1
	Septoria sp.	Tache septorienne	1
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Sphaerotheca fuliginea	Blanc	3
	Ulocladium sp.	Tache foliaire	1
	Xanthomonas campestris	Tache bactérienne sur fruit	1
	Phytotoxicité glyphosate		3
	Stress climatiques		2
	Stress culturaux		3
Épinard	*Aphanomyces* sp.	Racine noire	2
Haricot / Pois / Gourgane	*Colletotrichum* sp.	Anthracnose	2
	CMV	Malformation foliaire et mosaïque	5
	Fusarium oxysporum / F. solani	Pourriture fusarienne	12
	Phoma sp. / *Ascochyta* sp.	Ascochytose	2
	Pseudomonas syringae	Graisse bactérienne	1
	Pythium ultimum	Pourriture pythienne des racines	3
	Rhizoctonia solani	Rhizoctone	3
	Sclerotinia sclerotiorum	Pourriture sclérotique	2
	Thielaviopsis basicola	Pourriture noire des racines	2
	Phytotoxicité pesticides		6
	Stress climatiques		2
	Stress culturaux		11

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Laitue	*Bremiae lactucae*	Mildiou	1
	Fusarium sp.	Pourriture des racines	3
	Meloidogyne sp.	Nodosité des racines	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pseudomonas fluorescens	Brûlure de la marge	1
	Pseudomonas syringae	Tache foliaire	2
	Pythium spp.	Pourriture des racines et du collet, nanisme	9
	Rhizoctonia solani	Rhizoctone	1
	Septoria lactucae	Septoriose	2
	Xanthomonas campestris	Tache bactérienne	5
	Phytotoxicité herbicides		3
	Froid		1
	Déséquilibres minéraux		2
	Stress culturaux		5
Maïs sucré	*Cladosporium* sp.	Moisissure noire	1
	Colletotrichum graminicola	Anthracnose	1
	Fusarium graminearum	Piétin fusarien	3
	Fusarium oxysporum	Piétin fusarien	3
	Kabatiella sp.	Kabatiellose	1
	Phoma terrestris	Racine rose	1
	Pythium sp.	Piétin brun	1
	Setosphaeria turcica	Dépérissement	1
	Ustilago zeae	Charbon commun	1
	Phytotoxicité herbicides		8
	Stress climatiques		5
	Stress culturaux		3
Melon /Pastèque	*Fusarium oxysporum*	Pourriture fusarienne	2
	Fusarium acuminatum, F. equiseti, F. graminearum	Pourriture fusarienne	3
	Phytophthora capsici	Pourriture du fruit	1
	Pseudomonas syringae	Tache angulaire	1
	Stress culturaux		2
Oignon / Échalote / Poireau	*Alternaria porri*	Alternariose	2
	Aphelenchoides sp.	Pourriture du bulbe	1
	Botrytis squamosa	Brûlure des feuilles	1
	Botrytis spp.	Tache foliaire / pourriture du bulbe	1
	Cladosporium allii	Brûlure hétérosporienne	5
	Colletotrichum circinans	Anthracnose	1
	Burkholderia cepaciae	Pourriture bactérienne	1
	Fusarium moniliforme	Pourriture du bulbe et des racines	2
	Fusarium oxysporum	Fusariose du plateau	3

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Oignon / Échalote / Poireau	*Fusarium verticillioides*	Tache fusarienne	13
	Levures		1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Penicillium sp.	Anomalie de coloration du bulbe	1
	Peronospora sp.	Mildiou	1
	Pseudomonas fluorescens	Pourriture molle de feuilles	2
	Pseudomonas marginalis	Pourriture molle de feuilles	3
	Pythium sp.	Pourriture pythienne	1
	Stemphylium sp.	Moisissure noire des feuilles	4
	Stress climatiques		10
	Stress culturaux		4
Physalis	*Entyloma* sp.	Charbon	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Oedème		1
Piment/ Poivron	*Alternaria solani*	Alternariose	1
	AMV	Malformation de feuilles et fruits	2
	Botrytis cinerea	Moisissure grise	1
	Clavibacter michiganensis ssp. michiganensis	Chancre bactérien	1
	Colletotrichum sp.	Anthracnose	10
	Fusarium oxysporum	Fusariose des racines et du collet	8
	Phytophthora capsici	Pourriture de fruits	5
	Phytophthora sp.	Pourriture des racines et du collet	3
	Pseudomonas syringae	Moucheture bactérienne	5
	Pythium ultimum	Pourridié pythien	3
	Rhizoctonia solani	Tige noire	2
	Sclerotinia sclerotiorum	Sclérotiniose	8
	Stress climatique		2
	Stress cultural		4
Pomme de terre	*Alternaria solani*	Alternariose	3
	Botrytis cinerea	Moisissure grise	3
	Clavibacter michiganensis ssp. *sepedonicus*	Flétrissement bactérien	2
	Colletotrichum coccodes	Dartrose	12
	Fusarium oxysporum	Pourriture fusarienne	6
	Fusarium solani	Pourriture du semenceau	4
	Geotrichum sp.	Pourriture de tubercules	1
	Helminthosporium solani	Tache argentée	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	7
	Phytophthora erythroseptica	Pourriture rose	4
	Phytophthora infestans	Mildiou	13
	Pseudomonas fluorescens	Pourriture molle bactérienne	1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Pomme de terre	PMTV	Malformation et anomalie de coloration foliaire	1
	PVY	Mosaïque foliaire	1
	Pythium ultimum	Pourriture des racines	4
	Rhizoctonia solani	Rhizoctonie	12
	Sclerotinia sclerotiorum	Pourriture sclérotique	3
	Spongospora sp.	Gale poudreuse	3
	Verticillium dahliae	Verticilliose	2
	Asphyxie par excès d'eau		4
	Blessures mécaniques diverses		3
	Cœur brun		2
	Cœur creux		1
	Déséquilibre minéral		3
	Gel printanier		2
	Nécrose vasculaire au défanage		2
	Phytotoxicité herbicides		4
	Autres stress climatiques		7
	Autres stress culturaux		6
Tomate	*Alternaria alternata / A. solani*	Alternariose	5
	Botrytis cinerea	Moisissure grise	3
	Clavibacter michiganensis ssp. *michiganensis*	Chancre bactérien	5
	Colletotrichum coccodes	Anthracnose sur fruit	5
	Fusarium graminearum	Pourriture du fruit	1
	Fusarium oxysporum, F. acuminatum	Fusariose des racines	6
	Geotrichum candidum	Pourriture laiteuse	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phoma sp.	Pourriture des fruits et du collet	3
	Phytophthora capsici / P. nicotianae	Pourriture des fruits et des tiges	2
	Phytophthora infestans	Mildiou	4
	Potyvirus	Mosaïque	10
	Pseudomonas syringae	Moucheture bactérienne	5
	Pyrenochaeta sp.	Racine liégeuse	5
	Pythium ultimum	Pourriture pythienne	3
	Rhizoctonia solani	Rhizoctone commun	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Verticillium dahliae	Verticilliose	1
	Xanthomonas campestris	Tache bactérienne	3
	Grêle		6
	Agents non infectieux		2
Zucchini	*Cladosporium cucumerinum*	Gale	1
	CMV	Mosaïque	2
	Microdochium tabacinum	Tache foliaire	2

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Zucchini	*Pythium ultimum* *Pseudomonas syringae* *Septoria* sp.	Pourriture de fruits Tache angulaire Septoriose	1 1 1
Total			**749**

Tableau 2. Sommaire des maladies diagnostiquées parmi les **légumes d'entrepôt** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Pomme de terre	*Colletotrichum coccodes* *Fusarium avenaceum* , *F. sambucinum*, *Fusarium* spp. *Fusarium graminearum* *Helminthosporium solani* *Phytophthora infestans* PMTV *Rhizoctonia solani* *Spongospora* sp. *Verticillium dahliae* Défanage / défanant Cœur creux Froid Autres agents non infectieux	Dartrose Pourriture fusarienne Pourriture du tubercule Tache argentée Mildiou Anomalie de coloration dans le tubercule Rhizoctonie Gale poudreuse Verticilliose Nécrose vasculaire au tubercule	1 5 1 1 2 4 7 2 1 2 1 1 2
Rutabaga	*Sclerotium rolfsii*	Pourriture sclérotique	1
Total			**31**

Tableau 3. Sommaire des maladies diagnostiquées parmi les **plantes maraîchères de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Concombre	*Ascochyta sp.*	Chancre gommeux	1
	Botrytis cinerea	Moisissure grise	1
	Corynespora sp.	Tache foliaire	1
	Fusarium oxysporum	Fusariose vasculaire	2
	Potyvirus	Mosaïque, marbrure foliaire	1
	Pythium spp.	Pourriture des tiges et du collet	4
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Verticillium dahliae	Verticilliose	1
	Stress climatiques		3
Laitue	*Botrytis cinerea*	Moisissure grise	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	2
	Sclerotinia sp.	Sclérotiniose	1
	Déséquilibre minéral		2
	pH élevé du sol		2
	Salinité élevée du sol		2
	Autres stress culturaux		1
Poivron	*Fusarium solani*	Pourriture des racines et du collet	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium ultimum	Pourriture des racines	1
	pH élevé du sol		1
Tomate	*Botrytis cinerea*	Moisissure grise	5
	Clavibacter michiganensis ssp. *michiganensis*	Chancre bactérien	12
	CMV	Mosaïque	1
	Erysiphe orontii	Blanc	2
	Fulvia fulva	Moisissure olive	25
	Fusarium oxysporum	Pourriture des racines et du collet	3
	Fusarium solani	Chancre de collet et de tige	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	2
	PePMV	Anomalie de coloration foliaire	6
	Phytophthora infestans	Mildiou	4
	Phytophthora nicotianae	Pourriture et chancre à la tige	36
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium aphanidermatum	Pourriture pythienne	2
	Pythium irregulare	Pourriture pythienne	1
	Pythium ultimum	Pourriture pythienne	3
	Pythium spp.	Pourriture pythienne	4
	Rhizoctonia solani	Rhizoctone commun	4
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Verticillium dahliae	Verticilliose	4
	Carences minérales (P, K, Ca, Mg, B)		11

Tableau 3. Sommaire des maladies diagnostiquées parmi les **plantes maraîchères de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Tomate	Manque d'eau		2
	Maturité inégale		1
	pH élevé du sol		4
	Phytotoxicité herbicides		5
	Salinité du sol élevée		7
	Toxicité en manganèse		1
	Transpiration excessive du feuillage		7
	Autres agents non infectieux		3
Total			**189**

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Amélanchier	*Colletotrichum* sp.	Anthracnose	2
	Entomosporium mespili	Entomosporiose	1
	Gymnosporangium sp.	Rouille	2
	Oïdium sp.	Blanc	1
Argousier	Excès d'eau		2
Bleuetier en corymbe / nain	*Rhizobium radiobacter*	Tumeur du collet	1
	Aureobasidium sp.	Brûlure des rameaux	1
	BlScV	Dépérissement	2
	Botrytis cinerea	Moisissure grise	4
	Cercospora sp.	Tache foliaire	1
	Exobasidium vaccinii	Rouge	1
	Fusicoccum sp.	Chancre	3
	Gibbera vaccinicola (Protoventuria)	Gale de tige	2
	Guignardia sp.		1
	Monilinia sp.	Pourriture sclérotique	1
	Phomopsis vaccinii	Brûlure phomopsienne	3
	Protoventuria myrtilli	Tache foliaire	1
	Pucciniastrum goeppertianum	Rouille-balai de sorcière	1
	Pucciniastrum vaccinii	Rouille de la pruche	4
	Pseudomonas syringae	Brûlure bactérienne	1
	Ramularia effusa	Ramulariose	2
	ToRSV	Malformation foliaire	1
	Valdensinia heterodoxa	Tache foliaire	1

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Bleuetier en corymbe / nain	Carences minérales		8
	Gel hivernal		7
	Phytotoxicité herbicide		11
	pH inadéquat		5
	Autres stress climatiques		7
	Autres stress culturaux		1
Canneberge	*Colletotrichum* sp.	Brûlure de tige	1
	Fusicoccum putrefaciens	Chancre godronien	3
	Phyllosticta sp.	Tache foliaire	3
	Physalospora vaccinii	Tache foliaire	1
	Protoventuria myrtilli	Tache foliaire	2
	Agents non infectieux		5
Cassissier / Gadellier /Groseillier	*Sphaerotheca* sp.	Blanc	1
Fraisier	*Botrytis cinerea*	Moisissure grise	7
	Colletotrichum acutatum	Anthracnose	2
	Diplocarpon earlianum	Tache pourpre	1
	Myxomycète	Feuille bleutée	1
	Phytophthora cactorum	Pourriture de fruit et de collet	9
	Phytophthora fragariae	Stèle rouge	12
	Phytophthora spp.	Pourridié phytophthoréen	7
	Phytoplasme	Malformation	1
	Pythium/*Rhizoctonia*/*Cylindrocarpon*/ *Fusarium*	Pourriture noire des racines	58
	Sphaerotheca macularis (Oïdium)	Blanc	2
	Verticillium dahliae	Verticilliose	7
	Zythia fragariae	Pourriture de fruit	1
	Abrasion par le vent		2
	Gel hivernal		17
	Gel printanier		3
	Insolation		2
	pH du sol inadéquat		2
	Phytotoxicité herbicide		8
	Salinité inadéquate du sol		2
	Autres agents non infectieux		2
Framboisier rouge	*Armillaria* sp.	Pourridié agaric	2
	Botrytis cinerea	Moisissure grise	2
	Didymella applanata	Brûlure des dards	1
	Erwinia amylovora	Brûlure bactérienne	2
	Phytophthora spp.	Pourridié phytophthoréen	15

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Framboisier rouge	*Pseudomonas syringae*	Brûlure bactérienne	1
	Pythium/*Rhizoctonia*/*Cylindrocarpon*/ *Fusarium*	Pourriture noire des racines	9
	Septoria rubi	Tache septorienne	3
	Sphaceloma necator	Anthracnose	2
	ToRSV	Anomalie de coloration foliaire	1
	Gel hivernal		7
	Insolation		2
	pH acide		3
	Phytotoxicité herbicide		6
	Autres agents non infectieux		9
Vigne	*Alternaria* sp.	Pourriture des baies	1
	Botrytis cinerea	Moisissure grise	5
	Elsinoe (Sphaceloma) ampelina	Anthracnose	1
	Oïdium sp.	Blanc	3
	Phyllosticta ampelicida	Pourriture noire	5
	Plasmopara viticola	Mildiou	1
	Pseudopezicula sp.	Rougeot parasitaire	2
	Septoria sp.	Tache septorienne	4
	ToRSV		1
	Déséquilibre minéral		11
	Gel printanier		3
	Phytotoxicité pesticide		8
	Autres stress climatiques		7
	Autres stress culturaux		1
Total			**358**

Tableau 5. Sommaire des maladies diagnostiquées parmi les **céréales** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Avoine	*Alternaria alternata* / *Cladosporium* sp.	Moisissure noire	18
	Bipolaris sp. / *Drechslera* sp.	Victoriose / Tache brune	2
	BYDV	Feuille rouge	2
	Colletotrichum graminicola	Anthracnose	5
	Fusarium spp.	Piétin fusarien	2
	Puccinia sp.	Rouille des tiges	5
	Pythium spp.	Piétin brun	4
	Carences minérales		2

Tableau 5. Sommaire des maladies diagnostiquées parmi les **céréales** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Avoine	Gel printanier Stress culturaux		1 6
Orge	*Bipolaris sorokiniana* *Drechslera teres* *Fusarium* spp. *Gaeumannomyces graminis* *Pythium* sp. *Ustilago* sp. Agents non infectieux	Tache helminthosporienne Rayure réticulée Fusariose Piétin-échaudage Piétin brun Charbon	6 3 4 2 2 1 4
Blé	*Blumeria graminis* *Fusarium graminearum* *Pythium* spp. *Rhizoctonia solani* Gel printanier	Blanc Fusariose Piétin brun Rhizoctone commun	2 3 3 1 1
Total			**79**

Tableau 6. Sommaire des maladies diagnostiquées parmi les **cultures industrielles** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Canola	*Fusarium* spp. *Phytophthora nicotianae* *Pythium* spp. *Rhizoctonia solani*	Pourriture fusarienne Pourridié phytophthoréen Pourriture pythienne Rhizoctone commun	3 1 1 2
Houblon	Carence de potassium Autres agents non infectieux		3 3
Maïs	*Cladosporium* sp. *Colletotrichum graminicola* *Fusarium* spp. *Pythium* spp. *Rhizoctonia* sp. Phytotoxicité herbicide	Moisissure noire Anthracnose Piétin fusarien Piétin brun Rhizoctone commun	3 2 9 4 1 3

Tableau 6. Sommaire des maladies diagnostiquées parmi les **cultures industrielles** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Maïs	Stress climatiques Stress culturaux		4 5
Soya	*Alternaria alternata* *Ascochyta* sp. *Colletotrichum* sp. *Corynespora cassiicola* *Fusarium* spp. *Peronospora manshurica* *Phytophthora* spp. *Pratylenchus* sp. *Pythium* spp. *Rhizoctonia solani* *Sclerotinia sclerotiorum* *Septoria glycines* Carence Ca Insolation Phytotoxicité herbicides Autres agents non infectieux	Alternariose Ascochytose Anthracnose Pourriture des racines Pourriture fusarienne Mildiou Pourridié phytophthoréenne Lésion des racines Pourriture pythienne Rhizoctone commun Sclérotiniose Tache septorienne	3 3 4 1 9 4 2 1 5 2 1 1 2 2 5 5
Tabac	Potyvirus		1
Tournesol	*Sclerotinia sclerotiorum*	Pourriture sclérotique	1
Total			**96**

Tableau 7. Sommaire des maladies diagnostiquées parmi les **plantes fourragères** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Luzerne	*Cercospora medicaginis* *Colletotrichum* sp. *Fusarium* spp. *Phytophthora megasperma*	Cercosporose Anthracnose Pourriture fusarienne des racines Pourriture du collet	1 1 7 1

Tableau 7. Sommaire des maladies diagnostiquées parmi les **plantes fourragères** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Luzerne	*Pythium* spp.	Pourriture du collet et des racines	6
	Uromyces striatus	Rouille commune	1
	Gel hivernal		7
Millet perlé	*Fusarium* sp.	Pourriture de la tige	1
	Agents non infectieux		
Panic érigé	*Colletotrichum graminicola*	Anthracnose	1
Total			**26**

Tableau 8. Sommaire des maladies diagnostiquées parmi les **arbres et arbustes fruitiers** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Argousier	*Pseudomonas syringae*	Dépérissement des feuilles	1
	Gel hivernal	Chancre sur tige	1
Cerisier	*Cercospora* sp.	Tache cercosporéenne	2
	Rhizoctonia sp.	Brunissement des racines	1
	Septoria sp.	Tache septorienne	1
	Thielaviopsis basicola	Pourriture noire des racines	1
	Pseudomonas syringae	Tache foliaire	1
	Gel hivernal		1
Poirier	*Erwinia amylovora*	Brûlure bactérienne	1
	Nectria cinnabarina	Maladie du corail	1
	Gel hivernal		2
	Grêle		1
	Phytotoxicité par pesticides		1
Pommier	*Alternaria* sp. / *Aspergillus* sp. / *Aureobasidium* sp. / *Botrytis cinerea* / *Cladosporium* sp. / *Fusarium* spp. / *Hainesia* sp. / levures / *Microsphaeropsis* sp. / *Penicillium* sp. / *Phoma* sp.	Moisissure du coeur	37
	Cytospora leucosperma	Chancre cytosporéen	2

Tableau 8. Sommaire des maladies diagnostiquées parmi les **arbres et arbustes fruitiers** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Pommier	*Erwinia amylovora*	Brûlure bactérienne	6
	Phomopsis mali	Chancre phomopsien	3
	Phytophthora cactorum	Pourriture du collet	1
	Pseudomonas syringae	Chancre bactérien	1
	Sphaeropsis malorum	Chancre sur rameau	2
	Septoria sp.	Tache septorienne	1
	Spilocea pomi	Tavelure	24
	Nectria cinnabarina	Maladie du corail	1
	Gel hivernal		2
	Phytotoxicité par les pesticides		1
	Autres agents non infectieux		2
Prunier	*Taphrina* sp.	Tache sur fruit	1
Total			**99**

Tableau 9. Sommaire des maladies diagnostiquées parmi les **graminées à gazon** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Vert de golf (Agrostide / pâturin annuel)	*Colletotrichum graminicola*	Anthracnose	2
	Curvularia sp.	Tache foliaire	3
	Fusarium equiseti / F. avenaceum / F. graminearum / Microdochium nivale	Tache fusarienne, pourriture fusarienne des racines	4
	Gaeumannomyces graminis	Piétin-échaudage	2
	Leptosphaeria sp.	Pourriture des racines	2
	Microdochium nivale	Moisissure nivéale rosée	2
	Myxomycètes	Anomalie de coloration foliaire	1
	Pratylenchus sp.	Dépérissement des racines	1
	Pythium torulosum	Piétin brun	19
	Pythium spp.	Piétin brun	6
	Agents non infectieux		2
Total			**44**

Tableau 10. Sommaire des maladies diagnostiquées parmi les **arbres** et **arbustes ornementaux** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Abies sp.	*Botrytis* sp.	Chancre de tige	1
	Cylindrocarpon sp.	Pourriture des racines	3
	Fusarium spp.	Pourriture des racines	3
	Phacidiopycnis balsamicola	Dépérissement des tiges	1
	Phomopsis sp.	Brûlure de rameaux	1
	Phytophthora spp.	Pourriture des racines	3
	Rhizosphaera pini	Rouge	1
	Asphyxie		2
	Gel hivernal		1
Acer	*Aureobasidium* sp.	Anthracnose	1
	Cytospora sp.	Chancre cytosporéen	1
	Gel printanier		1
Carya sp.	*Cytospora* sp.	Chancre cytosporéen	1
Catalpa sp.	*Discula* sp.	Anthracnose	1
Fraxinus sp.	Phytotoxicité herbicide		1
Hydrangea	*Xanthomonas campestris*	Tache bactérienne	2
	Stress culturaux		2
Larix	*Mycosphaerella* sp.	Tache foliaire	1
Magnolia	*Pseudomonas syringae*	Tache foliaire	1
Malus sp.	*Spilocaea* sp.	Tavelure	1
Morus alba	*Phloeospora* sp.	Tache foliaire	1
Physocarpus	*Sphaerotheca* sp.	Blanc	1
Picea alba	*Rhizosphaera kalkhoffii*	Rouge	2
	Stress de température		1
Pinus sp.	*Cylindrocarpon* sp.	Pourriture des racines	1
	Fusarium spp.	Pourriture des racines	1
	Hendersonia pinicola	Rouge	1
	Pestalotiopsis funerea	Brûlure des aiguilles	2
	Phoma sp.	Chancre de tige	1
	Sphaeropsis sapinea	Brûlure des rameaux	2
	Gel hivernal		1

Tableau 10. Sommaire des maladies diagnostiquées parmi les **arbres** et **arbustes ornementaux** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Quercus rubra	*Discula umbrinella*	Anthracnose	1
Rhododendron	*Colletotrichum sp.* *Pestalotiopsis* sp. *Phomopsis* sp. Agents non infectieux	Tache foliaire Tache foliaire Chancre sur tige	1 2 1 4
Sambucus sp.	*Colletotrichum* sp. *Microsphaeropsis* sp. *Sphaceloma* sp. Potyvirus	Anthracnose Tache du fruit Tache foliaire Jaunissement, malformation foliaire	1 1 1 1
Thuja occidentalis	*Didymascella thujina* *Pestalotiopsis funerea* Dessèchement hivernal	Brûlure des aiguilles Brûlure des aiguilles	1 1 1
Tilia sp.	*Microsphaeropsis* sp. *Pseudomonas syringae*	Tache sur tige Brûlure de tige	1 1
Ulmus sp.	Oedème Algues	Tache foliaire Anomalie de coloration foliaire	2 1
Viburnum sp.	*Ascochyta* sp.	Tache foliaire	1
Total			**65**

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Aconitum	CMV	Malformation foliaire	1
Aeonium	Pythium sp. *Rhizoctonia solani*	Pourriture des racines Pourriture des racines	1 1
Anemone	*Pythium* sp. TRSV TSWV	Pourriture des racines Malformation foliaire Malformation foliaire	1 1 1
Angelonia	*Pythium ultimum*	Pourriture pythienne	1

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Anthirrhinum	INSV	Tache foliaire	1
Begonia	*Fusarium oxysporum*	Pourriture fusarienne	2
Bonsaï	*Fusarium oxysporum* Stress culturaux	Pourriture fusarienne	1 2
Calibrachoa	*Erysiphe* sp. *Fusarium* spp. *Phytophthora drechsleri* *Pythium* spp. *Ramularia* sp. Salinité élevée du sol Autres agents non infectieux	Blanc Pourriture des racines Pourriture des racines et du collet Pourriture des racines et du collet Tache foliaire	1 4 9 2 1 4 5
Campanula	Myxomycètes	Anomalie de coloration sur tige	1
Castanospermum	Agents non infectieux		2
Clematis	*Ascochyta* sp.	Ascochytose	4
Cyclamen	*Pythium* sp.	Pourriture pythienne	1
Cyperus	*Pythium irregulare* pH élevé du sol	Pourriture pythienne	1 1
Dahlia	pH élevé du sol. Salinité élevée du sol		1 1
Delphinium	*Ascochyta* sp. *Pseudomonas syringae* Carence minérale pH élevé	Tache ascochytique Tache noire bactérienne	2 1 1 2
Dianthus	*Fusarium* spp. Phytotoxicité pesticide	Pourriture fusarienne	4 1
Dracaena	Stress culturaux	Anomalie de coloration des feuilles	2
Echinacea	*Aphelenchoides* sp. *Colletotrichum* sp. *Erysiphe* sp. Phytoplasme	Tache foliaire Anthracnose Blanc Malformation de fleur	1 2 1 1

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Epipremnum	Salinité élevée du sol		1
Ficus	*Fusarium oxysporum*	Pourriture des racines et du collet	1
Filipendula	*Sphaerotheca* sp.	Blanc	1
Gerbera	*Erysiphe* sp.	Blanc	1
Helichrysum	*Verticillium dahliae*	Verticilliose	1
Hemerocallis	*Kabatiella* sp. TRSV	Tache foliaire Malformation foliaire	1 2
Heuchera	*Pythium splendens* Stress culturaux	Jaunissement des feuilles	1 2
Hosta	*Alternaria alternata* ArMV *Fusarium tricinctum* HVX	Tache foliaire Anomalie de coloration foliaire Pourriture du collet et des racines Mosaïque	1 2 4 2
Hoya	INSV	Brûlure foliaire	1
Impatiens	INSV	Tache foliaire	1
Kohleria	INSV	Brûlure foliaire	1
Lamium	*Pythium* sp. *Rhizoctonia solani*	Pourriture pythienne Rhizoctone	1 2
Lavandula	*Botrytis cinerea* *Rhizoctonia solani* *Thielaviopsis basicola* Salinité élevée du sol	Moisissure grise Rhizoctone brun Pourriture noire des racines	2 2 1 1
Leucanthemum	*Fusarium* sp. INSV *Phoma* sp. *Rhizobium radiobacter* Stress culturaux	Pourriture des racines Tache foliaire Pourriture de collet Tumeur du collet	1 2 1 2 2
Ligularia	INSV	Tache foliaire	1

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Lilium	Potyvirus	Anomalie de coloration foliaire	1
	Froid		1
Lobelia	*Pythium* sp.	Pourriture pythienne	1
	Verticillium dahliae	Verticilliose	1
Lupinus	Gel hivernal		1
Lythrum	*Septoria lythrina*	Tache septorienne	2
Miscanthus	Potyvirus	Jaunissement foliaire	1
Myosotis	INSV	Malformation foliaire	1
Pachysandra	AMV	Anomalie de coloration foliaire	1
Panax	*Pythium ultimum*	Pourriture pythienne	1
	Salinité élevée du sol		1
Paeonia	*Pythium ultimum*	Pourriture pythienne	1
	Rhizoctonia solani	Rhizoctone	2
	Xanthomonas campestris	Tache foliaire	1
	Stress culturaux		4
Pelargonium	ArMV	Mosaïque	2
	PFBV	Jaunissement des nervures	1
	Potyvirus	Mosaïque	1
	Pythium spp.	Pied noir	2
	Rhizoctonia solani	Rhizoctone brun	1
	Uromyces geranii	Rouille	1
	Verticillium dahliae	Verticilliose	1
	Xanthomonas hortorum pv. *pelargonii*	Pourriture bactérienne	1
	Autres agents non infectieux		4
Petunia	*Rhizoctonia solani*	Rhizoctone brun	1
Phlox	*Aphelenchoides* sp.	Dépérissement du collet	1
	ArMV	Anomalie de coloration foliaire	1
	INSV	Anomalie de coloration foliaire	1
	Potyvirus	Anomalie de coloration foliaire	6
	Rhizoctonia solani	Rhizoctone brun	1
	TBRV	Anomalie de coloration foliaire	1
	Thielaviopsis basicola	Pourriture noire des racines	1

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales** (jardins, pépinières, serres) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Plantago	*Peronospora* sp.	Mildiou	1
Pulsatilla	*Ascochyta* sp.	Ascochytose	1
Racomitrium	*Rhizoctonia sp.*	Dépérissement	1
Rudbeckia	*Pythium ultimum* *Rhizobium radiobacter* Stress culturaux	Pourriture pythienne Tumeur du collet	1 1 2
Salvia	*Xanthomonas campestris*	Tache bactérienne	1
Sedum	Potyvirus TBRV	Brûlure marginale des feuilles Tache foliaire	1 1
Sphagnum	*Chaetomium* sp.	Dépérissement	1
Surfinia	*Botrytis cinerea*	Moisissure grise	1
Trollius	*Botrytis cinerea*	Moisissure grise	1
Verbena	pH élevé du sol		1
Vinca	*Phoma* sp.	Dépérissement	1
Zamia	*Cylindrocarpon* sp. *Fusarium* sp.	Pourriture des racines Pourriture des racines	1 1
Zinnia	*Pythium* sp.	Pourriture de racines	1
Total			**175**

Tableau 12. Sommaire des maladies diagnostiquées parmi les **plantes aromatiques et les fines herbes** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2009.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Basilic	*Fusarium oxysporum*	Pourriture des racines et du collet	2
	Peronospora sp.	Mildiou	1
	Blessure par l'eau		1
	pH élevé du sol		1
Fenouil	*Fusarium oxysporum*	Pourriture fusarienne	2
	Pythium ultimum	Pourriture pythienne	1
	Rhizoctonia solani	Rhizoctone	2
Total			**10**

GRAND TOTAL **1921**

CROPS: Diagnostic Laboratory Report - All Crops
LOCATION: Prince Edward Island

NAME AND AGENCY:
M.M.Clark, P.E. Department of Agriculture, Plant Disease Diagnostic Laboratory, P.O. Box 306, Kensington, Prince Edward Island C0B 1M0
Telephone: (902) 836-8922; **Facsimile:** (902)836-8921 **Email**: mmclark@gov.pe.ca

TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS IN PRINCE EDWARD ISLAND, 2009

METHODS: The Prince Edward Island Department of Agriculture's Plant Disease Diagnostic Service (PDDS) provides diagnosis and control recommendations primarily for disease problems of commercial crops produced on PE. The PDDS also provides a Dutch elm disease (DED) diagnostic service for the Provincial Department of Environment, Energy and Forestry and local cities. Samples are submitted to the laboratory by agriculture extension staff, producers, growers, agri-business representatives, crop insurance agents and the general public. Diagnoses are based on a combination of a visual examination of symptoms, microscopic observation and culturing onto artificial media.

RESULTS AND COMMENTS: A total of 467 samples were processed for the 2009 growing season. Categories of samples received were: potato (66.8%), cereals (6.0%), other crops (17.6%) and Dutch elm disease service samples (9.6%). The percentage of samples received from provincial crop insurance agents was 46.6 %. A total of 655 disease identifications and 19 insect identifications were completed during the period January 1st, 2009 - December 11th 2009. The diagnoses reported may not necessarily reflect the major disease problems encountered during the season, but rather those most prevalent within the samples submitted. Excessive moisture during the earlier part of the growing season contributed to the development of blackleg in potato. Precipitation during the potato harvest period was less than in the 2008 growing season. As a result, the incidence of potato late blight was lower.

Table 1. Summary of diseases diagnosed on commercial crop samples submitted to the Prince Edward Island Plant Disease Diagnostic Laboratory in 2009.

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO. OF IDENTIFICATIONS
VEGETABLES:			
Bean	Anthracnose	*Colletotrichum* sp.	1
	Insect	Maggot	1
Cabbage	Fusarium wilt	*Fusarium oxysporum*	1
Carrot	Crown and root rot	*Rhizoctonia solani*	1
	Fusarium dry rot	*Fusarium* sp.	1
Cauliflower	Alternaria leaf spot	*Alternaria* sp.	1
	Head rot	*Erwinia* sp.	2
Cucumber	Leaf blight	*Alternaria alternata*	1
		Ulocladium sp.	1
Garlic	Basal rot	*Fusarium oxysporum*	1
Lettuce	Leaf spot	*Stemphylium* sp.	1
Onion	Pink root	*Phoma* sp.	1
Pepper	Botrytis leaf spot	*Botrytis cinerea*	1
Pumpkin	Bacterial soft rot	*Erwinia* sp.	1
	Crown and foot rot	*Fusarium oxysporum*	1
Potato	Bacterial soft rot	*Clostridium* sp.	17
		Erwinia sp.	32
		Pseudomonas sp.	8
	Black dot	*Colletotrichum coccodes*	7
	Black scurf	*Rhizoctonia solani*	10
	Blackleg	*Pectobacterium* sp.	29
	Botrytis grey mould	*Botrytis cinerea*	3
	Common scab	*Streptomyces scabies*	2
	Early blight	*Alternaria solani*	*2*
	Early dying	*Colletotrichum coccodes*	7
		Erwinia sp.	1
		Fusarium oxysporum	1
		Verticillium dahliae	1
		Verticillium albo-atrum	1
	Fusarium dry rot	*Fusarium avenaceum*	10
		Fusarium coeruleum	6
		Fusarium oxysporum	4
		Fusarium sambucinum	7
		Fusarium solani	9
		Fusarium spp.	1

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO. OF IDENTIFICATIONS
Potato (contd.)	Fusarium wilt	*Fusarium avenaceum*	1
		Fusarium oxysporum	1
		Fusarium roseum	1
		Fusarium solani	1
		Fusarium spp.	3
	Insect	Cutworm	3
		Maggot	1
		Millipede	1
		Mite	1
		Wireworm	7
	Nematode	Unidentified species	2
	Slug	Slug	3
	Late blight	*Phytophthora infestans*	87
	Leak	*Pythium* sp.	6
	Physiological disorder	Blackheart	5
		Burn	4
		Bruising	6
		Chemical damage	7
		Chilling	12
		Elephant hide	2
		Fertilizer burn	1
		Frost damage	15
		Greening	9
		Hollow heart	4
		Lightning injury	2
		Mechanical injury	7
		Oxygen deficiency	1
		Ozone damage	1
	Pink rot	*Phytophthora erythroseptica*	20
	Pinkeye	*Pseudomonas* sp.	18
	Powdery mildew	*Erysiphe* sp.	3
	Stem canker	*Rhizoctonia solani*	18
	Seed piece decay	*Clostridium* sp.	*3*
		Erwinia sp.	3
		Fusarium sp.	4
	Silver scurf	*Helminthosporium solani*	7
	Verticillium wilt	*Verticillium albo-atrum*	8
		Verticillium sp.	4
	Virus	Mosaic virus	2
Rutabaga	Ring spot	*Mycosphaerella* sp.	1
	White mould	*Sclerotinia sclerotiorum*	1
Squash	Alternaria leaf spot	*Alternaria* sp.	1
	Downy mildew	*Pseudoperonospora* sp.	1
	Fusarium wilt	*Fusarium* sp.	1
	Leaf blight	*Alternaria* sp.	1
		Ulocladium sp.	1

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO. OF IDENTIFICATIONS
Sweet potato	Soft rot	*Rhizopus* sp.	1
		Erwinia sp.	1
Tomato	Anthracnose	*Colletotrichum coccodes*	1
	Physiological disorder	PAN	1
	Verticillium wilt	*Verticillium albo-atrum*	1
FORAGE CROPS:			
Barley	Net blotch	*Pyrenophora* sp.	2
	Physiological disorder	Nutritional imbalance	2
	Powdery mildew	*Blumeria graminis*	2
	Root rot	*Cochliobolus* sp.	5
	Spot blotch	*Bipolaris* sp.	8
Oat	Anthracnose	*Colletotrichum* sp.	1
	Black head moulds	*Alternaria* sp.	2
		Bipolaris sp.	1
	Fusarium head blight	*Fusarium* sp.	2
Soybean	Anthracnose	*Colletotrichum* sp.	1
	Brown spot	*Septoria* sp.	7
	Downy mildew	*Peronospora* sp.	2
	Leaf blight	*Rhizoctonia solani*	1
	Powdery mildew	*Microsphaera* sp.	1
	Root rot	*Fusarium* sp.	1
		Rhizoctonia sp.	5
	Sudden death syndrome	*Fusarium solani*	2
	Virus	Mosaic virus	1
Wheat	Black head moulds	*Alternaria* sp.	4
		Aspergillus sp.	2
		Bipolaris sp.	4
	Fusarium head blight	*Fusarium* spp.	13
	Glume blotch	*Septoria* sp.	1
	Physiological disorder	Winter injury	2
	Powdery mildew	*Blumeria graminis*	3
	Rust	*Puccinia* sp.	1
	Seedling blight	*Cochliobolus* sp.	2
		Fusarium sp.	1
	Septoria blotch	*Septoria* sp.	3
SMALL FRUITS:			
Blueberry	Botrytis blight	*Botrytis cinerea*	4
(Lowbush)	Red leaf	*Exobasidium* sp.	3
	Monilinia blight	*Monilinia* sp.	2
	Phomopsis canker	*Phomopsis* sp.	1
	Rust	*Puccinia* sp.	1
	Septoria brown spot	*Septoria* sp.	2
	Twig blight	*Phomopsis* sp.	1

CROP	DISEASE	CAUSAL AGENT/ PLANT PATHOGEN	NO. OF IDENTIFICATIONS
Cranberry	Bitter rot	*Colletotrichum* sp.	1
	Fairy ring	*Helicobasidium* sp.	1
	Fruit rot	*Alternaria* sp.	1
		Penicillium sp.	1
		Phomopsis sp.	1
Grape	Angular leaf spot	*Mycosphaerella* sp.	1
	Botrytis vine rot	*Botrytis cinerea*	1
	Downy mildew	*Plasmopara viticola*	
Peach	Insect damage	Pear slug (*Caliroa cerasi*)	2
Pear	Leaf spot	*Entomosporium* sp.	1
Raspberry	Cane botrytis	*Botrytis cinerea*	1
	Canker and twig blight	*Leptosphaeria* sp.	1
	Physiological disorder	Chemical damage	1
	Phytophthora root rot	*Phytophthora* sp.	1
	Spur blight	*Didymella* sp.	1
	Verticillium wilt	*Verticillium albo-atrum*	1
Strawberry	Anthracnose	*Colletotrichum gloesporioides*	1
	Fusarium wilt	*Fusarium* sp.	1
	Leaf spot	*Phomopsis* sp.	1
	Root rot	*Ceratobasidium* sp.	3
		Pythium sp.	1
		Rhizoctonia sp.	2
	Verticillium wilt	*Verticillium albo-atrum*	2
OTHER CROPS:			
Elm	Dutch elm disease	*Ophiostoma nova-ulmi*	17
	Samples negative for DED		28
Sage	Powdery mildew	*Erysiphe* sp.	1
Turfgrass	Pink patch	*Limonomyces* sp.	1
	Red thread	*Laetisaria* sp.	1
	Leaf spot	*Stemphylium* sp.	1

TOTAL: 655

Cereals / Céréales

CROP / CULTURE: Barley
LOCATION / RÉGION: Central Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
N.E. Rauhala and T.K. Turkington
Agriculture and Agri-Food Canada, Lacombe Research Centre, 6000 C & E Trail, Lacombe AB, T4L 1W1
Telephone: (403) 782-8100; **Facsimile:** (403) 782-6120; **E-mail:** noryne.rauhala@agr.gc.ca

TITLE / TITRE: 2009 BARLEY DISEASE SURVEY IN CENTRAL ALBERTA

INTRODUCTION AND METHODS: A survey of diseases of barley was conducted in 23 fields in Central Alberta from July 31-August 17, 2009. Growers were contacted for permission to access their land, with the evaluation being done at the late milk to soft dough stage. The fields were traversed in a diamond pattern starting at least 25 m in from the edge, with visual assessment made on five penultimate leaves at each of five locations. Leaf diseases were scored as the percent leaf area diseased (PLAD) by either scald, net blotch or other leaf spots. Common root rot (CRR) was assessed on sub-crown internodes using a 0-4 scale where 0=none, 1=trace and 4=severe. Other diseases, if present, were rated as the percent plants affected. Following the survey, a representative tissue sub-sample of diseased plant parts collected at each location was cultured in the laboratory for pathogen isolation and identification.

RESULTS AND COMMENTS: Growing conditions in Central Alberta were very dry in May, June, and early July with scattered showers supplying the little moisture available. August moisture was adequate to finish the crops, but harvest was delayed by about two weeks because of initial variable and delayed crop emergence caused by the early-season drought. Disease development was irregular in the region.

Scald (*Rhynchosporium secalis*) severity ranged from PLAD 0.1 to 5.8% in eight fields, with one crop having a rating of 52%; all remaining fields had no evidence of scald (Table 1). As with scald, there was less netted net blotch (*Pyrenophora teres* f. *teres*) observed throughout the survey region compared to 2008 (Rauhala and Turkington 2009); PLAD levels ranged from 0.1 to 5.9% in 11 fields, with one crop having a rating of 13.6% and no netted net blotch found in the remaining fields. However, other barley leaf spots, diagnosed primarily as spotted net blotch (*P. teres* f. *maculata*), and those caused by A*lternaria spp*. were found in all fields surveyed. Severity of these 'other' leaf spots ranged from PLAD 1 to 21%. Stripe rust (*Puccinia striiformis)* was noted in only one commercial barley field at a trace level.

Common root rot of barley (*Cochliobolus sativus* and *Fusarium* spp.) occurred in all of the surveyed fields at slightly higher levels than in 2008 (Rauhala and Turkington 2009).

REFERENCE:
Rauhala, N.E, and Turkington, T.K. 2009. 2008 barley disease survey in central Alberta. Can. Plant Dis. Surv. 89:53. (http://www.cps-scp.ca/cpds.htm)

Table 1. Disease incidence and severity in 23 commercial barley fields in Central Alberta, 2009.

Disease (rating scale)	Percent of Fields Affected	Overall average severity (%)	Range in average severity per field (%)
Scald (PLAD*)	39	2.8	0 – 52.0
Net blotch (PLAD)	52	1.2	0 – 13.6
Other leaf spots (PLAD)	100	6.9	1 – 21.2
Common root rot (0-4)	100	1.7	0 - 4

*Percent penultimate leaf area diseased

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A. Tekauz, J. Gilbert, M. Stulzer, M. Beyene, and K. Slusarenko
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0944; **Facsimile:** (204) 983-4604; **E-mail:** andy.tekauz@agr.gc.ca

TITLE / TITRE: MONITORING FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA IN 2009

INTRODUCTION AND METHODS: In 2009 from July 28 to August 31, 32 fields (24 two-row, 8 six-row) of barley in southern Manitoba were monitored for the presence of fusarium head blight (FHB), when crops were at the early- to soft-dough (ZGS 81-86) stages of growth. The fields were selected at random along the survey routes, depending on crop frequency. The area sampled was bounded by Highways # 67, 16 and 46 to the north, the Manitoba/North Dakota border to the south, Hwys #12 and 9 to the east, and Hwys #83 and 41 to the west. FHB incidence (the percentage of heads with typical symptoms) was assessed in each crop by sampling 80-120 spikes at three locations and averaging the results. The average spike proportion infected (SPI) was estimated for each field. Several affected spikes were collected at each survey site and stored in paper envelopes. Subsequently, a total of 50 discoloured, putatively infected kernels, with those of normal appearance making up the remainder if needed, were removed from five spikes per location. The kernels were surface sterilized in 0.3% NaOCl (Javex brand) and plated onto potato dextrose agar in Petri dishes (10 seeds per plate) to quantify and identify the *Fusarium* spp. on kernels, based on morphological traits described in standard taxonomic keys.

RESULTS AND COMMENTS: Seeding of cereal crops in southern Manitoba in spring 2009 was protracted due to varying conditions in the region, and this, combined with below normal temperatures throughout much of the growing season, led to delayed and staggered crop development. Seasonal moisture levels were at normal to above normal levels for most of the region, including the Interlake, where many fields once again went unplanted due to soils already being waterlogged from the previous two years. Fortunately, the weather in September improved dramatically, allowing crops to be harvested in good condition.

The cool spring and early-summer temperatures probably curtailed development of *Fusarium* inoculum on overwintered straw and stubble, and would also have been unfavourable for subsequent infection of spikes. The below normal temperatures that continued throughout July and August, and the relatively low levels of FHB in barley (and other cereals) in the previous three years (Tekauz et al. 2009, 2008, 2007), likely contributed to the low amount of FHB found in Manitoba barley crops in 2009.

Visual evidence of FHB was noted in 31 of the 32 fields surveyed. Average incidence of FHB in two-row crops was 14.5% (range 0.3 – 56.1%), while the spike proportion infected (SPI) averaged 10.3% (range 3.0 – 30.0%); in six-row crops incidence was 2.6% (range 0 – 10.5%) and the SPI 5.6% (range 0 – 20.0%). The resulting Fusarium head blight index or FHB-I (%incidence X %SPI / 100) for 2-row barley was 2.0% (range 0.1 – 15.0%), that for 6-row barley 0.3% (range 0 – 2.1%). The mean FHB-I for all barley was 1.5%. This level would have resulted in a minimal yield loss to FHB in 2009, particularly in six-row barley, which is generally regarded as more susceptible to FHB than the two-row crop. The mean FHB-I in 2009 was somewhat higher than that reported for 2008 (0.9%) (Tekauz et al. 2009).

Fusarium colonies developed from kernels collected from each of the 32 fields, and from 46% of the total kernels plated on potato dextrose agar; this was a considerably higher level than reported for 2008 (Tekauz et al. 2009). The *Fusarium* species isolated from kernels are listed in Table 1. As found in Manitoba in most years, *F. graminearum* was the predominant pathogenic species isolated from kernels, followed by *F. poae.* Levels of the two other species were <5.0%. *Fusarium avenaceum* was not detected on barley in 2009.

REFERENCES:

Tekauz, A., Gilbert, J., Mueller, E., Stulzer, M., Beyene, M. and Unrau, T. 2009. Monitoring fusarium head blight in Manitoba in 2008. Can. Plant Dis. Surv. 89:(www.cps-scp.ca/cpds.htm)

Tekauz, A., Gilbert, J., Mueller, E., Stulzer, M., Beyene, M. and Kaethler, R. 2008. Survey for fusarium head blight of barley in 2007 in Manitoba. Can. Plant Dis. Surv. 88: 45-46. (www.cps-scp.ca/cpds.htm)

Tekauz, A., Gilbert, J., Mueller, E., Stulzer, M., Beyene, M., Kaethler, R., and Gozé, P. 2007. 2006 Survey for fusarium head blight of barley in Manitoba. Can. Plant Dis. Surv. 87: 53-54. (www.cps-scp.ca/cpds.htm)

Table 1. *Fusarium* spp. isolated from fusarium head blight-affected kernels of barley in Manitoba in 2009.

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. equiseti	3	0.1
F. graminearum	75	58.0
F. poae	69	36.9
F. sporotrichioides	19	4.9

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A. Tekauz, J. Gilbert, M. Stulzer, M. Beyene, and R. Kaethler.
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0944; **Facsimile:** (204) 983-4604; **E-mail:** andy.tekauz@agr.gc.ca

TITLE / TITRE: LEAF SPOT DISEASES DETECTED IN MANITOBA BARLEY FIELDS IN 2009

INTRODUCTION AND METHODS: In 2009, leaf spot diseases of barley in Manitoba were assessed by surveying 32 farm fields (24 two-row, 8 six-row) from July 28 to August 21 when most crops were at the early- to soft-dough stages of growth (ZGS 81-86). Fields were sampled at regular intervals along the survey routes, depending on availability. The area sampled was bounded by Highways # 67, 16 and 46 to the north, the Manitoba/North Dakota border to the south, Hwys #12 and 9 to the east, and Hwys #83 and 41 to the west. Disease incidence and severity were recorded by averaging their occurrence on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Disease ratings were taken on both the upper (flag and penultimate leaves) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site, dried, and stored in paper envelopes. Subsequently, surface-sterilized pieces of infected leaf tissue were placed on filter paper in moist chambers for 3-5 days to promote fungal sporulation to identify the causal agent(s), and thereby determine the disease(s) present.

RESULTS AND COMMENTS: Except for the latter half of June and a 'summer-like' September, the 2009 growing season in southern Manitoba was cooler than normal, delaying both seeding operations and subsequent crop development. Precipitation was generally at above-normal levels. The much improved conditions in September allowed the late-developing crops to mature and to realize both good yields and quality.

Leaf spots were observed in the upper and/or lower leaf canopies of all the barley crops surveyed. Disease levels in the upper canopy were trace, very slight or slight in 59% of fields, moderate in 28%, and severe in 9%. Respective severity categories in the lower canopy were tabulated as 16%, 6%, and 3%, with 75% being senescent. These levels were somewhat higher than those reported for 2008 or 2007, and the enhanced leaf spot severity noted in 2009 was likely the result of higher precipitation. The 12 crops with the highest leaf spot severities (along with those having low severities) were found in all regions of the province, suggesting that field history, i.e., the presence or absence of barley stubble from the previous year(s), was the principal factor influencing development of leaf spots. On average, yield losses attributable to leaf spots were likely near 5%, but would have been in the 10-25% range in the 12 most severely affected fields.

Pyrenophora teres (causal agent of net blotch) and *Cochliobolus sativus* (spot blotch) were the principal pathogens, causing about 2/3rd and 1/3rd of the leaf spot damage, respectively (Table 1). The predominance of *P. teres* and its presence in more crops were likely due to the lower 2009 temperatures which would not have favoured *C. sativus*. *Septoria passerinii* (speckled leaf blotch) also was found, but only in a few fields and at very low levels.

REFERENCES:
Tekauz, A., Gilbert, J, Mueller, E., Stulzer, M., Beyene, M and Unrau, T. 2009. Leaf spot diseases in Manitoba barley crops in 2008. Can. Plant Dis. Surv. 88:56-57. (www.cps-scp.ca/cpds.htm)

Tekauz, A., Gilbert, J, Mueller, E., Stulzer, M., Beyene, M. and Kaethler, R. 2008. Survey for leaf spot diseases of barley in Manitoba in 2007. Can. Plant Dis. Surv. 87:47-48. (www.cps-scp.ca/cpds.htm)

Table 1. Incidence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2009

Pathogen	Incidence (% of fields)	Frequency (% of isolations)*
Pyrenophora teres	81	64
Cochliobolus sativus	62	34
Septoria passerinii	9	2

*indicative of the relative foliar damage caused

CROP / CULTURE: Barley
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
M.R. Fernandez[1], M.R. Boire[1], F.L. Dokken-Bouchard[2], C. McCartney[3], and P. R. Northover[4]
[1] Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, P.O. Box 1030, Swift Current SK, S9H 3X2
Telephone: (306) 778-7255; **Facsimile:** (306) 778-3188; **E-mail:** myriam.fernandez@agr.gc.ca
[2] Saskatchewan Ministry of Agriculture, Crops Branch, 3085 Albert St., Regina SK, S4S 0B1
[3] Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK, S7N 5A8
[4] Saskatchewan Ministry of Agriculture, Crop Protection Laboratory, 346 McDonald Street, Regina SK, S4N 6P6

TITLE / TITRE: LEAF SPOTTING DISEASES OF BARLEY IN SASKATCHEWAN IN 2008

INTRODUCTION AND METHODS: A survey for leaf spotting diseases was conducted in barley crops randomly selected from 18 crop districts (CDs) in Saskatchewan in 2008. Fifty flag leaves were collected at random from each of 48 crops (38 two-row, 10 six-row) at the late-milk to early-dough development stages, and air-dried at room temperature. Mean percent leaf area with spot lesions (severity) was calculated for each crop and for crops grouped by soil zone (SZ): 1) Brown, 2) Dark Brown, and 3) Black/Grey. Surface-disinfested leaf tissue pieces from the 32 crops which had ≥2% severity were plated on water agar to identify and quantify pathogenic fungi. Information on tillage method was recorded for 47 of the crops sampled.

RESULT AND COMMENTS: All barley crops surveyed had leaf spotting diseases (Table 1). For individual crops, disease severity ranged from trace (≤0.5%) to 25% of total flag leaf area affected. The overall leaf spotting severity (4.7%) was similar to that in 2007 (4.4%) and 2006 (5.1%) (Fernandez et al., 2007, 2008). Mean leaf spotting ratings were highest in the east-central (CDs 2B, 5A) and north-eastern (CDs 8B, 9AE) regions of Saskatchewan, and were lowest in the south-west (CDs 3ASW, 3BN, 3BS, 4A). As in 2006 and 2007, mean disease severity was lowest in SZ1. Fungal identification and quantification revealed that *Pyrenophora teres* was the most commonly isolated pathogen in all soil zones (mean of 60% of isolates), and especially SZ2 where it represented 74% of all isolates. The relative prevalence of *P. teres* was slightly higher than in 2007 (56%), and somewhat lower than in 2006 (71%). *Stagonospora nodorum* was the second most common pathogen isolated in all three soil zones, followed by *Stagonospora avenae* f. sp. *triticea* and *Cochliobolus sativus*. *Septoria tritici* and *P. tritici-repentis* each accounted for less than 10% of all fungal isolations (data not shown).

When barley crops were classified by tillage method (Table 2), leaf spotting diseases appeared to be most severe under minimum-till, as was the case in 2007 and 2006 (Fernandez et al., 2007; 2008). *Stagonospora nodorum* and *C. sativus* were the most frequently isolated under minimum-till, while the opposite trend occurred with *S. avenae* f. sp. *triticea*.

ACKNOWLEDGEMENT:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff and Saskatchewan Ministry of Agriculture irrigation agrologists for the collection of leaf samples for this survey.

REFERENCES:
Fernandez, M.R., Dusabenyagasani, M. and Pearse, P.G. 2008. Leaf spotting diseases of barley in Saskatchewan in 2007. Can. Plant Dis. Surv 88: 43-44. (http://www.cps-scp.ca/cpds.htm)

Fernandez, M.R. and Pearse, P.G. 2007. Leaf spotting diseases of barley in Saskatchewan in 2006. Can. Plant Dis. Surv 87: 51-52. (http://www.cps-scp.ca/cpds.htm)

Table 1. Incidence and severity of leaf spotting diseases and mean percent isolation of leaf spotting pathogens, by soil zone, for barley crops sampled in Saskatchewan in 2008.

Soil Zone	# Crops affected/ surveyed	Mean severity	*Pyrenophora teres*	*Stagonospora nodorum*	*S. avenae* f. sp. *triticea*	*Cochliobolus sativus*
			%			
1 (Brown)	8/8[1]	1.2[2]	57/2[3]	21/2	0/0	15/1
2 (Dark Brown)	16/16	5.4	74/12	11/11	21/2	8/5
3 (Black/Grey)	20/20	5.6	49/14	45/13	14/5	9/12
Total/mean:	44/44	4.7	60/28	29/26	16/7	10/18

[1] Number of barley crops with leaf spots on flag leaves/total number of crops sampled.
[2] Mean percent flag leaf area with lesions.
[3] Mean percent isolation of fungus/number of barley crops where fungus was isolated.

Table 2. Incidence and severity of leaf spotting diseases and mean percent isolation of leaf spotting pathogens, by tillage system, for barley crops sampled in Saskatchewan in 2008.

Tillage system	# Crops affected/ surveyed	Mean severity	*Pyrenophora teres*	*Stagonospora nodorum*	*S. avenae* f. sp. *triticea*	*Cochliobolus sativus*
			%			
CT[1]	13/13[2]	3.9[3]	59/9[4]	21/9	22/3	6/7
MT	10/10	6.1	55/8	34/7	3/2	14/5
ZT	24/24	4.7	66/13	28/12	15/3	9/7

[1] CT: conventional-till, MT: minimum-till, ZT: zero-till.
[2] Number of barley crops with leaf spots on flag leaves/total number of crops sampled.
[3] Mean percent flag leaf area with lesions.
[4] Mean percent isolation of fungus/number of barley crops where fungus was isolated.

CROP / CULTURE : Barley
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
F.L. Dokken-Bouchard[1], P.R. Northover[2], C.N. Weitzel[2], J.J. Shiplack[2], and M.R. Fernandez[3]
[1] Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina SK, S4S 0B1;
Telephone: (306) 787-4671; **Facsimile:** (306) 787-0428; **E-mail:** faye.dokkenbouchard@gov.sk.ca
[2] Saskatchewan Ministry of Agriculture, Crop Protection Laboratory, 346 MacDonald Street, Regina SK, S4S 0B1
[3] Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, Box 1030, Swift Current SK, S9H 3X2

TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY IN SASKATCHEWAN IN 2009

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 57 barley crops (46 two-row; 11 six-row). Crops were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey).

Crop adjustors with Saskatchewan Crop Insurance Corporation and irrigation agrologists with Saskatchewan Ministry of Agriculture randomly collected 50 spikes from barley crops at the late milk to early dough stages (Lancashire et al. 1991). Spikes were analyzed for visible FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each barley crop surveyed: FHB severity (%) = [% of spikes affected x mean % of kernels infected] / 100. Mean FHB severity values were calculated for each soil/irrigation zone and for the whole province. Glumes or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min and cultured on potato dextrose agar and carnation leaf agar to obtain isolates for subsequent identification and quantification of *Fusarium* species.

RESULTS AND COMMENTS: Approximately 3.1 million acres (1.3 million ha) of barley were seeded in Saskatchewan in 2009 (Saskatchewan Ministry of Agriculture, 2009). Cool weather delayed seeding in most areas. West-central and north-west parts of the province experienced low moisture conditions in the spring and some areas did not receive adequate moisture during the critical crop season. Repeated frosts until the last week of May in several parts of the province and low spring and summer temperatures delayed crop emergence and slowed growth. Unseasonably warm weather in September created good harvest conditions; however, cold weather and precipitation in October halted harvest across most of the province until November.

In 2009, FHB occurred in 83% and 73% of the two-row and six-row barley crops surveyed, respectively (Table 1). Prevalence of FHB was similar to previous years, but the provincial mean FHB severities for two-row barley (1.4%) and six-row barley (1.1%) were approximately double those of previous years (Dokken et al. 2009). Incidence and severity of FHB in two-row barley were highest in soil zone 3, with all 25 of the crops surveyed having visible FHB symptoms. Four of the two-row barley and one of the six-row barley crops showed severities higher than 3%.

Similar to 2008, the most frequently isolated causal pathogen identified on samples with visible FHB symptoms was *F. poae* (77% of all *Fusarium* isolates), followed by *F. graminearum* (8.8%) and *F. avenaceum* (7.2%). *Fusarium acuminatum, F. sporotrichioides,* and *F. equiseti* each represented 3.1% of the isolates.

Fusarium graminearum was isolated from 5 of the 57 barley crops, and accounted for 1% of isolates from two-row and 15% of isolates from six-row barley. Three of the samples with *F. graminearum* (one two-row and two six-row barley) were from north-east Saskatchewan and two (one each of two-row and six-row barley) were from east-central Saskatchewan.

Other barley pathogens found infrequently included *Cochliobolus* and *Septoria* spp. Secondary moulds were isolated from 84% of barley samples in 2009.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff and Saskatchewan Ministry of Agriculture irrigation agrologists for the collection of cereal samples for this survey.

REFERENCES:
Lancashire, P.D., Bleiholder, H., Van Den Boom, T., Langeluddeke, P., Stauss, R., Weber, E., and Witzenberger, A. 1991. A uniform decimal code for growth stages of crops and weeds. Ann. Appl. Biol. 119:561-601.

Dokken, F.L., Holzgang, G., Weitzel, C.N., and Fernandez, M.R. 2009. Fusarium head blight in barley and oat in Saskatchewan in 2008. Can. Plant Dis. Survey 89:60-61 (http://www.cps-scp.ca/cpds.htm).

Saskatchewan Ministry of Agriculture. 2009. Saskatchewan Agricultural Statistics Pocket Resources: December 2009.

Table 1. Prevalence and severity of fusarium head blight (FHB) in barley crops grouped by soil zone in Saskatchewan, 2009.

Soil Zones	Two-Row Barley		Six-Row Barley	
	No. crops affected / total crops surveyed (% of crops infected)	**Mean FHB Severity[1] (range)**	**No. crops affected / total crops surveyed (% of crops infected)**	**Mean FHB Severity[1] (range)**
Zone 1 Brown	2/4 (50%)	0.2% (0 - 0.5%)	0/1 (0%)	0%
Zone 2 Dark Brown	11/17 (65%)	1.0% (0 - 5.0%)	1/1 (100%)	Trace[2]
Zone 3 Black/Grey	25/25 (100%)	2.4% (0.1 - 11.3%)	8/9 (78%)	1.4% (0 - 6.2%)
Overall Total/Mean	38/46 (83%)	1.4%	9/11 (73%)	1.1%

[1] Percent FHB severity = [% of spikes affected x mean % of kernels infected] / 100
[2] FHB severity values less than 0.1% reported as trace

CROP / CULTURE: Barley
LOCATION / RÉGION: Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A.G. Xue and Y. Chen
Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre, K.W. Neatby Building, 960 Carling Avenue, Ottawa ON, K1A 0C6;
Telephone: (613) 759-1513; **Facsimile:** (613)759-1926; **E-mail:** allen.xue@agr.gc.ca

TITLE / TITRE: DISEASES OF BARLEY IN EASTERN ONTARIO IN 2009

INTRODUCTION AND METHODS: A survey of barley diseases was conducted in 21 fields in eastern Ontario in late July when plants were at the soft dough stage. The fields were chosen at random in the regions where most of the spring barley is grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Diagnosis was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity for covered smut, ergot, leaf stripe, loose smut, and take-all was based on % plants infected. Fusarium head blight (FHB) was rated for incidence (percent infected spikes) and severity (percent infected spikelets in the affected spikes) based on about 200 spikes from each of three random sites per field. A FHB % index [(% incidence x % severity)/100] was determined for each field. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of the causal species of FHB was based on 10 infected spikes collected from each field. The spikes were air-dried at room temperature and subsequently threshed. Thirty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 30 seconds and plated in 9-cm diameter petri dishes on modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm of streptomycin sulphate. The plates were incubated for 10-14 days at 22-25ºC and a 14-hour photoperiod using fluorescent and long wavelength ultraviolet tubes. *Fusarium* species isolated from the kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: The fields consisted of three two-row and 18 six-row barley crops. A total of 14 diseases or complexes were observed (Table 1). Net blotch (*Pyrenophora teres*) and spot blotch (*Cochliobolus sativus*) were the most common foliar diseases, and were seen in 20 and 21 fields at mean severities of 4.6 and 4.3, respectively. For both diseases, eight crops were rated as having severe levels of infection. Yield reductions from these diseases were estimated to average >10% in the surveyed fields. Septoria complex [including speckled leaf blotch (*Septoria tritici*) and leaf blotch (*Stagonospora nodorum*)], and leaf rust (*Puccinia hordei*) were observed in six and five fields at mean severities of 3.2 and 2.8, respectively. Severe levels of these diseases were not found. Other foliar diseases included barley yellow dwarf (BYD), powdery mildew *(Erysiphe graminis*), scald (*Rhynchosporium secalis*) and stem rust (*Puccinia graminis* f. sp. *tritici* or *secalis*). Their average severities were 1.0, 1.1, 1.7, and 1.0 as observed in five, seven, seven, and two fields, respectively. The affected plants all had only trace to slight levels of infection. None of these diseases would have resulted in significant damage to the crop. Covered smut (*Ustilago hordei*), ergot (*Claviceps purpurea*), leaf stripe (*Pyrenophora graminea*), and loose smut (*U. nuda*) were found in two, six, five, and five fields at incidences of 1.5, 1.0, 2.3, and 1.3%, respectively and likely resulted in minimum damage. Take-all (*Gaeumannomyces graminis*) was found in 19 fields at a mean of incidence of 2.1%; this was more severe than in 2008 (Xue and Chen 2009). Fusarium head blight was found in most (21/23) fields (Table 1). The FHB index ranged from 0.3 to 16% with a mean of 1.8%. Nine *Fusarium* species were isolated from infected kernels (Table 2). *Fusarium graminearum* occurred in 90.5% of surveyed fields and on 29.3% of putatively infected kernels. *Fusarium poae* was found in 86% of surveyed fields and 14% of affected kernels; the frequency of this species on kernels was three times higher than found in 2008 (Xue and Chen 2009). *Fusarium avenaceum, F. equiseti,* and *F. sporotrichioides* were common, occurring in over 50% of surveyed fields, but kernel infection only ranged from 2 to 6%. Other species found included *F. acuminatum, F. tricinctum and F. verticillioides,* all in relatively few fields and on less than 1% of kernels.

Overall, the relative prevalence and severity of foliar diseases and FHB in barley in 2009 were greater than found in 2008 (Xue and Chen 2009). Net blotch and spot blotch were estimated to have caused significant yield reduction in 2009, but were minor diseases in previous years (Xue and Chen 2009). The lower temperatures and frequent periods of rain in June and July were likely responsible for the increase seen in net blotch, septoria complex, take-all, and FHB in 2009.

REFERENCE:

Xue, A.G. and Chen, Y. 2009. Diseases of barley in eastern Ontario in 2008. Can. Plant Dis. Surv. 89:58-59. (http://www.cps-scp.ca/cpds.htm)

Table1: Prevalence and severity of barley disease in eastern Ontario in 2009.

DISEASE	NO. CROPS AFFECTED (n=21)	DISEASE SEVERITY IN AFFECTED CROPS*	
		Mean	Range
BYD	5	1.0	1.0
Leaf rust	5	2.8	1.0 - 5.0
Net blotch	20	4.6	2.0 - 8.0
Powdery mildew	7	1.1	1.0 - 2.0
Scald	7	1.7	1.0 - 3.0
Septoria complex	6	3.2	2.0 - 4.0
Spot blotch	21	4.3	1.0 - 8.0
Stem rust	2	1.0	1.0
Covered smut (%)	2	1.5	1.0 - 2.0
Ergot (%)	6	1.0	0.1 - 2.0
Leaf stripe (%)	5	2.3	0.5 - 4.0
Loose smut (%)	5	1.3	0.1 - 2.0
Take-all (%)	19	2.1	1.0 - 5.0
Fusarium head blight**	21		
Incidence (%)		10.5	5.0 - 40.0
Severity (%)		11.2	5.0 - 40.0
Index (%)		1.8	0.3 - 16.0

*Foliar disease severity was rated on a scale of 0 (no disease) to 9 (severely diseased); leaf stripe, covered smut, ergot, loose smut, and take-all severity was based on % plants infected
** %FHB Index = (% incidence x % severity)/100.

Table 2: Frequency of *Fusarium* species in fusarium damaged barley kernels in eastern Ontario in 2009.

***Fusarium* spp.**	**% OF FIELDS**	**% OF KERNELS**
Fusarium spp.	100.0	57.0
F. acuminatum	9.5	0.3
F. avenaceum	71.4	3.8
F. culmorum	4.8	0.1
F. equiseti	52.4	2.3
F. graminearum	90.5	29.3
F. poae	85.7	14.2
F. sporotrichioides	71.4	6.1
F. tricinctum	9.5	0.2
F. verticillioides	4.8	0.8

CROPS / CULTURES: Wheat, barley, oat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
R.A.A. Morrall[1], B. Carriere[2], B. Ernst[3], and D. Schmeling[4]
[1]Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon SK, S7N 5E2
Telephone: 306-966-4410, **Facsimile:** 306-966-4461, **E-mail:** robin.morrall@usask.ca
[2]Discovery Seed Labs Ltd., 450 Melville Street, Saskatoon SK, S7J 4M2
[3]Prairie Diagnostic Seed Lab, 1105 Railway Avenue, Weyburn SK, S4H 3H5
[4]Lendon Seed Lab., 147 Hodsman Road, Regina SK, S4N 5W5

TITLE /TITRE: SEED-BORNE FUSARIUM ON CEREALS IN SASKATCHEWAN IN 2009

INTRODUCTION AND METHODS: The results of agar plate tests on cereal seed samples from Saskatchewan provided by three companies were summarized. The tests were conducted between early September and mid-December, 2009. It was assumed that the majority of samples were from the 2009 crop. The tests were conducted either to determine the frequencies of each species of *Fusarium* present or simply to detect *F. graminearum.* Data were tabulated only for all species combined (total *Fusarium*) and for *F. graminearum*. The mean percent seed infection levels with *F. graminearum* and with total *Fusarium* were calculated for each Saskatchewan crop district [CD] (6). In addition, the percentage of samples in which *F. graminearum* was not detected was calculated for each CD. As only 7.5 % of the total samples tested were free of all *Fusarium* spp. and there was little variation among CDs, data on % *Fusarium*-free samples were not tabulated by crop district.

The tests were performed on random seed samples, with no attempt to select fusarium-damaged kernels. Plating techniques varied slightly among companies. All tests were done using potato dextrose agar and the petri dishes in which seed was plated were incubated for 5 to 7 days. Illumination was with either fluorescent or a mixture of fluorescent and near UV (black) light and the dishes were arranged either singly or in stacked pairs under the light source. The number of seeds tested per sample was usually 200, but occasionally 400 or 1000. Thus, the probability of obtaining false negative results varied among tests.

RESULTS AND COMMENTS: In Saskatchewan the 2009 growing season was characterized by abnormally cool conditions from April to August, which delayed emergence and crop development (6). Areas in the south and west were dry or very dry in the spring but after late June most regions received adequate moisture. Harvest started very late in all but some areas of the southwest. September was hot and dry and crops matured well, but October was cold and wet and harvesting ceased. Many farmers did a large proportion of their harvest in November when drier weather returned. With the exception of some areas badly drought-stricken in the spring, both crop yields and quality in Saskatchewan were above the 10-year average (6).

Fusarium head blight was less conspicuous in mid-August on wheat and barley in eastern and south-eastern regions (1, 2) than in 2008. However, no data are available on the proportion of cereal crops that were sprayed with fungicides to control head blight. Generally hot, dry weather in September was not conducive to saprophytic spread of *Fusarium* spp. in ripening floral tissues, which can also lead to infection of cereal grains.

The data compiled are based on 362 samples (40% common wheat [all classes of spring and winter combined], 46% durum, 12% barley, 1% oat, <1% rye). As in previous years, *F. acuminatum*, *F. avenaceum*, *F. culmorum*, *F. equiseti*, *F. graminearum*, *F. poae* or *F. sporotrichioides* accounted for most of the *Fusarium spp.* isolated. Mean levels of *F. graminearum* and of total *Fusarium* varied among CDs (Table 1). The provincial mean for total *Fusarium* (4.9%) was the same as in 2008 (3) but means in individual CDs were quite different. In the last four years total *Fusarium* levels have never been as high as in 2005, when the mean reported was 7.3% (5).

Fusarium graminearum was found in only 12 of 20 districts, one fewer than in 2008. However, overall it was found in 42% of samples tested, a similar figure to 2008 and 2005. Percent seed infection was usually low (Table 1) although the overall provincial mean (0.8%) was the highest since 2005 (5). As in previous years (3, 4, 5), *F. graminearum* was more common in seed from regions close to Manitoba or North Dakota, i.e. CDs 1, 2, 5 and 8A. Notable exceptions to the low percent seed infections with *F. graminearum* were the following highest levels of infection in individual samples of four cereal types: durum 10.0% (CD 5A); common wheat 12.5% (CD 6B); barley 2.0 (CD 5A) oat 2.0 (CD 5A). Corresponding highest values for total *Fusarium* were: durum 20.0% (CD 5A); common wheat 21.0% (CD 6B); barley 62.5% (CD 5B); oat 28.5% (CD 1B). The highly infected wheat from CD 6B had been grown under irrigation.

REFERENCES:

1. Dokken-Bouchard, F.L., Northover, P.L., Weitzel, C.N., Shiplack, J.J. and Fernandez, M.R. Fusarium head blight in barley in Saskatchewan in 2009. Can. Plant Dis. Survey 90: 66-67. (http://www.cps-scp.ca/cpds.htm)

2. Dokken-Bouchard, F.L., Northover, P.L., Weitzel, C.N., Shiplack, J.J. and Fernandez, M.R. Fusarium head blight in common and durum wheat in Saskatchewan in 2009. Can. Plant Dis. Survey 90: 98-99. (http://www.cps-scp.ca/cpds.htm)

3. Morrall, R.A.A., Carriere, B., Ernst, B., Nysetvold, T. and Schmeling, D. 2009. Seed-borne Fusarium on cereals in Saskatchewan in 2008. Can. Plant Dis. Survey 89: 62-64. (http://www.cps-scp.ca/cpds.htm)

4. Morrall, R.A.A., Carriere, B., Ernst, B., Nysetvold, T., Schmeling, D. and Thomson, L. 2008. Seed-borne Fusarium on cereals in Saskatchewan in 2007. Can. Plant Dis. Survey 88: 55-57. (http://www.cps-scp.ca/cpds.htm)

5. Morrall,R.A.A., Carriere, B., Ernst, B., Pearse, C., Schmeling, D. and Thomson, L. 2006. Seed-borne Fusarium on cereals in Saskatchewan in 2005. Can. Plant Dis. Survey 86: 47-49. (http://www.cps-scp.ca/cpds.htm)

6. Saskatchewan Ministry of Agriculture. 2009. Final Crop Report December, 2009. Regina, SK. 12 pp. (http://www.agriculture.gov.sk.ca/Statistics-Crops)

Table 1. Number of cereal seed samples tested from September to December 2009 and levels of infection with *Fusarium graminearum* or total *Fusarium* spp. in relation to Saskatchewan Crop Districts

		Fusarium graminearum		**Total *Fusarium****
Crop District	**No. of samples tested**	**Mean % infection**	**Samples with no infection detected**	**Mean % infection**
1A	5	0.6	20%	2.3
1B	4	1.1	0%	10.1
2A	40	1.1	30%	5.8
2B	68	1.0	35%	4.5
3AN	4	0	100%	0.3
3AS	33	0.7	64%	2.5
3BN	19	0.2	84%	2.3
3BS	0	-	-	-
4A	8	0	100%	0
4B	5	0.2	60%	0.5
5A	23	1.6	47%	9.9
5B	13	0.2	67%	11.2
6A	18	0.2	67%	5.0
6B	66	0.6	77%	5.2
7A	7	0	100%	1.6
7B	1	0	100%	0
8A	26	1.5	27%	5.5
8B	4	0	100%	2.6
9A	17	0	100%	1.3
9B	1	0	100%	2.5
TOTAL	362	0.8	58%	4.9

*Number of samples tested for total *Fusarium* from all crop districts was only 346.

CROPS / CULTURES: Barley, Oat and Wheat
LOCATION / RÉGION: Manitoba and Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
S. Haber[1] and M. Desjardins[2]
[1]Agriculture and Agri-Food Canada, Cereal Research Centre, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-1467; **Facsimile:** (204) 983-4604; **E-mail:** steve.haber@agr.gc.ca
[2]Manitoba Agriculture, Food and Rural Initiatives, Plant Pathology Laboratory, 201-545 University Crescent, Winnipeg MB, R3T 5S6

TITLE / TITRE: **CEREAL VIRUS DISEASE SITUATION IN MANITOBA AND EASTERN SASKATCHEWAN IN 2009**

INTRODUCTION AND METHODS: Virus diseases on cereals in Manitoba and parts of eastern Saskatchewan monitored in 2009 were barley yellow dwarf (BYD), wheat streak mosaic (WSM) and oat necrotic mottle (ONM). Collaborators identified and collected samples from mid May to early September in cereals in Manitoba and parts of eastern Saskatchewan (1); samples were identified as originating from commercial fields or from field experiments not subjected to deliberate inoculation with the viruses. The proportion of plants with suspected virus symptoms in surveyed fields was estimated and specimens with and without symptoms collected for testing. Infection with BYDV, WSMV and ONMV was evaluated by transmission to indicator hosts (2), and the identities of the causal viruses confirmed by serology (ELISA). Transmission to indicator hosts also served to assess the virulence of the isolates against historical benchmarks. For WSMV, transmission was by mechanical inoculation to a range of susceptible spring bread and durum wheats. Oat specimens with symptoms that resembled those of ONM or of WSM on oat were assayed by mechanical inoculation to a differential set of susceptible bread wheat and oat hosts. For BYDV, transmission was by cereal aphids to seedlings of the oat cultivar Riel, a susceptible host.

RESULTS AND COMMENTS:
Barley Yellow Dwarf - In 2009, seeding was delayed in some of the principal cereal-producing regions of the eastern Prairies by cool, damp conditions. As in 2008, viruliferous aphid inoculum arrived later than average (early to mid-June). There were a few outbreaks of disease, particularly in barley and oat in the Interlake region of Manitoba. All isolates that were collected from cereal crops were similar to the PAV strain (non-specifically transmitted by the oat bird-cherry aphid).

Wheat Streak Mosaic – Outbreaks in spring wheat crops are especially severe when plants are infected at the early seedling stage. Although severe outbreaks of WSM in spring wheat in Manitoba were few in 2009, low or trace incidences of WSM were found in mid-to-late season in almost every field examined. Plants that fit this pattern of incidence were not colonized by the wheat curl mite, the recognized vector of WSMV. The possibility that WSMV might be also transmitted, if much less efficiently, by vectors other than the wheat curl mite, is now being investigated. Natural outbreaks of WSM on oat were again observed in 2009, but economic losses were seen only on wheat. Isolates obtained from oat and assayed on susceptible wheat seedlings were not more virulent than WSMV isolates from wheat in Manitoba.

Oat Necrotic Mottle (ONM) -The mild streak mosaic symptoms of WSM and ONM on oat are difficult to distinguish; oat crops displaying such symptoms should be tested for both WSMV and ONMV, respectively. In 2009, consistent with experience since 2006, oats with putative WSM or ONM symptoms were identified at a small number of sites in south-eastern Manitoba that were within a few hundred metres of stands of winter wheat. As in 2008, infection with WSMV was confirmed in all cases while transmission and serological assays failed to detect ONMV.

REFERENCES:
1. Haber, S. and Kurtz, R. 2004. Cereal virus disease outbreaks in Manitoba in 2003. Can. Pl. Dis. Surv. 84:54. (www.cps-scp.ca/cpds.htm)

2. Gill, C.C. and Westdal, P.H. 1966. Virus diseases of cereals and vector populations in the Canadian prairies during 1965. Can. Pl. Dis. Surv. 46: 18-19. (www.cps-scp.ca/cpds.htm)

CROPS / CULTURES: Barley, Oat, Wheat
LOCATION / RÉGION: Manitoba and Saskatchewan

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
J.G. Menzies, Z. Popovic, C. Saramaga, and B.B. Wong
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9;
Telephone: (204) 983-5714; **Facsimile:** (204) 983-4604; **E-mail:** jim.menzies@agr.gc.ca

TITLE / TITRE: **CEREAL SMUT SURVEYS, 2009**

INTRODUCTION AND METHODS: In July 2009, cereal crops in Manitoba and Saskatchewan were surveyed for the presence of smut diseases caused by *Ustilago hordei, U. nigra, U. nuda, U. tritici, U. avenae* and *U. kolleri*. The region sampled was covered by routes from Winnipeg - Weyburn - Moose Jaw - Saskatoon - Melfort - Wadena - Canora – Yorkton - Roblin - Dauphin - Neepawa - Winnipeg, as well as one-day trips around Winnipeg, MB, in the Red River valley, and the regions around Brandon, MB, and in Manitoba's Interlake. Fields were selected at random at approximately 10 - 15 km intervals, depending on the frequency of the crops in the region. An estimate of the percentage of infected plants (i.e., plants with sori) was made while walking an ovoid path of approximately 100 m in each field. Levels of smut greater than trace (<0.01%) were estimated by counting plants in a $1m^2$ area at a minimum of two sites on the path.

An isolate of smut was collected from each positive crop and compared with a carboxin-sensitive isolate, '72-66', from Canada, and a carboxin-resistant isolate, 'Viva' (Newcombe and Thomas, 1991) from France, using the teliospore germination assay of Leroux (1986) and Leroux and Berthier (1988) to determine if resistance to the fungicide carboxin was present. Teliospores of each isolate were streaked onto half-strength potato dextrose agar amended with 0 or 1.0 µg ml^{-1} of carboxin. The streak cultures were incubated at 20°C in a controlled environment chamber and examined for teliospore germination after 24 hours.

RESULTS AND COMMENTS: Loose smut (*Ustilago tritici*) was found in 25 (28%) of the 90 fields of awnless, common wheat surveyed. One field each had incidences of 5%, 2% or 1% infection, two fields had an incidence of 0.1% infection, and the incidence of smut in the remainder of the infested fields was at trace levels (<0.01%). In awned, common wheat fields, loose smut was found in 23 (31%) of 74 fields. One field had an incidence of 1% infection, two fields had 0.5% infection, one had 0.2% infection, one had 0.1% infection, and the other infested fields had trace levels of infection. In durum wheat, loose smut was found in 12 (41%) of the 29 fields surveyed. Five fields had 1% infection, one had 0.1% infection and the rest of the infested fields had trace levels of infection.

None of the 39 fields of oat surveyed was observed to have smutted plants.

Loose smut (*U. nuda*) was found in 19 (59%) of 32 fields of six-row barley. Two fields had an incidence of 5.0% infection, one field had a 1.5% infection level, five fields had an incidence of 1.0% infection, one field had an incidence of 0.7% infection and ten fields had an incidence of 0.1% infection; the incidence of smutted plants in the remainder of infested fields was at trace levels. Ten (20%) of the 50 fields of two-row barley surveyed were found to have smutted plants. Two fields had an incidence of 2% infection, one field had an incidence of 1% infection, two fields had an incidence of 0.5% infection, and plants in the remainder of the infested two-row barley fields were infected at trace levels. False loose smut (*Ustilago nigra*) and covered smut (*U. hordei*) were not found in any barley fields surveyed in 2009. However, a colleague submitted a sample of *U. hordei* from a six-row barley field near Winnipeg, in which there was a trace level of infection.

Isolates of *U. nuda* collected from 6 fields of two-row barley were able to germinate and grow on agar medium amended with carboxin. These data suggest that the isolates may be resistant to carboxin fungicide, but further studies must be done to confirm these preliminary findings.

REFERENCES :

Leroux P., 1986. Caractéristiques des souches d'*Ustilago nuda*, agent du charbon nu de l'orge, résistantes à la carboxine. Agronomie 6:225-226.

Leroux P. and Berthier, G. 1988. Resistance to carboxin and fenfuram in *Ustilago nuda* (Jens) Rostr., the causal agent of barley loose smut. Crop Protection 7:6-19.

Newcombe G. and Thomas, P.L. 1991. Incidence of carboxin resistance in *Ustilago nuda*. Phytopathology 81:247-250.

CROP/ CULTURE: Barley, Oat and Wheat
LOCATION / RÉGION: Manitoba and eastern Saskatchewan

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
T. Fetch, K. Dunsmore, and T. Zegeye
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9;
Telephone: (204) 983-1462; **Facsimile:** (204) 983-4604; **E-mail:** tom.fetch@agr.gc.ca

TITLE / TITRE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2009

INTRODUCTION AND METHODS: Surveys of producer fields and trap 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* Pers. f. sp. *avenae* Eriks. & E. Henn.) were conducted in July, August, and September 2009. Infected stem tissue samples were collected from the sites surveyed. Urediniospores were obtained from collections and evaluated for virulence specialization on appropriate sets of host differential lines (Fetch, 2009).

RESULTS AND COMMENTS: Very low temperatures in May resulted in delayed planting of cereal crops. The temperature remained below normal for the 2009 growing season across the eastern Prairie region. Precipitation was variable, with above normal amounts in the Red River Valley but lower than normal amounts in eastern Saskatchewan and central to western Manitoba. Cool nights provided good dew, particularly in the Red River Basin. While this provided favorable conditions for stem rust infection, incidence and severity on susceptible lines in trap nurseries and in commercial oat and barley fields were at trace levels across Western Canada. This indicated that very low levels of stem rust inoculum migrated from the USA. As in recent years, most commercial grain crops were sprayed with foliar fungicides, thus limiting the number of untreated crops for rust to infect.

All spring wheat cultivars recommended for production in Manitoba and Saskatchewan have excellent resistance to stem rust, and no stem rust infection was observed in any commercial wheat fields. Stem rust was detected at trace levels on susceptible wheat lines in trap nurseries, on cultivated barley, and on wild barley (*Hordeum jubatum*) in 2009. The dominant *P. graminis* f. sp. *tritici* race in 2009 was QFCSC (88%), which has been predominant since 2004. A similar race (RFCSC) was found in 2009 in eastern Canada.

Stem rust in cultivated and wild oat was at trace levels in western Canada in 2009. All oat cultivars except 'Stainless' are susceptible to stem rust races TJG, TJJ, and TJS (Fetch and Jin, 2007). Race TGD (NA29) was dominant in 2009 (29% of total samples), followed by TJN (16%), TGN (16%), TJS (11%) and TJJ (10%). Race TJS, which is a highly virulent race that appeared in 2005, increased from 4% in 2008 to 11% in 2009 (Fetch et al. 2009. One novel race (TJL) was detected in 2009, and most likely is an asexual single-gene mutant of the gene in race TJN for avirulence to gene *Pg15* in oat.

REFERENCES:
Fetch, T.G. Jr. 2009. Races of *Puccinia graminis* on barley, oat, and wheat in Canada in 2005. Can. J. Plant Pathol. 31:74-79.

Fetch, T.G., Dunsmore, K. and Zegeye, T. 2009. Stem rust of cereals in western Canada in 2008. Can. Plant Dis. Surv. 89:67. (http://www.cps-scp.ca/cpds.htm)

Fetch, T. G. Jr., and Jin, Y. 2007. Letter code system of nomenclature for *Puccinia graminis* f. sp. *avenae*. Plant Dis. 91:763-766.

CULTURES / CROPS: Avoine, *Avena sativa*; Orge, *Hordeum vulgare*; Blé, *Triticum aestivum*
RÉGION / LOCATION: Québec

NOMS ET ÉTABLISSEMENTS / NAMES AND AGENCIES:
S. Rioux[1], F. Langevin[2], A. Comeau[2] et R. Yelda[3]
[1] Centre de recherche sur les grains inc. (CÉROM), 2700, rue Einstein, Québec (Québec), G1P 3W8
Téléphone: (418) 528-7896; **Télécopieur:** (418) 644-6855; **Courriel:** sylvie.rioux@cerom.qc.ca
[2] Centre de recherche et de développement sur les sols et les grandes cultures, Agriculture et Agroalimentaire Canada, 2560, boul. Hochelaga, Québec (Québec), G1V 2J3
[3] Fédération des producteurs de cultures commerciales du Québec, 555, boul. Roland-Therrien, Longueuil (Québec), J4H 3Y9

TITRE / TITLE: MALADIES DES CÉRÉALES PRÉSENTES AU QUÉBEC EN 2009

INTRODUCTION et MÉTHODES: L'intensité des symptômes des maladies foliaires a été notée dans les essais d'enregistrement et de recommandation de blé de printemps, d'orge et d'avoine. Ces essais localisés dans différentes régions du Québec (CÉROM 2009) ont été visités une fois durant la saison lorsque la céréale était au stade de développement laiteux moyen à pâteux moyen. Une échelle de notation de 0 à 9 a été utilisée: la catégorie 0 correspondant à aucun symptôme et 9 à des symptômes sur plus de 50 % de la surface de la feuille étendard. Une intensité faible réfère à des valeurs de 0 à 4, une intensité moyenne à des valeurs de 4 à 6 et une intensité élevée à des valeurs de 6 à 9. La proportion de lots de blé déclassés par la présence de grains fusariés ou de désoxynivalénol (DON) a été fournie par le Service de mise en vente en commun du blé destiné à la consommation humaine de la Fédération des producteurs de cultures commerciales du Québec (FPCCQ). Des informations sur le nombre d'avis de dommages aux cultures d'orge causés principalement par la fusariose de l'épi proviennent, quant à elles, de La Financière agricole du Québec (FADQ). Les dommages causés par la cécidomyie orangée du blé (*Sitodiplosis mosellana*), un insecte associé à la fusariose de l'épi (*Fusarium graminearum*) par le transport de l'inoculum de *Fusarium* jusqu'aux épis, ont été notés visuellement sur des échantillons de grains de blé provenant de champs commerciaux de différentes régions du Québec.

RÉSULTATS et COMMENTAIRES: En 2009, les conditions climatiques printanières ont dans l'ensemble été favorables aux opérations de semis. Durant toute la saison les températures ont rarement excédé 25ºC, même dans les régions du sud du Québec. Dans la région du Saguenay-Lac-Saint-Jean, les pluies ont été rares pendant les trois premières semaines de juin limitant sérieusement la croissance des plantes, alors que de la fin juin jusqu'au 10 août la situation était inverse et semblable à celle des autres régions du Québec pour la même période, soit des pluies abondantes et fréquentes. Pendant cette période de pluies fréquentes les plantes ont souffert d'excès d'eau et plusieurs maladies de racines ont été aggravées, dont le piétin-échaudage (*Gaeumannomyces graminis*). Ce dernier a causé des dommages notamment à Princeville (Centre-du-Québec) et à Causapscal (Gaspésie). L'excès d'eau entraîne une hypoxie (manque d'oxygène) au niveau des racines, ce qui amène chez les céréales un cortège de conséquences incluant l'inefficacité des engrais et une sensibilité accrue à un grand nombre de stress et de maladies. Il devient important dans ce contexte de bouleversement climatique que les généticiens travaillent à créer des génotypes aptes à mieux tolérer l'excès d'eau et l'hypoxie.

Chez l'avoine, la présence et l'intensité des maladies du feuillage, la tache ovoïde (*Stagonospora avenae*) et la rouille couronnée (*Puccinia coronata*), ont été très semblables à celles de la saison 2008 (Rioux et al. 2009). La tache ovoïde d'intensité moyenne à élevée a été observée partout et la rouille couronnée était surtout présente en Montérégie et à La Pocatière dans le Bas-Saint-Laurent. Quant à la jaunisse nanisante de l'orge (VJNO), elle a été quasi absente en 2009.

Les taches foliaires (*Drechslera tritici-repentis*, *Stagonospora nodorum* et *Cochliobolus sativus*), la rouille des feuilles (*Puccinia triticina*) et l'oïdium (*Blumeria graminis* f. sp. *tritici*, syn. *Erysiphe graminis*) sont les maladies foliaires qui ont été observées chez le blé en 2009. Les taches foliaires ont été comme à l'habitude les plus répandues et d'intensité moyenne à élevée. La rouille des feuilles qui a touché seulement la Montérégie-Est a eu une intensité plutôt faible. Comme par les années passées, l'oïdium

était présent à la station de Princeville et l'intensité des symptômes variait de faible à moyenne, alors qu'à Saint-Augustin-de-Desmaures (Capitale-Nationale) son intensité était beaucoup plus faible. Pour une deuxième année consécutive la fusariose de l'épi a touché durement la culture, les pluies fréquentes du mois de juillet ayant nettement contribué à l'infection et au développement de la maladie. La proportion des lots de blé mis en vente par le service de la FPCCQ qui ont été déclassés fourrager à cause de la fusariose, était de 40 à 50 %, soit 10 % de plus qu'en 2008, et aucune région n'a été épargnée. La Montérégie-Est a encore été, en 2009, une des régions les plus touchées. La cécidomyie orangée du blé a été moins présente en 2009 qu'elle ne l'a été en 2008 provoquant rarement plus de 1 % de grains endommagés par l'insecte. La germination sur épi favorisée elle aussi par les pluies abondantes et fréquentes a entraîné une détérioration de l'apparence des grains de blé. L'observation visuelle de ces grains était plus difficile et moins précise car l'aspect blanchâtre, délavé ou déformé des grains pouvait être facilement confondu avec des dommages causés par des champignons ou des insectes.

Les maladies foliaires de l'orge qui sont présentes tous les ans et dans toutes les régions du Québec, soit les taches foliaires (*D. teres*, *Rhynchosporium secalis* et *C. sativus*), n'ont pas fait exception en 2009. Elles ont été observées dans tous les essais et l'intensité des symptômes variait de moyenne à élevée. La rouille des feuilles (*Puccinia hordei*) et l'oïdium (*B. graminis* f.sp. *hordei,* syn. *E. graminis*) sont des maladies beaucoup moins courantes chez l'orge. Elles se sont tout de même manifestées, bien que faiblement, en Montérégie-Est (rouille et oïdium) et à Saint-Augustin-de-Desmaures (oïdium). Tout comme chez le blé, la fusariose de l'épi a passablement affecté la production d'orge en 2009. Les producteurs assurés à la FADQ ont été encore plus nombreux en 2009 à signifier des dommages causés à leur culture par la fusariose (Bertrand Leclerc, FADQ, communication personnelle), soit une proportion de 26,9 % (708 producteurs sur 2630) comparativement à 14,3 % en 2008.

RÉFÉRENCES:

CÉROM. 2009. Recommandations de cultivars de céréales à paille 2010. Dans : Résultats 2009 et Recommandations 2010 des RGCQ. CÉROM, pages 22-29. [http://www.cerom.qc.ca/Documentations/Resultats_RGCQ_2009.pdf]

Rioux, S., Langevin, F. et Comeau, A. 2009. Principales maladies observées chez les céréales au Québec en 2008. Can. Plant Dis. Surv. 89:68-69. (www.cps-scp.ca/cpds.htm)

CROP / CULTURE: Corn
LOCATION / RÉGION: Ontario and Québec

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
X. Zhu, L. M. Reid, T. Woldemariam, and C. Voloaca
Agriculture and Agri-Food Canada, Central Experimental Farm, Ottawa ON, K1A 0C6
Telephone: (613) 759-1616; **Facsimile:** (613) 952-9295; **E-mail:** xiaoyang.zhu@agr.gc.ca

TITLE / TITRE: SURVEY OF CORN DISEASES AND PESTS IN EASTERN ONTARIO AND WESTERN QUÉBEC IN 2009

INTRODUCTION AND METHODS: A survey to document the occurrence of diseases and pests of corn in eastern Ontario and western Québec was conducted from September 10 to 24, 2009. The primary emphasis of the survey, as in previous years, was to determine the distribution and severity of the bacterial disease, Stewart's wilt (*Pantoea stewartii* = *Erwinia stewartii*). The distribution and severity of other diseases and insect pests, including eyespot (*Aureobasidium zeae*), common rust (*Puccinia sorghi*), northern leaf blight (*Exserohilum turcicum*), anthracnose leaf blight (*Colletotrichum graminicol*a), common smut (*Ustilago maydis*), head smut (*Sporisorium holci-sorghi* = *Sphacelotheca reiliana*), ear rot (*Fusarium spp*.), stalk rot (*Fusarium spp*. and *C. graminicol*a), European corn borer (*Ostrinia nubilalis*), corn rootworm (*Diabrotica longicornis* and/or *D. virgifera*), and corn flea beetle (*Chaetocnema pulicaria*) were also recorded. In addition, scouting for any newer diseases and pests of corn in eastern Canada was conducted, especially for grey leaf spot (*Cercospora zeae-maydis*) in Ontario.

At each of 87 fields in eastern Ontario and 19 fields in western Québec surveyed, the incidence of all diseases or pests and the severity of those that predominated, were recorded.

RESULTS AND COMMENTS:
Fungal leaf diseases: Eyespot was found in most fields in Ontario and Québec (Table 1). The disease was a serious problem in the county of Stormont, Dundas, and Glengarry, Ontario, along an approximate 20 km stretch of Hwy. #43 from Winchester to St. Luke. Three hybrids were found to be highly susceptible to eyespot, and entire plants were almost fully covered with yellowish spots and near death. Common rust was found in many fields in Ontario and Québec (Table 1); however, levels were not severe and symptoms were only evident on the lower leaves. Typical symptoms of grey leaf spot were found in one field in Lanark County, Ontario (Table 1). This is the second year grey leaf spot was observed in this county. No grey leaf spot was observed in Québec. Anthracnose leaf blight was found in a high proportion of fields in Ontario and Québec (Table 1). The disease was more common than in 2008 but of lower severity than recorded in 2007 (1, 2). Northern leaf blight (NLB) also was prevalent in both Ontario and Québec. This was the second year that NLB was found in more than 60% of surveyed crops, i.e. 64% in 2009 and 62% in 2008 (2). Three fields in Ontario were rated as having an intermediate to high severity of NLB, two of these near Lancaster, in Stormont, Dundas, and Glengarry County. This confirmed once again that NLB is a serious problem in corn in eastern Canada (1, 2).

Fungal ear and stalk diseases: At the time of the survey, gibberella/fusarium ear rot was observed only in 5 fields in Ontario (Table 1) at relatively low levels. Ear rot was less prevalent than usual, as was the case in 2008 (2), possibly because plants were 2-3 weeks later in maturing, due to the frequent rainy, cloudy periods during the summer months. However, in October and November, reports from other sources of outbreaks of ear rot became more numerous. Common smut was distributed across 14 fields in Ontario and 9 fields in Québec in 2009 (Table 1). Common smut incidence was extremely low in the three Ontario counties of Frontenac, Leeds and Grenville, and Ottawa-Carleton, and disease incidence in all fields in Ontario as well as Québec was less than 1%. Head smut was not detected in 2009. Bird damage to ears was common and relatively severe throughout the region, resulting in black mould spores on corn kernels.

Stalk rot, including anthracnose stalk rot/top-die back, fusarium stalk rot, and pythium stalk rot was found in 30 fields in Ontario and most fields in Québec (Table 1). Top-die back was very common in Stormont, Dundas, and Glengarry County, Ontario and in Vaudreuil-Solanges, the only county surveyed in Québec. A number of crops sampled in late September had more than 90% of the plants with top-die back**.**

Bacterial diseases: Only two cases of Stewart's wilt-like leaf symptoms were noted, but when the collections were subsequently tested by ELISA, these proved to be negative for *Pantoea stewartii*.

Viral diseases: No maize dwarf mosaic or symptoms of any other viruses were noted in 2009.

Insects: European corn borer (ECB) damage was observed in about 20% of Ontario fields, and in only one field in Québec (Table 1). Significant damage was not found anywhere. Corn rootworm (CRW) damage was observed at 30 fields in Ontario and 12 fields in Québec (Table 1). As reported previously, the damage caused by CRW in most fields results primarily from leaf feeding and silk pruning. As with ECB, the level of damage caused by CRW in 2009 was lighter than usual. The number of crops with ECB or CRW in 2009 was very low, similar to 2008 (2), likely because of wet summer conditions in both years.

Populations of grasshoppers, most likely the red-legged grasshopper [*Melanoplus femur-rubrum* (De Geer)], were also lower in 2009, as in 2008 (2), with only 21% of crops showing evidence of damage by the insect. Corn blotch leaf miner (*Agramyza parvicornis* Loew) was not found as frequently as in other years in either Ontario or Québec. Brown stink bug (*Euschistus servus*) and Picnic beetle (*Glischrochilus quadrisignatus*) were observed in a few fields in both Ontario and Québec.

Mites: Two-spotted spider mite (*Tetranychus urticae* Koch = *T. bimaculatus* Harvey) populations were low in 2009, and most damage was restricted to the bottom 3-4 leaves. This was also noted in 2008 (2). However, the proportion of fields showing mite damage in 2009 (43%) was slightly higher than found in 2008 (38%).

Other: Bird damage, and damage caused by other animals, was extensive in many fields in both Ontario and Québec, as has been typical in most years.

Summary: High moisture levels during the growing season, and several particularly wet days, had a major impact on corn production and on disease and pest levels in 2009. As was also the case in 2008, the crop was 2-3 weeks late in maturing compared to the norm. Stewart's wilt was not diagnosed in the region in 2009. The incidence of eyespot and northern leaf blight was higher than normal, but the incidence of other leaf diseases, such as anthracnose leaf blight and common rust, was low in 2009. Based on the timeframe the survey was conducted, stalk rot, ear rot and conditions caused by pests such as the European corn borer, corn rootworm, and mites, were less prevalent and severe in 2009 than usual.

ACKNOWLEDGEMENTS:
Support for this survey by Agriculture and Agri-Food Canada is gratefully acknowledged.

REFERENCES:

1. Zhu, X., Reid, L.M., Woldemariam, T., Tenuta, A. and C. Van Herk. 2008. Survey of corn diseases and pests in Ontario and Québec in 2007. Can. Plant Dis. Surv. 88: 62-65. (http://www.cps-scp.ca/cpds.htm)

2. Zhu, X., Reid, L.M., Woldemariam, T. and Voloaca, C. 2009. Survey of corn diseases and pests in eastern Ontario and western Québec, 2008. Can. Plant Dis. Surv. 89:74-75. (http://www.cps-scp.ca/cpds.htm)

Table 1. Distribution of diseases and pests in Ontario and Québec corn fields in 2009

County	# of Fields	Eyespot	Rust	GLS	ALB	NLB	Wilt	Smut	Head smut	Ear rot	Stalk rot	ECB	CRW	Grasshopper	Mites
Ontario															
Frontenac	5	5	1		2	1				1	1	3	5	4	1
Lanark	10	10	2	1	5	5		3		1	2	2	2		6
Leeds & Grenville	12	10	7		9	10				2	1	6	9	8	2
Ottawa-Carleton	15	14	5		12	11		1		1	2	6	5	1	11
Prescott & Russell	3	1	1		2	1		1			3		1	2	
Renfrew	19	17	18		15	11		2			1		1		6
Stormont, Dundas & Glengarry	23	22	19		22	18		7			20	2	7	1	11
Total	**87**	**79**	**53**	**1**	**67**	**57**		**14**		**5**	**30**	**19**	**30**	**16**	**37**
Québec															
Vaudreuil-Soulanges	19	17	14		14	11		9			17	1	12	6	8
Overall Total	**106**	**96**	**67**	**1**	**81**	**68**	**0**	**23**	**0**	**5**	**47**	**20**	**42**	**22**	**45**

Rust = common rust. GLS = grey leaf spot; ALB = anthracnose leaf blight; NLB = northern leaf blight; Wilt = Stewart's wilt; Smut = common smut; Ear rot = combined gibberella ear rot and fusarium ear rot; Stalk rot = combined fusarium stalk rot, anthracnose stalk rot, and top-die back; ECB = European corn borer; CRW = Corn rootworm, including both western and northern corn rootworm.

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A. Tekauz, M. Stulzer, and M. Beyene
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0944; **Facsimile:** (204) 983-4604; **E-mail:** andy.tekauz@agr.gc.ca

TITLE / TITRE: FUSARIUM HEAD BLIGHT OF OAT IN MANITOBA IN 2009

INTRODUCTION AND METHODS: The occurrence of Fusarium head blight (FHB) in oat in southern Manitoba was monitored in 36 farm fields from July 28 to August 31, 2009 when crops were at early- to hard dough (ZGS 80-87) stages of growth. The fields were selected at random along the survey routes, depending on crop frequency. The area sampled was bounded by Highways # 67, 16 and 46 to the north, the Manitoba/North Dakota border to the south, Hwys #12 and 9 to the east, and Hwys #83 and 41 to the west. Fusarium head blight in each field was assessed by sampling a minimum of 80-100 plants gathered as a clump, at each of 3 locations, for the presence of infected spikelets on panicles (disease incidence), and for the average proportion of panicle spikelets infected (SPI) by FHB. Fusarium head blight severity was calculated as the 'FHB Index' (% incidence x % SPI) / 100. Several putatively affected panicles, and (or) those of normal appearance, as necessary, were collected from each location, placed in plastic bags and frozen. Subsequently, 50 discoloured and (or) clean seeds per field were surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar in Petri dishes (10 seeds per plate) to identify and quantify the *Fusarium* spp. present, based on morphological traits described in standard taxonomic keys.

RESULTS AND COMMENTS: Seeding of cereal crops in southern Manitoba in spring 2009 was protracted due to varying conditions in the region, and this, combined with the below normal temperatures during much of the growing season, led to delayed or staggered crop development. Seasonal moisture levels were at normal to above normal levels for most of the region, including the Interlake, where many fields once again went unplanted due to soils being already waterlogged from the previous two years. Fortunately, the weather in September improved dramatically, allowing crops to be harvested in good condition.

The cool spring and early-summer temperatures likely curtailed development of *Fusarium* inoculum on overwintered straw and stubble, and would also have been unfavourable for subsequent infection of spikelets. The below normal temperatures that continued throughout July and August, the relatively low levels of FHB in cereal crops in 2008 (Gilbert et al. 2009, Tekauz et al. 2009a, 2009b, 2009c), and the difficulty of recognizing this disease in an oat crop, would have contributed to the minimal amount of FHB recorded in Manitoba oat crops in 2009.

One third of the fields sampled showed no visual evidence of FHB. In most of the remainder, putative disease symptoms were enumerated, but in a few fields, the presence of distinct orange-pink discoloured spikelets made disease diagnosis unequivocal. The latter situation is unusual. Overall, average incidence of FHB was estimated to be 2.2% (range 0 - 30.5%), SPI as 2.5% (range 0 – 10.0%) and the FHB Index (%incidence x % SPI / 100), 0.12% (range 0 – 1.5%). The mean FHB Index of more than 0.1% for 2009 was higher than for all previous years since 2003 (Tekauz et al. 2009b). Nonetheless, FHB would have caused no actual yield loss to oat crops in Manitoba in 2009.

Fusarium colonies developed from 17.6% of the oat kernels plated on potato dextrose agar. Kernels sampled from all 36 crops yielded *Fusarium* spp. (range 2 – 54% *Fusarium* isolation). This is the highest level reported since surveys for FHB in oat in Manitoba were initiated in 2002. Both *F. graminearum* and *F. poae* predominated in 2009, while three other species were each isolated from <5.0% of kernels (Table 1).

REFERENCES:

Gilbert, J., Tekauz, A, Kaethler, R., Slusarenko, K., Leclerc, C, Mueller, E., Stulzer, M. and Beyene, M. 2009. Survey of fusarium head blight of spring wheat in Manitoba in 2008. Can. Plant Dis. Surv. 89: 94-95. (www.cps-scp/cpds.htm)

Tekauz, A., Gilbert, J., Mueller, E., Stulzer, M., Beyene, M. and Unrau, T. 2009a. Monitoring fusarium head blight of barley in Manitoba in 2008. Can. Plant Dis. Surv. 89: 54-55. (www.cps-scp.ca/cpds.htm)

Tekauz, A., Mueller, E., Stulzer, M. and Beyene, M. 2009b. Monitoring of fusarium head blight of oat in Manitoba in 2008. Can. Plant Dis. Surv. 89: 79-80. (www.cps-scp.ca/cpds.htm)

Tekauz, A., Stulzer, M., Mueller, E and Beyene, M. 2009c. Monitoring fusarium head blight of winter wheat in Manitoba in 2009. Can. Plant Dis. Surv. 89: 96-97. (www.cps-scp.ca/cpds.htm)

Table 1. *Fusarium* spp. isolated from fusarium head blight affected crops and oat kernels from Manitoba in 2009.

Fusarium spp.	Percent of crops	Percent of kernels
F. avenaceum	6	0.6
F. equiseti	3	0.3
F. graminearum	69	48.2
F. poae	78	46.1
F. sporotrichioides	22	4.7

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba and East-Central Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
A. Tekauz[1], H.R. Kutcher[2], C. McCartney[3], Z. Lewchuk[4], M. Beyene[1], M. Stulzer[1] and C. L. Kirkham[2]
[1]Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0944; **Facsimile:** (204) 983-4604; **E-mail:** andy.tekauz@agr.gc.ca
[2]Agriculture and Agri-Food Canada, Melfort Research Station, Box 1240, Melfort SK, S0E 1A0
[3]Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK, S7N 5A8
[4]Saskatchewan Ministry of Agriculture, Regional Services Branch, 38-5th Ave. N., Yorkton SK, S3N OY8

TITLE / TITRE: LEAF SPOTS IN MANITOBA AND SASKATCHEWAN OAT CROPS IN 2009

INTRODUCTION AND METHODS: In 2009, leaf spot diseases in 36 commercial oat crops in Manitoba and 47 crops in Saskatchewan were assessed during surveys done from July 28 to August 31 (MB) and August to September (SK). At these times plants were at the early milk to hard dough (ZGS 73-87) stages of growth. Fields were sampled at regular intervals along the survey routes, depending on availability. The area sampled in Manitoba was bounded by Highways # 67, 16 and 46 to the north, the Manitoba/North Dakota border to the south, Hwys #12 and 9 to the east, and Hwys #83 and 41 to the west. Disease incidence and severity were recorded by averaging their occurrence on approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Disease ratings were taken on both the upper (flag and penultimate leaves) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site and dried and stored in paper envelopes. In Saskatchewan, the area surveyed was in east-central regions and only the upper canopy was sampled for leaf spot severity. Foliar tissue with typical lesions was collected at each site, placed in paper envelopes and allowed to dry. For all collections, surface-sterilized pieces of infected leaf tissue were subsequently placed in moist chambers for 3-5 days to promote fungal sporulation and identify the causal agent(s), and to determine the disease(s) present and their relative importance.

RESULTS AND COMMENTS: In southern Manitoba, except for the latter half of June and a 'summer-like' September, the 2009 growing season was cooler than normal, delaying both seeding and subsequent crop development. Precipitation was generally at above-normal levels. The much improved conditions in September allowed the late-developing crops to mature and realize respectable yields and quality. Early season conditions were similar in Saskatchewan to Manitoba, and delayed emergence and crop development were widespread. Moisture was adequate from late June until late August. September was hot and dry but October was cold and damp. Many farmers did a large proportion of their harvesting in November.

Leaf spots were observed in the upper or lower leaf canopies in 94% and 100% of the Manitoba and Saskatchewan oat fields monitored, respectively, similar percentages to those found in 2007 and 2008 (Tekauz et al. 2008, 2009). In Manitoba, disease levels in the upper canopy were trace to slight in 80% of fields and moderate or severe in 20%. Respective severity categories in the lower canopy were estimated as 11% and 11%, with 78% of the lower foliage having senesced. In several fields, leaf spot severity was the highest that has been observed on this crop in Manitoba in the past 8 years. In these fields yield losses of 10-20%, or possibly higher, likely occurred. On average, losses from leaf spots in oat would have been about 5%. In Saskatchewan, 74% of crops (data available for 42 of the 47 fields) had trace or slight levels of leaf spotting in the upper canopy, while in 26% levels were rated as moderate or severe. This suggests than leaf spots also caused appreciable yield losses in oat in Saskatchewan in 2009, perhaps in individual fields, or on average, at levels similar to those estimated for Manitoba.

In Manitoba, *Stagonospora avenae* f.sp. *avenae* (stagonospora leaf blotch) predominated and was found in more fields and estimated to have caused more damage than *Pyrenophora avenae,* (pyrenophora leaf blotch) (Table 1). In the past, the latter has been the more prevalent pathogen. This was the highest level of *S. avenae* recorded since 2002 when systematic monitoring of oat crops was initiated in

Manitoba. The ascendancy (either a single occurrence, or possibly a future trend) of *S. avenae* relative to *P. avenae* was first noted in 2008 (Tekauz et al. 2009). *Cochliobolus sativus* (spot blotch), was a minor component of the oat leaf spot complex, as has typically been the case in Manitoba.

In east-central Saskatchewan, *P. avenae* predominated, as was found in 2008 and on two previous occasions (Tekauz et al. 2009). The pathogen was detected in most fields and caused near ¾ of the leaf spot damage observed. *Stagonospora. avenae* f.sp. *avenae* was also present and was responsible for a smaller portion of the damage observed, as in 2008. *Cochliobolus sativus* levels remained low in Saskatchewan in 2009.

REFERENCES:

Tekauz, A., Kutcher, H.R, Mueller, E., Stulzer, M. and Beyene, M. 2009. Leaf spot diseases in Manitoba and Saskatchewan oat crops in 2008. Can. Plant Dis. Surv. 89:81-82. (www.cps-scp.ca/cpds.htm)

Tekauz, A., Kutcher, H.R, Mueller, E., Stulzer, M. and Beyene, M. 2008. Foliar diseases in Manitoba and Saskatchewan oat fields in 2007. Can. Plant Dis. Surv. 88:75-76. (www.cps-scp.ca/cpds.htm)

Table 1. Incidence and isolation frequency of leaf spot pathogens of oat in Manitoba and east-central Saskatchewan in 2009.

Pathogen	Incidence (% of fields)		Frequency (% of isolations)*	
	MB	SK	MB	SK
Pyrenophora avenae	56	85	36	72
Stagonospora avenae f. sp. *avenae*	81	77	56	23
Cochliobolus sativus	28	39	8	5

*indicative of the relative amount of foliar damage observed

CROP / CULTURE: Oat
LOCATION / RÉGION: Eastern Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A.G. Xue and Y. Chen
Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre, K.W. Neatby Building, 960 Carling Avenue, Ottawa ON K1A 0C6;
Telephone: (613) 759-1513; **Facsimile:** (613)759-1926; **E-mail:** allen.xue@agr.gc.ca

TITLE / TITRE: DISEASES OF OAT IN EASTERN ONTARIO IN 2009

INTRODUCTION AND METHODS: A survey for oat diseases in 2009 was conducted in the last week of July when plants were between the late milk and soft dough stages of development. Ten oat fields were chosen at random in regions of eastern Ontario where the most oat is grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field using a rating scale of 0 (no disease) to 9 (severely diseased). Diseases were identified by visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe levels, respectively. Severity of ergot, loose smut, and take-all was based on the percent plants infected.

Symptoms of fusarium head blight (FHB) were not commonly observed and therefore the severity of this disease was not rated at the time of the survey. Levels of seed-borne *Fusarium* spp. that may have contributed to FHB were determined by sampling 50 panicles from each field. The panicles were air dried at room temperature and subsequently threshed. Fifty randomly-selected discolored kernels per sample were surface sterilized in 1% NaOCl for 30 seconds and plated in 9-cm diameter Petri plates on modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm of streptomycin sulphate. Plates were incubated for 10-14 days at 22-25˚C with a 14-hour photoperiod supplied by fluorescent and long wavelength ultraviolet tubes. *Fusarium* species isolated from the kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Nine diseases were identified in the 10 fields surveyed (Table 1). Crown rust (*Puccinia coronata f.sp. avenae*) was the most prevalent disease and was observed in eight fields at a mean severity of 5.5. Severe levels of infection were noted in five fields. Yield reductions due to crown rust were estimated to average 15%. Stagonospora leaf blotch (*Stagonospora avenae f.sp. avenaria)* was observed in seven fields at a moderate (3.3) severity; severe levels were not observed. Pyrenophora leaf blotch (*Pyrenophora avenae*) was seen in five fields at a mean severity of 2.6. Barley yellow dwarf (BYD), halo blight (*Pseudomonas syringae pv. coronafaciens*), and spot blotch (*Cochliobolus sativus*) also were observed in two, nine, and five fields at mean severity levels of 2.5, 2.4 and 3.8, respectively. These diseases had not been reported from eastern Ontario in previous disease surveys from 2006 to 2008 (Xue et al. 2007, 2009).

Ergot (*Claviceps purpurea*), loose smut (*Ustilago nuda*) and take all (*Gaeumannomyces graminis* var. *avenae*) were observed in two, three and eight fields, respectively. Incidences of these diseases were 1.5% or less; crop yields would not have been affected significantly.

Six *Fusarium* species were isolated from putatively infected kernels (Table 2). *Fusarium poae* predominated; it occurred in all fields and was isolated from 13% of discolored kernels. *Fusarium avenaceum, F. graminearum* and *F. sporotrichioides* were common in the fields surveyed, and infected 5.6, 4.8 and 7.6% of kernels, respectively. *Fusarium culmorum* and *F. equiseti* were found in fewer fields and in less than 2% of kernels. Fields infested by *Fusarium avenaceum* and *F. graminearum* increased in frequency compared to 2008. *Fusarium culmorum* had not been observed in eastern Ontario oat crops during surveys done from 2006 to 2008 (Xue et al. 2007, 2009).

REFERENCES:

Xue, A.G., Chen, Y. and Yan, W.K. 2009. Diseases of oat in eastern Ontario in 2008. Can. Plant Dis. Surv. 89: 84-85. (http://www.cps-scp.ca.htm)

Xue, A.G., Chen, Y. and Yan, W.K. 2007. Foliar diseases of oat in eastern Ontario in 2006. Can. Plant Dis. Surv. 87:84. (http://www.cps-scp.ca.htm)

Table 1. Prevalence and severity of oat diseases in eastern Ontario in 2009.

DISEASE	NO. CROPS AFFECTED (n=10)	DISEASE SEVERITY IN AFFECTED CROPS*	
		Mean	Range
BYD	2	2.5	1.0-4.0
Crown rust	8	5.5	1.0-8.0
Halo blight	9	2.4	1.0-5.0
Pyrenophora leaf blotch	5	2.6	1.0-4.0
Spot blotch	5	3.8	1.0-5.0
Stagonospora leaf blotch	7	3.3	2.0-5.0
Ergot%	2	0.3	0.1-0.5
Loose smut%	3	0.4	0.1-0.5
Take-all%	8	1.5	1.0-3.0

*For foliar disease severity rated on a scale of 0 (no disease) to 9 (severely diseased); for ergot, loose smut, and take-all severity rated as percent plants infected.

Table 2. Frequency of *Fusarium* species isolated from discoloured kernels of oat in eastern Ontario, 2009.

***Fusarium* spp.**	**% Field**	**% Kernel**
Fusarium spp.	100.0	33.7
F. avenaceum	70.0	5.6
F. culmorum	30.0	1.7
F. equiseti	30.0	1.2
F. graminearum	80.0	4.8
F. poae	100.0	12.8
F. sporotrichioides	70.0	7.6

CROPS/ CULTURE: Wheat
LOCATION / RÉGION: Western and Eastern Canada

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
Randall M. Clear and S.K. Patrick
Canadian Grain Commission, Grain Research Laboratory, 1404-303 Main St., / Laboratoire de recherches sur les grains, Commission canadienne des grains, 303 rue Main, pièce 1404,Winnipeg MB, R3C 3G8;
Telephone: 204 983-7797; **Facsimile**: 204 983-0724; **E-mail**: randy.clear@grainscanada.gc.ca

TITLE / TITRE: *FUSARIUM GRAMINEARUM* AND OTHER FUNGI ISOLATED FROM FUSARIUM-DAMAGED KERNELS OF CANADIAN WHEAT, 1999 to 2008

INTRODUCTION AND METHODS: Fusarium head blight (FHB) is an important cereal disease, reducing yield, grade, and germination. It also impairs the functionality of the grain and can contaminate it with mycotoxins such as deoxynivalenol (DON) (Clear and Patrick 1999). Infection of wheat heads around the time of anthesis results in the production of *Fusarium*-damaged kernels (FDK). Affected kernels appear chalky-white, shrunken, and with visible mycelium on the surface (Clear and Patrick 2009). In this study, FDK were removed from wheat samples (a mixture of spring and winter cultivars) sent for analysis to the Canadian Grain Commission by producers, grain companies, and provincial and federal agricultural employees between 1999 and 2008. Analysis for the fungi infecting the FDK was done following the procedure of Clear and Patrick (1999).

RESULTS AND COMMENTS: The low number of samples from Alberta and western Saskatchewan with FDK allowed us to test, in most instances, all the FDK in the samples. Also, because FHB and *Fusarium graminearum* Schwabe are rare in most of this area, it was useful to test more FDK than in the eastern prairies where *F. graminearum* is common. The greater number of samples with FDK, and the much higher number of FDK in samples from Manitoba and eastern Saskatchewan required that we test only samples from any delivery point until *F. graminearum* was found; that location was then considered positive for *F. graminearum* and further testing of samples from there ceased. In these regions, usually only 10 seeds per sample were plated as *F.graminearum* was the most common cause of FDK. For reporting , Saskatchewan CDs were combined according to number alone. In addition, due to low sample numbers, Saskatchewan CDs 3 and 4 were combined, as were Manitoba CDs 9 and 10 (Fig. 1).

In Alberta, *F. graminearum* was not always the principal species isolated from FDK (Table 1). Samples from the two south-western CDs contained the greatest number and percentage of *F. graminearum* isolates, and they dominated in 6 of 10 years in CD 1 and 4 of 10 in CD 2. Also important from that region was *F. culmorum* (W.G. Smith). The relatively high frequency of *F. culmorum* was unique to this area, where it was the dominant species in CD 1 for 3 of 10 years and in CD 2 for 2 of 10 years. In central and northern Alberta, *F. avenaceum* (Fr.) Sacc. was clearly the most frequent *Fusarium* species causing FDK. However, *Stagonospora nodorum* (Berk.) Castellini & E.G. Germano was frequently the dominant fungus recovered from FDK in central and northern Alberta and occasionally from CD 2.

Crop districts in western Saskatchewan (CDs 3/4, 6, 7, and 9) rarely had *F. graminearum* as the dominant species (Table 2). Only twice in CD 3/4 and twice in CD 6 did *F. graminearum* dominate during the 10-year period. *Fusarium avenaceum* and *S. nodorum* were typically the dominant fungi from FDK, although in some years *F. culmorum* was the more common species in a few northern CDs. In eastern Saskatchewan (CD's 1, 2, 5, and 8) *F. graminearum* dominated. In CD 1 it was the main species recovered in all 10 years. In CDs 2, 5 and 8, it dominated in 6, 8 and 4 years, respectively.

In Manitoba, the northerly CDs 4, 5, 6, and 12 have few delivery points resulting in smaller sample sizes. As well, in years when growing conditions were unsuitable for the production of FDK, such as 2003, fewer FDK were collected, even from the southern CDs where *F. graminearum* is well established. *Fusarium graminearum* infected nearly all the FDK recovered between 1999 and 2008, and was the dominant species in all CDs in all years (Table 3). The frequency of this species was lowest in the more northerly

CDs. Few other fungi were recovered from FDK in Manitoba, but *F. avenaceum* was the second most common species recovered from Manitoba FDK in all years.

The species profiles of Ontario, Quebec, PEI, New Brunswick and Nova Scotia FDK were similar to those of Manitoba, with *F. graminearum* being almost the only fungus isolated (Tables 4 and 5). Poor storage conditions for some of the Maritime samples resulted in lower rates of recovery from the seeds, but *F. graminearum* was almost the sole fungus which did grow.

In the CDs or regions where losses from FHB are a significant problem (eastern Canadian provinces, Manitoba, and south-eastern Saskatchewan), *F. graminearum* is overwhelmingly the dominant species recovered from FDK. In central Saskatchewan and westward, losses from FHB continue to be minor. Here the species profiles recovered from FDK varied greatly year to year. In these 'marginal areas', non-*Fusarium* species were frequently more common than Fusaria on FDK. The most common of these was *S. nodorum*. However, the number of such seeds in any one sample was small.

The species pattern in the years from 1999 to 2008 is similar to that in the latter stages of a previous survey from years 1994 to 1998 (Clear and Patrick 1999). *Fusarium graminearum* does not appear to have greatly increased its presence in western Saskatchewan or Alberta over the last 10 years. However, only a few times in the last decade was the weather (mainly higher rainfall) suitable for FHB in the western prairies (Clear and Patrick 2009). In the normally dry area of southern Alberta, favourable weather was reported only during 2002 and 2007. In the south-eastern corner of Saskatchewan, the most suitable weather for FHB occurred in 1999, 2001 and 2007. In other years dryness and(or) low temperatures reduced disease pressure. In Manitoba, high disease levels occurred in 2001 and 2008 in the wheat crop. Other years were less suitable for disease development. Especially dry were the years 2003 and 2006, while in 2004 it was unusually cool. In 2005 and 2007 it was primarily the winter wheats in Manitoba that were affected, and in 2007 spring wheats escaped almost entirely. However, in 2008 both winter and spring wheats were affected, especially in the more northern parts of the agricultural area of Manitoba, where heavy rains fell throughout much of the summer. The highest frequency of *F. graminearum*, regardless of the geographical location in western Canada, occurred in years when conditions were most suitable for FHB (Tables 1, 2, 3). There have also been dramatic changes in the *F. graminearum* population in Canada, from a 15 ADON chemotype to a 3 ADON chemotype, over these same years (Ward et al. 2008). It remains to be seen what impact this change in the population will have on the production of FDK and DON in Canada.

ACKNOWLEDGEMENTS:
Thank you to staff at the Canadian Grain Commission in Winnipeg, Chatham, and Montreal for their assistance in sample collection. Thanks also to Dr. R. Martin of Agriculture and Agri-Food Canada, Charlottetown for providing samples from PEI and New Brunswick, and Ms. M. McTiernan of the New Brunswick Grain Commission for samples from New Brunswick and Nova Scotia.

REFERENCES:
Clear, R.M. and Patrick, S.K. 1999. Fusarium head blight pathogens isolated from *Fusarium*-damaged kernels of wheat in western Canada, 1993 to 1998. Can. J. Plant Pathol. 22:51-60.

Clear, R.M. and Patrick, S.K. 2009. Fusarium head blight in western Canada. (http://www.grainscanada.gc.ca/str-rst/fusarium/fhbwc-foc-eng.htm)

Ward, T.J., Clear, R.M., Rooney, A., O'Donnell, K., Gaba, D., Patrick, S., Starkey, D., Gilbert, J., Geiser, D. and Nowicki, T. 2008. An adaptive evolutionary shift in fusarium head blight pathogen populations is driving the rapid spread of more toxigenic *Fusarium graminearum* in North America. Fungal Genetics and Biology 45:473-484.

Table 1. Species isolated (% infection) from *Fusarium*-damaged kernels of wheat in Alberta crop districts (CD), 1999 to 2008.

CD	1	2	3	4	5	6	7
1999							
No. of FDK	83	210	193	773	31	4	69
F. graminearum	71	28	1	1	0	0	3
F. avenaceum	12	10	13	19	26	0	10
F. culmorum	14	7	8	8	3	0	4
S. nodorum	1	42	62	62	42	75	7
2000							
No. of FDK	24	196	66	2679	590	427	1966
F. graminearum	17	34	3	1	1	<1	<1
F. avenaceum	54	13	14	18	13	23	9
F. culmorum	4	7	9	13	5	7	11
S. nodorum	4	20	55	60	72	64	74
2001							
No. of FDK	11	64	11	436	397	273	1437
F. graminearum	9	20	9	9	0	8	1
F. avenaceum	0	2	18	13	28	36	16
F. culmorum	73	13	9	11	2	5	14
S. nodorum	9	50	27	39	44	38	62
2002							
No. of FDK	1133	775	46	25	22	6	213
F. graminearum	42	16	7	16	5	0	0
F. avenaceum	13	25	0	12	9	17	8
F. culmorum	33	35	4	8	9	0	7
S. nodorum	<1	14	0	16	36	33	22
2003							
No. of FDK	141	867	19	120	275	11	574
F. graminearum	21	23	0	2	0	0	1
F. avenaceum	18	7	0	41	27	18	26
F. culmorum	31	56	0	23	3	18	17
S. nodorum	6	6	5	17	58	55	38
2004							
No. of FDK	284	1204	194	593	529	116	874
F. graminearum	38	38	9	0	<1	0	<1
F. avenaceum	15	11	21	33	24	30	14
F. culmorum	22	29	24	16	11	1	14
S. nodorum	15	15	28	44	55	53	68
2005							
No. of FDK	240	1181	725	2242	996	325	295
F. graminearum	28	22	2	<1	<1	<1	<1
F. avenaceum	15	18	21	59	53	57	21
F. culmorum	18	8	1	1	3	2	11
S. nodorum	17	37	60	29	29	23	34

2006							
No. of FDK	175	1431	448	1316	510	338	534
F. graminearum	13	20	<1	<1	<1	<1	0
F. avenaceum	17	9	9	27	30	18	27
F. culmorum	27	12	2	2	2	1	10
S. nodorum	13	26	58	38	33	64	36
2007							
No. of FDK	493	990	483	612	543	370	1302
F. graminearum	68	29	1	0	<1	0	<1
F. avenaceum	2	3	12	18	45	29	23
F. culmorum	14	18	3	3	1	2	8
S. nodorum	4	27	55	34	36	42	46
2008							
No. of FDK	204	351	57	124	62	6	249
F. graminearum	65	73	47	5	3	33	1
F. avenaceum	3	3	0	6	5	17	2
F. culmorum	16	11	0	2	3	0	15
S. nodorum	9	10	39	60	58	17	27

FDK= *fusarium*-damaged kernels; F. graminearum= *Fusarium graminearum* Schwabe; F. avenaceum= *Fusarium avenaceum* (Fr.) Sacc.; F. culmorum= *Fusarium culmorum* (W.G. Smith); S. nodorum= *Stagonospora nodorum* (Berk.) Castellini & E.G. Germano

Table 2. Species isolated (% infection) from *fusarium*-damaged kernels of wheat in Saskatchewan crop districts, 1999 to 2008.

CD	1	2	3,4	5	6	7	8	9
1999								
No. of FDK	251	150	100	418	598	283	331	1280
F. graminearum	92	53	22	53	11	2	17	1
F. avenaceum	4	35	40	20	61	43	32	31
F. culmorum	1	3	9	7	9	9	8	12
S. nodorum	0	2	4	7	11	38	38	46
2000								
No. of FDK	301	357	298	428	713	130	368	1595
F. graminearum	79	36	18	44	7	1	35	2
F. avenaceum	14	47	50	22	66	50	34	31
F. culmorum	2	4	7	7	5	10	5	6
S. nodorum	<1	6	1	14	11	29	20	58
2001								
No. of FDK	257	274	121	244	100	17	103	96
F. graminearum	95	74	49	64	51	24	21	0
F. avenaceum	3	16	34	16	18	53	19	23
F. culmorum	1	1	6	6	4	6	12	3
S. nodorum	<1	1	2	3	7	6	17	29

2002								
No. of FDK	274	391	1745	420	715	289	321	152
F. graminearum	84	27	4	26	8	3	5	11
F. avenaceum	4	40	39	22	41	9	30	7
F. culmorum	1	5	11	9	15	53	22	43
S. nodorum	6	10	39	19	17	6	10	5
2003								
No. of FDK	78	110	52	228	191	36	128	38
F. graminearum	74	4	10	9	8	8	10	8
F. avenaceum	1	16	23	25	65	22	44	16
F. culmorum	1	8	2	25	10	39	19	42
S. nodorum	1	2	4	7	2	8	3	5
2004								
No. of FDK	143	223	715	224	334	239	298	445
F. graminearum	61	20	3	20	7	4	24	2
F. avenaceum	8	29	56	25	51	60	19	28
F. culmorum	7	5	6	11	12	13	21	32
S. nodorum	19	32	22	38	17	10	30	25
2005								
No. of FDK	246	247	221	289	369	677	318	653
F. graminearum	87	49	16	52	16	<1	16	<1
F. avenaceum	4	27	29	13	32	42	27	50
F. culmorum	4	4	4	7	5	3	3	2
S. nodorum	2	10	24	18	29	48	44	35
2006								
No. of FDK	90	296	185	283	452	539	455	966
F. graminearum	58	34	8	32	11	1	19	2
F. avenaceum	3	30	18	18	40	21	38	39
F. culmorum	1	<1	7	7	4	3	7	1
S. nodorum	6	17	15	16	18	44	18	44
2007								
No. of FDK	156	122	98	208	205	202	181	308
F. graminearum	93	56	31	45	20	13	36	4
F. avenaceum	2	11	5	19	21	18	15	31
F. culmorum	3	1	12	7	6	13	4	4
S. nodorum	1	1	6	5	5	23	14	26
2008								
No. of FDK	98	90	101	168	115	86	95	101
F. graminearum	77	56	13	51	53	8	38	20
F. avenaceum	3	22	17	20	15	24	25	29
F. culmorum	5	10	38	2	7	23	6	7
S. nodorum	2	0	11	20	12	20	15	18

FDK= *fusarium*-damaged kernels; F. graminearum= *Fusarium graminearum* Schwabe; F. avenaceum= *Fusarium avenaceum* (Fr.) Sacc.; F. culmorum= *Fusarium culmorum* (W.G. Smith); S. nodorum= *Stagonospora nodorum* (Berk.) Castellini & E.G. Germano

Table 3. Species isolated (% infection) from *fusarium*-damaged kernels of wheat in Manitoba crop districts, 1999 to 2008.

CD	1	2	3	4	5	6	7	8	9	11	12
1999											
No. of FDK	128	151	120	28	70	76	287	286	120	99	16
F. graminearum	90	95	98	93	86	99	96	96	99	96	63
F. avenaceum	2	1	4	6	0	0	1	0	1	1	6
F. culmorum	0	1	0	0	0	0	0	0	0	0	0
S. nodorum	1	1	0	0	3	0	0	0	0	0	6
2000											
No. of FDK	144	200	120	40	69	83	300	289	170	110	30
F. graminearum	99	94	95	98	99	92	100	99	98	100	70
F. avenaceum	1	2	2	0	1	4	0	0	0	0	7
F. culmorum	1	0	0	0	0	0	<1	0	0	0	0
S. nodorum	0	0	3	0	0	0	0	0	0	0	10
2001											
No. of FDK	140	200	110	22	46	75	280	280	110	110	30
F. graminearum	99	94	94	91	57	79	97	96	97	100	100
F. avenaceum	0	2	3	5	17	4	1	2	0	0	0
F. culmorum	0	1	0	0	0	16	1	<1	0	0	0
S. nodorum	0	0	1	0	7	0	0	0	0	0	0
2002											
No. of FDK	140	175	124	24	34	76	202	278	100	108	24
F. graminearum	99	99	90	96	18	78	99	99	100	99	83
F. avenaceum	0	0	3	4	9	3	0	<1	0	0	17
F. culmorum	1	1	0	0	3	13	1	0	0	0	0
S. nodorum	0	0	0	0	9	1	0	0	0	0	0
2003											
No. of FDK	37	58	73	11	36	44	131	226	117	110	12
F. graminearum	86	78	77	82	36	91	95	97	100	100	83
F. avenaceum	0	0	7	18	31	2	0	1	0	0	8
F. culmorum	3	0	0	0	3	7	1	0	0	0	0
S. nodorum	0	0	1	0	14	0	0	0	0	0	0
2004											
No. of FDK	79	134	78	19	48	38	120	165	66	45	33
F. graminearum	91	91	83	63	31	63	85	91	79	96	79
F. avenaceum	1	3	3	26	25	3	3	1	0	2	12
F. culmorum	0	1	6	0	6	3	0	1	3	0	0
S. nodorum	4	3	0	0	29	11	3	3	2	0	6
2005											
No. of FDK	110	188	140	40	55	66	148	277	68	90	26
F. graminearum	97	99	97	88	85	83	99	99	94	99	77
F. avenaceum	0	<1	1	3	7	3	0	<1	1	0	12
F. culmorum	0	0	0	3	5	2	0	0	0	0	0
S. nodorum	3	0	1	5	2	5	1	0	1	1	8

2006											
No. of FDK	89	128	73	40	43	54	68	166	59	48	42
F. graminearum	97	87	93	80	65	85	87	89	81	92	50
F. avenaceum	0	0	0	3	12	0	0	2	0	0	0
F. culmorum	0	2	1	0	2	0	3	0	0	0	0
S. nodorum	0	1	0	0	9	0	0	1	0	2	2
2007											
No. of FDK	86	135	63	28	48	52	109	234	72	74	52
F. graminearum	97	93	98	86	92	81	96	97	93	99	19
F. avenaceum	1	4	2	4	6	2	0	2	1	0	2
F. culmorum	0	0	0	0	0	0	0	0	0	0	2
S. nodorum	0	0	0	0	2	2	0	1	0	0	13
2008											
No. of FDK	70	80	70	30	50	54	110	147	80	66	23
F. graminearum	99	95	97	97	92	89	99	99	98	100	91
F. avenaceum	0	5	1	0	0	0	0	1	0	0	4
F. culmorum	1	0	0	3	8	0	1	1	0	0	0
S. nodorum	0	0	0	0	0	7	0	0	0	0	0

FDK= *fusarium*-damaged kernels; F. graminearum= *Fusarium graminearum* Schwabe; F. avenaceum= *Fusarium avenaceum* (Fr.) Sacc.; F. culmorum= *Fusarium culmorum* (W.G. Smith); S. nodorum= *Stagonospora nodorum* (Berk.) Castellini & E.G. Germano

Table 4. Species isolated (% infection) from *fusarium*-damaged kernels of wheat in Ontario and Quebec, 2005 to 2008.

	Ontario	Quebec
2005		
No. of FDK	136	209
F. graminearum	90	94
F. avenaceum	2	2
F. culmorum	1	0
S. nodorum	0	0
2006		
No. of FDK	298	550
F. graminearum	94	90
F. avenaceum	2	4
F. culmorum	0	0
S. nodorum	<1	0
2007		
No. of FDK	301	412
F. graminearum	77	97
F. avenaceum	3	2
F. culmorum	1	0
S. nodorum	0	0
2008		
No. of FDK	248	240
F. graminearum	83	95
F. avenaceum	11	5
F. culmorum	0	0
S. nodorum	0	0

FDK= *fusarium*-damaged kernels; F. graminearum= *Fusarium graminearum* Schwabe; F. avenaceum= *Fusarium avenaceum* (Fr.) Sacc.; F. culmorum= *Fusarium culmorum* (W.G. Smith); S. nodorum= *Stagonospora nodorum* (Berk.) Castellini & E.G. Germano

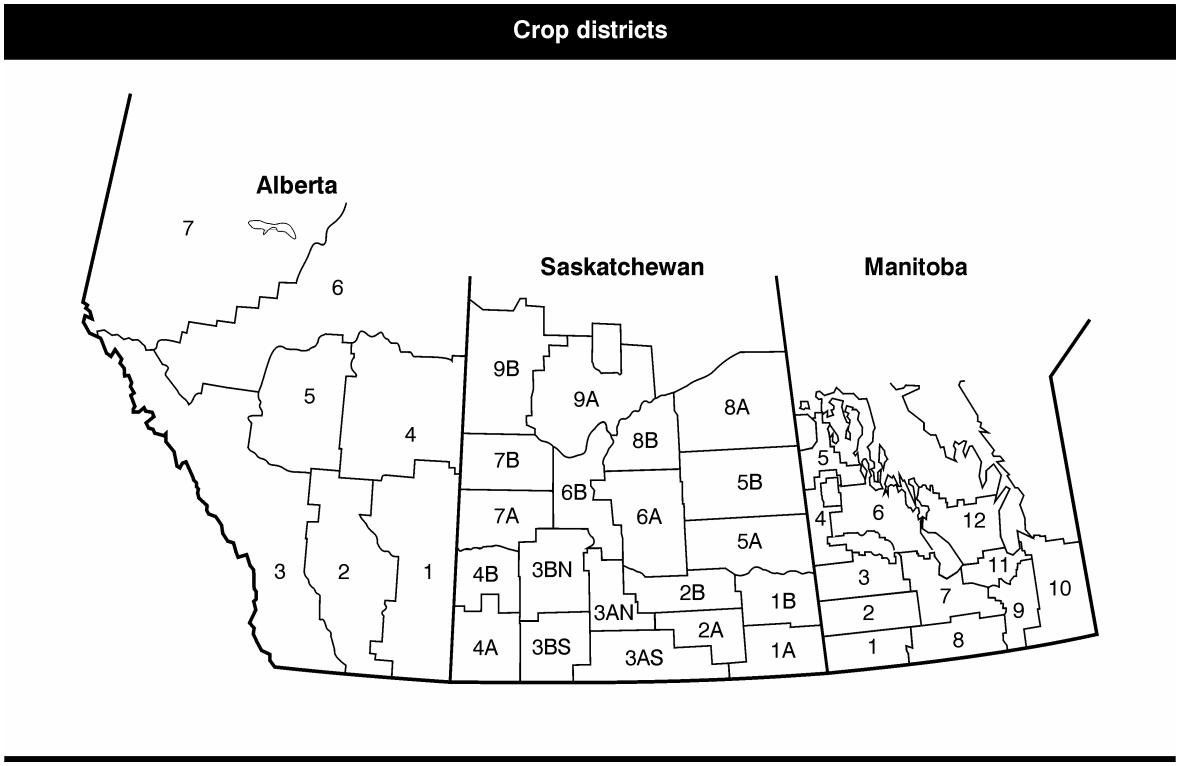
Table 5. Species isolated (% infection) from *fusarium*-damaged kernels of wheat in Prince Edward Island (PE), New Brunswick (NB), and Nova Scotia (NS), 2004 to 2007.

	PE	NB	NS
2004			
No. of FDK	105*		
F. graminearum	65		
F. avenaceum	0		
F. culmorum	0		
S. nodorum	0		
2005			
No. of FDK		169	
F. graminearum		95	
F. avenaceum		1	
F. culmorum		0	
S. nodorum		0	
2006			
No. of FDK	55*	150	45*
F. graminearum	80	98	51
F. avenaceum	4	0	4
F. culmorum	0	0	0
S. nodorum	0	0	0
2007			
No. of FDK		160*	
F. graminearum		85	
F. avenaceum		1	
F. culmorum		0	
S. nodorum		0	

* Samples were stored several months at room temperature prior to testing

FDK= *fusarium*-damaged kernels; F. graminearum= *Fusarium graminearum* Schwabe; F. avenaceum= *Fusarium avenaceum* (Fr.) Sacc.; F. culmorum= *Fusarium culmorum* (W.G. Smith); S. nodorum= *Stagonospora nodorum* (Berk.) Castellini & E.G. Germano

Figure 1. Map of Crop Districts in Western Canada



CROP / CULTURE: Wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
F.L. Dokken-Bouchard[1], P.R. Northover[2], C.N. Weitzel[2], J.J. Shiplack[2], and M.R. Fernandez[3]
[1] Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina SK, S4S 0B1;
Telephone: (306) 787-4671; **Facsimile:** (306) 787-0428; **E-mail:** faye.dokkenbouchard@gov.sk.ca
[2] Saskatchewan Ministry of Agriculture, Crop Protection Laboratory, 346 MacDonald Street, Regina SK, S4S 0B1
[3] Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, Box 1030, Swift Current SK, S9H 3X2

TITLE / TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2009

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 152 wheat crops in Saskatchewan in 2009: 130 common wheat (Canada Western Red Spring, Canada Prairie Spring, and Soft White Spring classes) and 22 durum wheat (Canada Western Amber Durum class). Crops were grouped according to soil zone (Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black/Grey).

Crop adjustors with Saskatchewan Crop Insurance Corporation and irrigation agrologists with Saskatchewan Ministry of Agriculture randomly collected 50 spikes from each wheat crop at the late milk to early dough stages (Lancashire et al. 1991). Spikes were analyzed for visible FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. A FHB disease severity rating, also known as the FHB index, was determined for each wheat crop surveyed: FHB severity (%) = [% of spikes affected x mean % of kernels infected] / 100. Mean FHB severity values were calculated for each soil/irrigation zone and for the whole province. Glumes or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min and cultured on potato dextrose agar and carnation leaf agar to obtain isolates for subsequent identification and quantification of *Fusarium* species.

RESULTS AND COMMENTS: Approximately 7.6 million acres (3.1 million ha) of spring wheat and 4.6 million acres (1.9 million ha) of durum wheat were seeded in Saskatchewan in 2009 (Saskatchewan Ministry of Agriculture, 2009). Cool weather delayed seeding in most areas. West-central and north-west parts of the province experienced low moisture conditions in the spring and some areas did not receive adequate moisture during the critical crop season. Repeated frost until the last week of May in several parts of the province and cold spring and summer weather delayed crop emergence and slowed growth. Unseasonably warm weather in September created good harvest conditions; however, cold weather and precipitation in October halted harvest across most of the province until November.

In 2009, FHB occurred in 40% and 50% of the common and durum wheat crops surveyed, respectively (Table 1). Prevalence and severity of FHB in common wheat were lowest in soil zone 1 and highest in soil zone 3. The sample with the highest FHB severity (5.4%) was from a SWS wheat crop in soil zone 2. This severity level was much lower than the highest found in 2008 (34%) from a HRS wheat crop in soil zone 3. Overall, the provincial mean FHB severity for common wheat (0.5%) was somewhat lower than in 2008 (0.8%), while that for durum wheat (0.3%) was similar. Provincial annual mean FHB severities have been <1% since 2001 (Dokken et al. 2009).

The most frequently isolated causal pathogen identified on samples with visible FHB symptoms was *F. poae*, accounting for 44% (common wheat) and 42% (durum wheat) of all *Fusarium* isolates. *Fusarium avenaceum* was identified in 19% of common wheat isolations and 23% of durum wheat isolations. Other *Fusarium* species isolated at lower levels included *F. acuminatum, F. culmorum, F. equiseti,*

F. graminearum and *F. sporotrichioides.* These results are similar to those obtained in 2008 (Dokken et al. 2009).

Fusarium graminearum was isolated from 9 (7 common, 2 durum) wheat crops surveyed, from the north-east (3), east-central (1), south-east (3), and west-central (2) regions. It accounted for 2.7% of isolates from common wheat and 3.9% from durum wheat.

Other fungal pathogens observed on wheat spikes collected in 2009 included *Septoria* and *Cochliobolus* spp. Secondary moulds were isolated from 82% of the wheat crops sampled.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff and Saskatchewan Ministry of Agriculture irrigation agrologists for the collection of cereal samples for this survey.

REFERENCES:
Lancashire, P.D., Bleiholder, H., Van Den Boom, T., Langeluddeke, P., Stauss, R., Weber, E., and Witzenberger, A. 1991. A uniform decimal code for growth stages of crops and weeds. Ann. Appl. Biol. 119:561-601.

Dokken, F.L., Holzgang, G., Weitzel, C.N., and Fernandez, M.R. 2009. Fusarium head blight in common and durum wheat in Saskatchewan in 2008. Can. Plant Dis. Survey 89:86-87 (http://www.cps-scp.ca/cpds.shtml).

Saskatchewan Ministry of Agriculture. 2009. Saskatchewan Agricultural Statistics Pocket Resources: December 2009.

Table 1. Prevalence and severity of fusarium head blight (FHB) in common and durum wheat crops grouped by soil zone in Saskatchewan, 2009.

Soil Zones	Common Wheat		Durum Wheat	
	No. crops affected / total crops surveyed (% of crops infected)	**Mean FHB Severity[1] (range)**	**No. crops affected / total crops surveyed (% of crops infected)**	**Mean FHB Severity[1] (range)**
Zone 1 Brown	19/33 (58%)	0.5% (0 - 4.0%)	6/9 (67%)	0.2% (0 - 1.0%)
Zone 2 Dark Brown	21/43 (49%)	0.5% (0 - 5.4%)	8/12 (67%)	0.2% (0 - 1.4%)
Zone 3 Black/Grey	40/54 (74%)	0.4% (0 - 2.5%)	1/1 (100%)	0.5%
Overall Total/Mean	80/130 (62%)	0.5%	15/22 (68%)	0.3%

[1] Percent FHB severity = [% of spikes affected x mean % of kernels infected] / 100.
FHB severity values less than 0.1% reported as trace

CROP / CULTURE: Common and durum wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
M.R. Fernandez[1], M.R. Boire[1], F.L. Dokken-Bouchard[2], P. R. Northover[3], and C. McCartney[4]
[1] Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, P.O. Box 1030, Swift Current SK, S9H 3X2
Telephone: (306) 778-7255; **Facsimile:** (306) 778-3188; **E-mail:** myriam.fernandez@agr.gc.ca
[2] Saskatchewan Ministry of Agriculture, Crops Branch, 3085 Albert St., Regina SK, S4S 0B1
[3] Saskatchewan Ministry of Agriculture, Crop Protection Laboratory, 346 McDonald Street, Regina SK, S4N 6P6
[4] Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK, S7N 5A8

TITLE / TITRE: LEAF DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2009

INTRODUCTION AND METHODS: A survey for leaf spotting diseases of common and durum wheat grown under dryland or irrigation was conducted between the milk and dough growth stages in 2009. A total of 127 common wheat and 18 durum wheat crops were sampled in 18 crop districts (CDs). In each field, 50 flag leaves were collected at random and air-dried at room temperature. Percent leaf area affected by leaf spots (severity) was recorded for each leaf, and the mean percent leaf area with lesions was calculated for each crop and each CD. For crops showing a leaf spot severity ≥3%, 1 cm^2 surface-disinfested leaf pieces with symptoms were plated on water agar for identification and quantification of leaf spotting pathogens.

Information on the previous crop and on tillage method was obtained for most of the fields. Comparison of disease and fungus levels among tillage systems (conventional, minimum-till, and zero-till) was done for dryland crops grouped by soil zone (SZ): 1) Brown, 2) Dark Brown, and 3) Black/Grey. The previous crop was a non-cereal (canola, flax, lentil, or peas) in 78 fields, a cereal (wheat, barley, or oat) in 21 fields, summerfallow in 23 fields, and unknown in the other 23 fields.

RESULTS AND COMMENTS: Leaf spots were present in all crops surveyed (Table 1). For individual crops, percent flag leaf area affected ranged from trace (≤0.5%) to 25%. The overall leaf spot severity of 7.0% was higher than that found in 2008 (5.6%) or 2007 (3.5%) (Fernandez et al. 2008, 2009). Mean leaf spot severities were highest in east-central (CDs 2B, 5B, 6A, 6B) and north-western (CDs 9A, 9B) regions, and were lowest in the south-east (CD 1A) and south-west (CDs 3B-N, 4B).

As reported in previous years**,** *Pyrenophora tritici-repentis* (tan spot) was the most prevalent leaf spot pathogen (Table 1). This was followed by *Septoria tritici* and *Stagonospora nodorum* (that together form the septoria leaf complex) and *Cochliobolus sativus* (spot blotch). *Septoria tritici* showed the highest mean percent isolation in eastern (1B, 5A, 5B) and central (6A, 6B, 8B) CDs. *Stagonospora nodorum* isolations were highest in eastern (1B), central (6A, 7A) and north-western (9B) CDs. *Cochliobolus sativus* was isolated at the highest levels in south-western (4A) and eastern (5A) CDs. A *Pseudoseptoria* species was detected in a total of 16 fields, mostly in western regions (CDs 3AS, 3B-S, 4A, 7A, 9A), but only at low levels (mean isolation frequency <7%). *Stagonospora avenae* f. sp. *triticea* was isolated from one sample in CD 1B at a mean isolation frequency of 6%.

Leaf rust was observed in some fields but only occurred at very low levels (mean 1%). Stripe rust was not evident in any of the common or durum wheat samples collected.

Leaf spot diseases were more prevalent in the Dark Brown (SZ2) and Black/Gray Zones (SZ3) than in the Brown Soil Zone (SZ1) (Table 2). *Pyrenophora tritici-repentis* was least prevalent in SZ3, whereas the other foliar pathogens were least prevalent in SZ1. The highest mean leaf spot levels were observed under conventional-till for SZ1 and under minimum-till for SZ2. There was no apparent difference among

tillage systems for SZ3. *Pyrenophora tritici-repentis* was isolated most frequently under zero-till in SZ3. Differences among tillage systems in percent isolation of other pathogens for any SZ were either minimal, or the sample size too small to generalize.

Classification of common and durum wheat crops according to previous crop showed the lowest mean leaf spot severities after summerfallow in SZ2, and the highest mean severities in crops preceded by a pulse in SZ3 (Table 3). For *P. tritici-repentis*, the lowest isolation frequencies were observed after summerfallow in SZ2, and the highest frequencies when the previous crop was a cereal or pulse in SZ3. For each SZ, differences among previous crop in percent isolation of the other pathogens were either minimal or the sample size too small to generalize.

ACKNOWLEDGEMENT:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff and Saskatchewan Ministry of Agriculture irrigation agrologists for the collection of leaf samples for this survey.

REFERENCES:
Fernandez, M.R., Boire, M.R., Dokken, F. and Holzgang, G. 2009. Leaf spotting diseases of common and durum wheat in Saskatchewan in 2008. Can. Plant Dis. Surv. 89:88-92. (http://www.cps-scp.ca/cpds.htm)

Fernandez, M.R., Dusabenyagasani, M., Pearse P.G. and Holzgang, G. 2008. Leaf spotting diseases of common and durum wheat in Saskatchewan in 2007. Can. Plant Dis. Surv. 88:80-82. (http://www.cps-scp.ca/cpds.htm)

Table 1. Incidence and severity of leaf spotting diseases and percent fungal isolations of the most common leaf spotting pathogens in common and durum wheat crops grown under dryland or irrigation in Saskatchewan in 2009.

Crop District	No. crops affected/ surveyed[1]	Mean severity[2]	*Pyrenophora tritici-repentis*[3]	*Septoria tritici*	*Stagonospora nodorum*	*Cochliobolus sativus*
			%			
1A	7/7	0.8	-	-	-	-
1B	8/8	5.0	40/5	41/5	16/4	5/4
2A	9/9	8.5	90/6	-	11/3	6/4
2B	10/10	9.2	90/5	4/1	7/3	5/3
3A-S	8/8	4.0	82/4	10/1	11/3	5/2
3B-N	8/8	0.9	-	-	-	-
3B-S	4/4	4.3	97/2	-	5/1	-
4A	3/3	3.0	80/1	-	-	19/1
4B	3/3	1.7	-	-	-	-
5A	5/5	6.0	73/3	30/1	10/2	30/1
5B	4/4	13.8	43/4	40/4	11/3	9/3
6A	10/10	9.7	66/8	34/5	20/6	2/2
6B	18/18	12.3	46/13	53/10	13/11	6/4
7A	16/16	3.5	72/7	1/1	21/5	4/4
8A	7/7	8.7	68/2	24/2	7/2	-
8B	6/6	7.7	43/3	46/3	11/3	-
9A	13/13	8.7	78/7	15/6	12/5	2/2
9B	6/6	9.8	79/4	14/2	29/2	-
Mean/total:	**145/145**	**7.0**	**67/74**	**35/41**	**14/53**	**7/30**

[1] Number of crops with leaf spot lesions on the flag leaf/total number of crops surveyed. Ten fields were in CD 6B were grown under irrigation.
[2] Mean percentage flag leaf area with leaf spots.
[3] Mean percent fungal isolations/number of crops where the fungus occurred.

Table 2. Incidence and severity of leaf spotting diseases and mean percent isolations of the most common leaf spotting pathogens, by tillage system within each soil zone, for common and durum wheat crops in Saskatchewan in 2009.

Soil Zone/ Tillage system	No. crops affected/ surveyed[1]	Mean severity[2]	*Pyrenophora tritici-repentis*[3]	*Septoria tritici*	*Stagonospora nodorum*	*Cochliobolus sativus*
		%				
Zone 1 (Brown)						
Conventional	4/4	4.5	97/2	-	5/1	-
Minimum	17/17	2.2	86/4	-	5/2	19/1
Zero	9/9	0.9	na[4]	na	na	na
Zone 2 (Dark Brown)						
Conventional	5/5	3.3	68/2	16/2	10/2	5/2
Minimum	15/15	13.5	82/13	33/4	8/8	3/5
Zero	33/33	5.0	74/6	19/5	19/12	6/7
Zone 3 (Black/Gray)						
Conventional	4/4	8.5	54/2	33/2	7/1	18/1
Minimum	17/17	8.3	53/10	30/9	17/10	6/3
Zero	27/27	8.2	70/14	27/11	12/9	7/6

[1] Number of common and durum wheat crops with leaf spot lesions on the flag leaf/total number of surveyed crops, excluding fields under irrigation.
[2] Mean percentage of flag leaf area with leaf spots estimated on leaves that were still green when sampled.
[3] Mean percent fungal isolations/number of common and durum wheat crops where the fungus occurred.
[4] na: no samples plated.

Table 3. Incidence and severity of leaf spotting diseases and mean percent isolations of the most common leaf spotting pathogens, by previous cropping practice, within each soil zone, for common and durum wheat crops in Saskatchewan in 2009.

Soil Zone/ Previous crop	No. crops affected/ surveyed[1]	Mean severity[2]	*Pyrenophora tritici-repentis*[3]	*Septoria tritici*	*Stagonospora nodorum*	*Cochliobolus sativus*
		%				
Zone 1 (Brown)						
Cereal	1/1	2.0	na[4]	na	na	na
Oilseed	1/1	1.0	na	na	na	na
Pulse	15/15	2.7	95/3	-	5/1	9/1
Summerfallow	16/16	2.6	82/5	10/1	11/3	11/2
Zone 2 (Dark Brown)						
Cereal	13/13	9.8	84/13	21/5	14/5	4/5
Oilseed	22/22	7.3	78/9	23/3	12/8	6/4
Pulse	10/10	7.1	75/6	1/1	15/6	3/3
Summerfallow	5/5	1.9	62/2	27/1	17/1	7/2
Zone 3 (Black/Gray)						
Cereal	5/5	9.4	72/4	16/3	14/4	3/1
Oilseed	22/22	7.1	53/11	34/10	17/8	6/7
Pulse	7/7	13.3	70/6	23/5	13/5	3/1
Summerfallow	2/2	8.0	17/1	64/1	-	18/1

[1] Number of common and durum wheat crops with leaf spot lesions on the flag leaf/total number of surveyed crops, excluding fields under irrigation.
[2] Mean percentage of flag leaf area with leaf spots estimated on leaves that were still green when sampled.
[3] Mean percent fungal isolations/number of common and durum wheat crops where the fungus occurred.
[4] na: no samples plated.

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
J. Gilbert, A. Tekauz, R. Kaethler, K. Slusarenko, C. Leclerc, R. Grant, M. Stulzer, and M. Beyene Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg, Manitoba, R3T 2M9 **Telephone:** (204) 983-0891; **Facsimile:** (204) 983-4604; **E-mail:** jeannie.gilbert@agr.gc.ca

TITLE / TITRE: SURVEY OF FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN MANITOBA IN 2009

INTRODUCTION AND METHODS: Forty-eight spring wheat fields were surveyed between August 11 and 21, 2009 in southern Manitoba to monitor the incidence and severity of fusarium head blight (FHB). Disease incidence and severity in each field were assessed at ZGS 65- 88 by sampling about 100 spikes at three locations for incidence and severity, and additional spikes were collected for subsequent pathogen identification. From each field collection, at least 10 spikes were threshed and 10 kernels were selected for subsequent analysis. Kernels were surface-sterilized and incubated on potato dextrose agar under continuous cool white light for 4 - 5 days to isolate and identify *Fusarium* species present. When the species was unclear, single spores were grown on carrot agar to facilitate identification. The FHB index (overall severity) was calculated as follows: (Average % incidence X Average % severity) / 100.

RESULTS AND COMMENTS: Average disease levels were generally low within the five regions surveyed, but several individual crops had higher disease severity (Table 1). The range in FHB indices varied widely from a minimum of .002 to a maximum of 28.44, with an average index for the province of 1.6. In the Central region there were 4 crops with higher FHB indices ranging from 4.6 - 8.4. The Eastern region had one crop with an index of 28.8, and the Interlake region had one field with an index of 9.3. Possible reasons for these higher indices might include time of planting, the cultivar grown, and localized precipitation.

Table 1. Fusarium head blight (FHB) index in surveyed crop reporting districts in Manitoba, 2009.

Region	Crop Reporting Districts	Number of fields surveyed	Average FHB Index	Range
Northwest	4, 6	4	0.1	0.0 – 0.2
Southwest	1, 2, 3	11	0.3	0.0 – 1.3
Central	7, 8	22	1.4	0.0 – 8.4
Eastern	9, 10	6	6.2	0.9 – 28.8
Interlake	11, 12	6	2.9	0.7 – 9.3

Fusarium species were isolated from 63.3% (304/480) of kernels examined in 2009, a relatively low level compared to the 97% in 2008 (Gilbert et al. 2009). As in other years, *Fusarium graminearum* was the predominant species, accounting for 94.7% of isolations. Three other species found at low levels included, *F. culmorum* (2.6%), *F. sporotrichioides* (1.6%) and *F. equiseti* (1.0%).

REFERENCE:
Gilbert, J., Tekauz, A., Kaethler, R., Slusarenko, K., Leclerc, C., Mueller, E., Stulzer, M. and Beyene, M. 2009. Survey of fusarium head blight of spring wheat in Manitoba in 2008. Can. Plant Dis. Surv. 89:94-95. (http://www.cps-scp.ca/cpds.htm)

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A. Tekauz, M. Stulzer, and M. Beyene
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0944; **Facsimile:** (204) 983-4604; **E-mail:** andy.tekauz@agr.gc.ca

TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA IN 2009

INTRODUCTION AND METHODS: The prevalence of fusarium head blight (FHB) in winter wheat in Manitoba in 2009 was assessed by monitoring 33 farm fields from July 21 to 27 when crops were at the late milk to early-dough stages of growth (ZGS 79-84). Winter wheat is not grown intensively or throughout Manitoba. In 2009 it was harvested from about 15% of the total wheat acreage. Therefore field locations were obtained from Manitoba Agriculture, Food and Rural Initiatives extension personnel, or producers. The fields surveyed were located in southern Manitoba, largely in the area bounded by Highways # 67 and 16 to the north, the Manitoba/North Dakota border to the south, Hwy #12 to the east and Hwy #83 to the west. Fusarium head blight in each field was assessed by non-destructive sampling of at least 80-100 plants at each of 3 sites to determine the percentage of infected spikes (% disease incidence), and the average spike proportion infected (SPI). Overall severity was expressed as the 'FHB Index' (% incidence x %SPI / 100). Several affected spikes, or 'healthy' spikes in several cases when symptoms were not evident, were collected from each monitored site and stored in paper envelopes. A total of 50 discoloured, putatively infected kernels, and (or) clean kernels to make up the remainder, were subsequently removed from five spikes per location. The kernels were surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated on potato dextrose agar in petri dishes (10 seeds/plate) to quantify and identify the *Fusarium* spp. present based on morphological traits described in standard taxonomic keys.

RESULTS AND COMMENTS: Temperatures in southern Manitoba were lower than normal throughout the growing season. Seasonal moisture levels were normal to above normal in most of the region, including the Interlake, where many fields remained weedy and fallow. Planting there in the fall of 2008 or spring of 2009 was impossible due to waterlogging from excessive precipitation in 2007 and 2008. The low early-season temperatures likely curtailed development of *Fusarium* inoculum on overwintered straw and stubble, and would also have been unfavourable for subsequent infection of spikes.

CDC Falcon was the predominant winter wheat cultivar sampled, and was grown in 18 (69%) of the 26 fields for which cultivar information was available. The cultivars CDC Buteo, CDC Harrier, CDC Ptarmigan and CDC Raptor were grown in 4, 2, 1 and 1 of the fields, respectively. Foliar fungicides are applied routinely to most winter wheat crops in Manitoba; for the 12 crops for which information was forwarded, Folicur® and Tilt® were each applied in 4 fields, Stratego® in 2 and Quilt® and Headline® in one each.

Symptoms of FHB were visible in 24 (72%) of the 33 winter wheat fields sampled. Overall, the incidence of FHB was 0.5% (range 0 – 2.0%), the SPI 44.5% (range 0 - 100%) and the FHB index 0.3% (range 0 - 1.2%). As such, FHB was estimated to have caused no yield loss in winter wheat in 2009. The estimated severity of FHB in 2009 was identical to that in 2008 (Tekauz et al. 2009), the lowest recorded since monitoring for FHB in winter wheat started in 1998. The proportion of crops with visible FHB also was lower than normal. The low temperatures and widespread use of foliar fungicide in winter wheat likely contributed to the very low levels of disease seen when monitoring was conducted in 2009.

No *Fusarium* colonies were isolated from kernels from the 9 fields without visible symptoms of FHB. The *Fusarium* species obtained from kernels in the remaining fields are shown in Table 1. Species of *Fusarium* were isolated from 46.7% of the total kernels (33 x 50 = 1,650) plated on potato dextrose agar. As was also found in 2008 (Tekauz et al. 2009), *F. graminearum* dominance was near 100%. *Fusarium poae* was the only other *Fusarium* species found on kernels in 2009.

REFERENCES:

Tekauz, A., M. Stulzer, E. Mueller, and M. Beyene. 2009. Monitoring fusarium head blight of winter wheat in Manitoba in 2008. Can. Plant Dis. Surv. 89:96-97. (www.cps-scp.ca/cpds.htm)

Table 1. *Fusarium* spp. isolated from winter wheat crops in Manitoba in 2009.

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. poae	3	0.1
F. graminearum	70	99.9

CROP / CULTURE: Wheat
LOCATION / RÉGION: Manitoba and eastern Saskatchewan

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
B. McCallum and P. Seto-Goh
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0771; **Facsimile:** (204) 983-4604; **E-mail:** Brent.McCallum@agr.gc.ca

TITLE / TITRE: LEAF RUST AND STRIPE RUST OF WHEAT IN MANITOBA AND EASTERN SASKATCHEWAN IN 2009

INTRODUCTION AND METHODS: Trap nurseries and commercial fields of wheat in Manitoba and eastern Saskatchewan were surveyed for the incidence and severity of leaf rust (*Puccinia triticina* Eriks.) and stripe rust (*Puccinia striiformis* Westend. f.sp. *tritici*) during July and August 2009.

RESULTS AND COMMENTS: Wheat leaf rust, caused by *Puccinia triticina*, was first observed on spring wheat in Manitoba in early July in 2008. This is much later than normal, and was likely because cool conditions during the growing season slowed the rate of rust development. While there were only low levels of disease, most wheat crops in southern Manitoba were sprayed with a foliar fungicide in 2009, which controlled any rust present. In the 45 nonsprayed fields surveyed in Manitoba and Saskatchewan, the level of leaf rust ranged from 0% to 5% of the flag leaf covered with leaf rust pustules and an average of less than 1.0%. This represents the lowest severity of leaf rust in Manitoba in the past 10 years (Table 1). Manitoba Crop Variety Evaluation Trials also were surveyed throughout southern Manitoba. At most locations there were only trace levels of leaf rust, but at the Portage La Prairie site higher levels developed, with approximately 20% flag leaf infection on AC Barrie during the last week in August. At this point most commercial crops were already ripening. Only isolated pustules of stripe rust (*P. striiformis*) were found throughout southern Manitoba and Saskatchewan. Yield losses due to both rusts would be minor in 2009.

Table 1. Average percentage (%) of the flag leaf infected with leaf rust in surveys from 2001 to 2009 in Manitoba and Saskatchewan

	Percentage (%) of flag leaf infected with leaf rust	
Year	Manitoba	Saskatchewan
2001	10.0	3.0
2002	18.0	5.0
2003	2.5	2.0
2004	7.0	2.0
2005	20.0	22.0
2006	10.2	5.3
2007	15.7	4.9
2008	1.1	0.1
2009	trace	trace

CROP / CULTURE: Winter Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A. Tekauz, M. Stulzer, and M. Beyene
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0944; **Facsimile:** (204) 983-4604; **E-mail:** andy.tekauz@agr.gc.ca

TITLE / TITRE: LEAF SPOT DISEASES OF WINTER WHEAT IN MANITOBA IN 2009

INTRODUCTION AND METHODS: The occurrence and severity of leaf spot diseases of winter wheat in Manitoba in 2009 were assessed by surveying 33 farm fields from July 21 to 27 when most crops were at the late milk to early-dough stage of growth (ZGS 79-84). Winter wheat is not grown intensively or throughout Manitoba. In 2009 it was harvested from about 15% of the total wheat acreage. Therefore field locations were obtained from Manitoba Agriculture, Food and Rural Initiatives extension personnel, or producers. The fields surveyed were located in southern Manitoba, largely in the area bounded by Highways # 67 and 16 to the north, the Manitoba/North Dakota border to the south, Hwy #12 to the east and Hwy #83 to the west. Leaf spots were rated on approximately 10 plants per field along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Severity of symptoms was recorded for both the upper (flag leaf) and lower leaf canopies using a six-category scale: 0 (no visible symptoms); trace (< 1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Leaves with leaf spot symptoms were collected at each site, placed in paper envelopes and allowed to dry. Subsequently, surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to promote fungal sporulation and allow for identification of the causal pathogen(s), so as to determine the specific disease(s) present.

RESULTS AND COMMENTS: Except for the latter half of June and a 'summer-like' September, the 2009 growing season in southern Manitoba was cooler than normal, delaying both seeding and crop development. Precipitation was generally at above-normal levels. The much improved conditions in September allowed the late-developing crops to mature and to realize both good yields and quality. 'CDC Falcon' was the predominant winter wheat cultivar sampled, and was grown on 18 (69%) of the 26 fields for which cultivar information was available. The cultivars 'CDC Buteo', 'CDC Harrier', 'CDC Ptarmigan' and 'CDC Raptor' were grown on 4, 2, 1 and 1 field(s), respectively. Foliar fungicides are applied routinely to most winter wheat crops in Manitoba for control of both foliar and head diseases; for the 12 crops for which information was forwarded, Folicur® and Tilt® were each applied in 4 fields, Stratego® in 2, and Quilt® and Headline® in one each.

Leaf spotting was evident in the upper or lower plant canopies of all fields surveyed. Disease levels in the upper canopy were trace to slight in 61% of fields, moderate in 15% and severe in 21%. In the lower canopy, trace to slight leaf spot levels were present in 24% of the fields, while in 76% of the fields these leaves had senesced. The upper canopy severity levels suggest that leaf spots caused some damage to winter wheat in 2009, estimated as a yield loss of 2-3%. The widespread use of foliar fungicides in winter wheat production in Manitoba likely reduced the level of leaf spot damage.

Pyrenophora tritici-repentis (tan spot), was the dominant leaf spot pathogen in 2009 (Table 1), as is the case in winter wheat in Manitoba in most years. The disease was detected in 85% of the fields and estimated to have caused almost all the foliar damage observed. *Stagonospora avenae* f.sp. *triticea* (stagonospora blotch) and *Cochliobolus sativus* (spot blotch) also were isolated, but from only a single field each; their impact was minimal, likely the result of the low temperatures during the 2009 growing season. No *Stagonospora nodorum*- or *Septoria tritici*-mediated leaf spots were diagnosed in 2009.

Table 1. Incidence and isolation frequency of leaf spot pathogens of winter wheat in Manitoba in 2009.

Pathogen	Incidence (% of fields)	Frequency (% of isolations)*
Pyrenophora tritici-repentis	85	98
Stagonospora avenae f.sp. *triticea*	3	1
Cochliobolus sativus	3	1

*indicative of the relative foliar damage caused

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
J. Gilbert, A. Tekauz, R. Kaethler, C. Leclerc, K. Slusarenko, R. Grant, M. Stulzer, and M. Beyene.
Cereal Research Centre, Agriculture and Agri-Food Canada, 195 Dafoe Road, Winnipeg MB, R3T 2M9
Telephone: (204) 983-0891; **Facsimile:** (204) 983-4604; **E-mail:** jeannie.gilbert@agr.gc.ca

TITLE / TITRE: SURVEY FOR LEAF SPOT DISEASES OF SPRING WHEAT IN MANITOBA IN 2009

INTRODUCTION AND METHODS: A survey of 49 southern Manitoba spring wheat fields was conducted from August 11 to 21, 2009 to assess prevalence and severity of foliar diseases. Leaves were collected between heading and the soft dough stage of development. Severity of diseases on upper and lower leaves was categorized based on necrosis as 0, trace, 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 for disease identification.

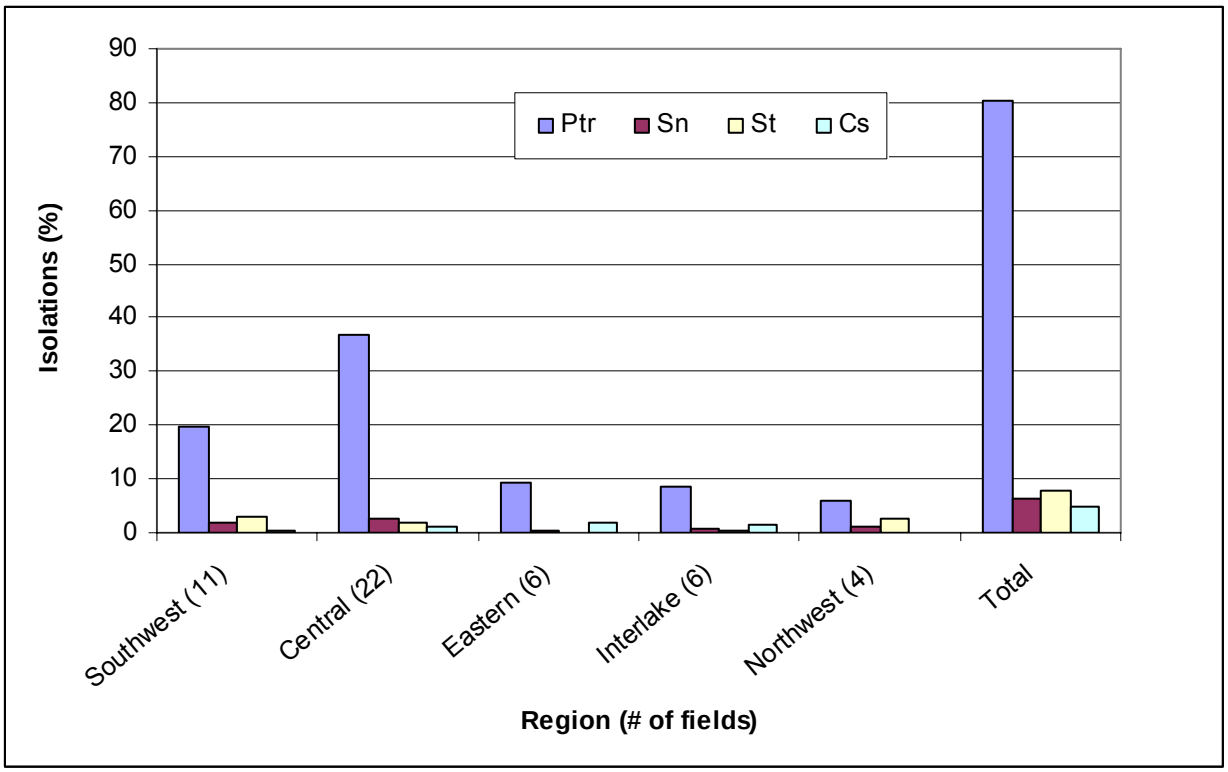
RESULTS AND COMMENTS: Average level of necrosis caused by leaf spots on the flag leaves was 2.4 and on the lower leaves 2.9 (excluding leaves that were already senesced by the time of the survey). The central region (crop reporting districts (CD) 7, 8) and the southwest region (CD 1, 2, 3) had the highest levels of severity. *Pyrenophora tritici-repentis* was the predominant pathogen in all regions, accounting for 80% of isolations (414 pathogen isolations in total) and was found in 48 of the 49 fields sampled (Table 1, Fig. 1). Only low levels of *Stagonospora nodorum, Cochliobolus sativus* and *Septoria tritici* were observed. *Stagonospora nodorum* isolations were reduced from 20% in 2008 to 6.4% in 2009. Conversely, *Septoria tritici* isolations increased from 1% in 2008 to 7.9% in 2009 (Gilbert et al. 2009).

Table 1. Prevalence and isolation frequency of leaf spot pathogens in hard red spring wheat fields in Manitoba in 2009.

	Disease and Pathogen			
	Septoria nodorum blotch *(Stagonospora nodorum*)	**Septoria tritici blotch *(Septoria tritici)***	**Tan spot *(Pyrenophora tritici-repentis*)**	**Spot blotch *(Cochliobolus sativus)***
Wheat crops affected (Total = 49)	17	17	48	13
Isolations (%) (Total = 414)	6.4	7.9	80.4	5.0

REFERENCE:
Gilbert, J., Tekauz, A., Kaethler, R., Kromer, U., Leclerc, C., Unrau, T., Mueller, E., Stulzer, M. and Beyene, M. 2009. Survey for leaf spot diseases of spring wheat in Manitoba in 2008. Can. Plant Dis. Surv: 89: 98-99, (www.cps-scp.ca/cpds.htm)

Figure 1. Isolations of foliar pathogens of spring wheat by crop reporting district in southern Manitoba in 2009.



Ptr - Pyrenophora tritici-repentis, Sn – Stagonspora nodorum, St – Septoria tritici, Cs – Cochliobolus sativus

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
L. Tamburic-Ilincic and A. W. Schaafsma.
Ridgetown Campus, University of Guelph, Ridgetown ON, N0P 2C0;
Telephone: (519) 674-1557; **Facsimile:** (519) 674-1600; **E-mail:** ltamburi@ridgetownc.uoguelph.ca

TITLE / TITRE: 2009 SURVEY FOR FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN ONTARIO

INTRODUCTION AND METHODS: Four winter wheat field tests from the '2009 Ontario Performance Trial' were sampled at harvest to assess the presence of fusarium head blight (FHB). FHB presence and severity were based on the levels of the mycotoxins, deoxynivalenol (DON), nivalenol, T2, and HT 2 detected. Grain was obtained from plots of the three soft winter wheat cultivars 'Superior', 'Emmit' and 'FT Wonder', and the three hard red winter wheat cultivars 'Harvard', 'Warthog' and 'AC Morley'. 'Superior' and 'Harvard' are rated as highly susceptible to FHB, 'Emmit' and 'Warthog' as moderately susceptible, and 'FT Wonder' and 'AC Morley' as moderately resistant. Mycotoxin content was assessed on a 20g sub-sample of the harvested seed using Gas Chromatography-Mass Spectrometry (GS-MS).

RESULTS AND COMMENTS: The lowest (0.10 ppm) levels of DON were detected in grain of cvs. 'Emmit' and 'FT Wonder' grown at Woodslee, while the highest level of DON (2.8 ppm) was found in the cv. 'Superior' grown at Woodstock (Table 1). Average DON levels at Elora, Woodstock, Palmerston and Woodslee were 0.81, 1.15, 0.54 and 0.18 ppm, respectively. These levels were lower than those measured in 2008 (Tamburic-Ilincic, 2009). Nivalenol was not detected in any sample. T2 toxin was detected at just one location, Woodslee, in grain of the cvs. 'Harvard' and 'FT Wonder' (Table 2.); HT2 toxin likewise was detected only at Woodslee in grain of 'Harvard' red winter wheat.

REFERENCE:
Tamburic-Ilincic, L. 2009. 2008 survey for fusarium head blight of winter wheat in Ontario. Can. Plant Dis. Surv. 89:102-103. (http://www.cps-scp.ca/cpds.htm)

Table 1. Levels of deoxynivalenol (DON) in parts per million (ppm) across six winter wheat cultivars planted at four locations in Ontario in 2009.

	LOCATION				
CULTIVAR	**ELORA**	**WOODSTOCK**	**PALMERSTON**	**WOODSLEE**	**MEAN ± (SD)**
HARVARD	1.70	0.62	0.98	0.18	0.87 (0.64)
WARTHOG	0.13	1.00	0.36	0.23	0.43 (0.39)
AC MORLEY	0.37	2.00	0.10	0.21	0.67 (0.89)
EMMIT	0.54	0.13	0.54	0.10	0.33 (0.25)
SUPERIOR	1.20	2.80	0.92	0.24	1.29 (1.08)
FT WONDER	0.94	0.33	0.31	0.10	0.42 (0.36)
MEAN ± (SD)	0.81 (0.58)	1.15 (1.05)	0.54 (0.35)	0.18 (0.06)	

Table 2. Levels of T2 and HT 2 toxin in parts per million (ppm) in two winter wheat cultivars planted at Woodslee, Ontario in 2009.

	TOXIN	
CULTIVAR	**T2**	**HT2**
HARVARD	0.07	0.06
FT WONDER	0.06	-

CROP / CULTURE: Spring Wheat
LOCATION / RÉGION: Eastern Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
A.G. Xue and Y. Chen
Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre, K.W. Neatby Building, 960 Carling Avenue, Ottawa ON, K1A 0C6;
Telephone: (613) 759-1513; **Facsimile:** (613) 759-1926; **E-mail:** allen.xue@agr.gc.ca

TITLE TITRE: DISEASES OF SPRING WHEAT IN EASTERN ONTARIO IN 2009

INTRODUCTION AND METHODS: A survey to document diseases in spring wheat was conducted in the last week of July 2009 when plants were at the late milk to soft dough stages of development. The 32 fields involved were chosen at random in regions of eastern Ontario where most of the spring wheat is grown. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at each of three random sites per field using a rating scale of 0 (no disease) to 9 (severely diseased). Disease identification was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe levels of infection, respectively. Severity of ergot, loose smut, and take-all was estimated as the percent plants infected. Fusarium head blight (FHB) was rated for incidence (percent infected spikes) and severity (percent infected spikelets in the affected spikes) based on approximately 200 spikes sampled at each of three random sites per field. The FHB %index [(%incidence x %severity)/100] was determined for each field. Index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe levels of infection, respectively.

Determination of the causal species of FHB was based on 10 infected spikes collected from each field. The heads were air-dried at room temperature and subsequently threshed. Thirty discolored kernels per sample were randomly chosen, surface sterilized in 1% NaOCI for 30 seconds and plated in 9-cm diameter Petri plates on modified potato dextrose agar (10 g dextrose per liter) amended with 50 ppm of streptomycin sulphate. Plates were incubated for 10-14 days at 22-25ºC with a 14-hour photoperiod supplied by fluorescent and long wavelength ultraviolet tubes. *Fusarium* species isolated from the kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: A total of 12 diseases were identified in the 32 fields of spring wheat surveyed (Table 1). Septoria/Stagonospora leaf blotch (normally associated with infection by *Septoria tritici* and *Stagonospora* spp.) was the most prevalent foliar disease and was observed in all fields at a mean severity at 4.4; in seven fields infection was rated as severe. The average yield reduction due to this leaf blotch was estimated as 10%. Leaf rust (*Puccinia triticina)* was observed in 23 fields at a mean severity of 3.1; this slight to medium level likely did not result in significant yield reductions.

Spot blotch (C*ochliobolus sativus*) and tan spot (*Pyrenophora tritici-repentis*) were detected in 24 and 16 fields, at mean severities of 2.8 and 2.6, respectively; no severely affected crops were recorded. Other foliar diseases observed included bacterial leaf blight (*Pseudomonas syringae* pv*. syringae*), powdery mildew (*Erysiphe graminis* f.sp. *tritici)*, and stem rust (*Puccinia graminis*). These were found in 18, 13 and one field, at mean severity levels of 1.4, 1.6 and 1.0, respectively, (i.e. near-trace levels). Stagonospora glume blotch (*Stagonospora nodorum*) was found in 23 fields at a mean severity of 3.4. A severe level of Stagonospora glume blotch was observed in one field and seed quality was likely affected.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago tritici*) and take-all (*Gaeumannomyces graminis* var*. tritici*) were observed in 13, 11, and 32 fields at mean incidences of 1.5, 0.7 and 2.1%, respectively. These diseases were quite common in 2009.

Fusarium head blight was observed in all surveyed fields at a mean incidence of 27.3% (range 5-70%), mean severity of 28% (range 5-70%), and a FHB Index of 9.8% (range 0.3-36%) (Table 1). Although only seven crops in 2009 were rated with severe levels of FHB, the average severity in affected fields was 7% greater than in 2008 (Xue et al. 2009). As such FHB likely had a greater impact on grain yield and quality in 2009.

Five *Fusarium* species were isolated from putatively infected kernels (Table 2). *Fusarium graminearum* predominated and occurred in 97% of surveyed fields and on 66% of kernels. Other species found included *F. avenaceum, F. equiseti, F. poae and F. sporotrichioides* in up to 36% of fields and 9.7% of kernels.

The profile of spring wheat disease in eastern Ontario in 2009 was similar to that found in 2008 (Xue et. al. 2009). Severity of the various diseases was similar to that in 2008 with the exception of take-all which was more severe in 2009 than 2008. Fusarium head blight likely caused significant yield reductions, as occurred in 2008. Thus, 2009 can be considered a second successive FHB-epidemic year for eastern Ontario. The relatively low temperatures and frequent periods of rain in June and July, and the high temperatures in August were likely responsible for the relatively severe outbreak of FHB observed.

REFERENCE:

Xue, A.G., Chen, Y. and Voldeng, H.D. 2009. Diseases of spring wheat in Ontario in 2008. Can. Plant Dis. Survey. 89:104-105. (http://www.cps-scp.ca/cpds.htm)

Table 1. Prevalence of spring wheat diseases and their recorded severity in eastern Ontario in 2009.

DISEASE	NO. CROPS AFFECTED (n=32)	DISEASE SEVERITY IN AFFECTED CROPS*	
		Mean	Range
Bacterial blight	18	1.4	1.0-2.0
Leaf rust	23	3.1	1.0-5.0
Powdery mildew	13	1.6	1.0-3.0
Stagonospora glume blotch	23	3.4	1.0-6.0
Septoria/Stagonospora leaf blotch	32	4.4	1.0-8.0
Spot blotch	24	2.8	1.0-5.0
Stem rust	1	1.0	1.0
Tan spot	16	2.6	1.0-5.0
Ergot (%)	13	1.5	1.0-3.0
Loose smut (%)	11	0.7	0.5-1.0
Take-all (%)	32	2.1	0.5-5.0
Fusarium head blight**	32		
Incidence (%)		27.3	5.0-70.0
Severity (%)		28.3	5.0-70.0
Index (%)		9.8	0.3-36.0

*Foliar disease severity was rated on a scale of 0 (no disease) to 9 (severely diseased); ergot, loose smut, and take-all severity based on percent plants infected.

** FHB Index = (FHB incidence x FHB severity)/100.

Table 2. Frequency of *Fusarium* species isolated from fusarium damaged kernels of spring wheat in eastern Ontario in 2009.

***Fusarium* spp.**	**% FIELDS**	**% KERNELS**
Fusarium spp.	100.0	81.0
F. avenaceum	36.4	9.7
F. equiseti	27.3	3.6
F. graminearum	97.0	65.5
F. poae	18.2	1.7
F. sporotrichioides	18.2	1.4

Forages / Plantes Fourragères

CROP / CULTURE: Alfalfa (*Medicago sativa*)
LOCATION / RÉGION: Saskatchewan, New York (USA), Vermont (USA)

NAME AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
M.J. Wunsch[1], K.A. Bassendowski[2], G.C. Bergstrom[1], and B.D. Gossen[2]
[1] Dept. of Plant Pathology and Plant-Microbe Biology, Cornell University, Ithaca, NY 14853-5904
Telephone: (607) 255-8393; **Facsimile:** (607) 255-4471; **Email:** mjw55@cornell.edu
[2] Agriculture and Agri-Food Canada (AAFC), Saskatoon Research Centre, 107 Science Place, Saskatoon, SK S7N 0X2

TITLE / TITRE: INCIDENCE OF FOLIAR INFECTION OF ALFALFA BY *PHOMA MEDICAGINIS* AND *P. SCLEROTIOIDES* IN SASKATCHEWAN, NEW YORK, AND VERMONT IN 2008 AND 2009.

METHODS: Alfalfa production fields were surveyed for foliar diseases to assess the incidence of infection by *Phoma medicaginis* and *P. sclerotioides*. *Phoma medicaginis* causes spring black stem and leaf spot of alfalfa (SBS), and *P. sclerotioides*, which causes brown root rot of alfalfa, can cause symptoms similar to those of SBS on alfalfa leaves (Wang et al. 2004). In September and October 2008, alfalfa foliar samples were collected from 7 fields in central Saskatchewan and 10 fields in northeastern New York. In May and early June 2009, alfalfa foliar samples were collected from 9 fields in central Saskatchewan, 10 fields in northeastern New York, 3 fields in northwestern Vermont, and 3 fields in central Vermont. All fields were located in regions where *P. sclerotioides* is present and brown root rot is common (Davidson 1990, Wunsch et al. 2007). The fields in New York and northwestern Vermont were located within 20 km of the U.S. border with Quebec.

In Saskatchewan, plants were collected at several sites along a teardrop-shaped circuit in each field, and 5 to 36 plants were sampled per field. In New York and Vermont, plants were collected in a zigzag pattern across five sites per field (total of 50 plants) in October 2008 and eight sites per field (40 plants) in May 2009. In the laboratory, four to eight leaflets were removed from each plant. For plants exhibiting SBS, leaflets with SBS symptoms were selected. For plants with no clear symptoms of SBS, leaflets were selected arbitrarily. Leaflets were surface sterilized in 0.6% sodium hypochlorite for 2 minutes and 70% ethanol for 45 seconds, rinsed in sterile distilled water, plated onto 1.5% water agar, and incubated at 10º C under continuous light for 3 to 4 months. A plant was considered positive for infection by *P. medicaginis* or *P. sclerotioides* if characteristic pycnidia were produced on leaf tissues or in the surrounding agar of at least one leaflet. For all plants from which pycnidia characteristic of *P. sclerotioides* were isolated, single-conidium cultures were established on potato dextrose agar to confirm the identity of the pathogen. In spring 2009, fields surveyed in Saskatchewan were also assessed for incidence and severity of SBS and for the presence of common leaf spot (*Pseudopeziza medicaginis*), yellow leaf blotch (*Leptotrochila medicaginis*), and crown rot. SBS severity was rated using the Horsfall-Barratt scale (0–11) and then converted to percent leaf area affected. For common leaf spot and yellow leaf blotch, occasional isolation was conducted to confirm the identity of the causal agent.

RESULTS AND DISCUSSION: The incidence of foliar infection with *P. medicaginis* in Saskatchewan and New York was moderate to high in the fall of 2008 (Table 1), and high at all sampling sites in 2009 (Tables 2 and 3). It is interesting to note that high levels of infection were present in Saskatchewan in 2009 even though the incidence and severity of foliar symptoms was very low (Table 3).

In the spring of 2009, SBS severity was moderate in alfalfa fields in New York and Vermont, affecting predominantly the lower leaves (data not shown). SBS severity was very low in Saskatchewan due to drought early in the growing season across the survey area. Also, common leaf spot and yellow leaf blotch occurred at trace levels and some winterkill (1%) was observed in one field (Table 3).

Phoma sclerotioides was recovered from only 2 of 17 fields in the fall of 2008 (Table 1), but was identified at a low incidence in most fields in the spring of 2009. The incidence of *P. sclerotioides* was generally higher in Saskatchewan than in New York and Vermont in 2009 (Tables 2 and 3). These data may indicate that foliar infection by *P. sclerotioides* is more common in spring than in fall.

ACKNOWLEDGEMENT: We thank Elizabeth Burrichter, Department of Plant Pathology and Plant-Microbe Biology, Cornell University, for her assistance in the laboratory processing of alfalfa samples.

REFERENCES:

Davidson, J.G.N. 1990. Brown root rot. Pages 29–31 in: Compendium of Alfalfa Diseases, D.L. Stuteville and D.C. Erwin, eds. APS Press, St. Paul, MN.

Wang, H., Hwang, S.F., Chang, K.F., Gossen, B.D., Turnbull, G.D. and Howard, R.J. 2004. Assessing resistance to spring black stem of alfalfa caused by *Phoma* spp. Can. J. Plant Sci. 84: 311–317.

Wunsch, M.J., Schindelbeck, R.R., van Es, M.M. and Bergstrom, G.C. 2007. Distribution, impact and soil environment of *Phoma sclerotioides* in northeastern U.S. alfalfa fields. Plant Dis. 91: 1293–1304.

Table 1. Incidence of foliar infection (percent recovery from plants) by *Phoma sclerotioides* and *P. medicaginis* in alfalfa samples collected in Saskatchewan and New York in September and October 2008.

CENTRAL SASKATCHEWAN			NORTHEASTERN NEW YORK		
Field	***Pscl*** [1]	***Pmed*** [2]	**Field**	***Pscl*** [1]	***Pmed*** [2]
Yellow Creek 1	7	93	Chazy 1	0	8
Yellow Creek 2	0	96	Chazy 2	0	56
Valparaiso	0	83	Chazy 3	8	14
Tisdale	0	20	Chazy 4	0	0
Crooked River	0	24	Chazy 5	0	0
Carrot River	0	64	Chazy 6	0	4
Smeaton	0	62	Chazy 7	0	48
			Chazy 8	0	14
			Chazy 9	0	2
			Chazy 10	0	94

[1] ***Pscl*****:** The percentage of plants from which *P. sclerotioides* was isolated from leaves.
[2] ***Pmed*****:** The percentage of plants from which *P. medicaginis* was isolated from leaves.

Table 2. Incidence of foliar infection (percent recovery from plants) by *Phoma sclerotioides* and *P. medicaginis* in alfalfa samples collected in New York and Vermont in May 2009.

NORTHEASTERN NEW YORK		
Field	***Pscl*** [1]	***Pmed*** [2]
Chazy 1	3	98
Chazy 2	0	73
Chazy 3	3	100
Chazy 4	0	93
Chazy 5	8	100
Chazy 6	3	100
Chazy 7	0	95
Chazy 8	0	100
Chazy 9	0	100
Chazy 10	3	100

NORTHWESTERN VERMONT		
Field	***Pscl*** [1]	***Pmed*** [2]
St. Albans 1	3	100
St. Albans 2	5	100
St. Albans 3	5	70

CENTRAL VERMONT		
Field	***Pscl*** [1]	***Pmed*** [2]
Starksboro 1	3	93
Starksboro 2	3	100
Starksboro 3	0	100

[1] ***Pscl*****:** The percentage of plants from which *P. sclerotioides* was isolated from leaves.
[2] ***Pmed*****:** The percentage of plants from which *P. medicaginis* was isolated from leaves.

Table 3. Spring black stem and leaf spot (SBS) incidence and severity, incidence of foliar infection (percent recovery from plants) by *Phoma sclerotioides* and *P. medicaginis, and* occurrence of other diseases in alfalfa fields surveyed in Saskatchewan in early June 2009.

Field	**SBS incidence (%)**	**SBS severity (%)**	**Incidence, *Pscl* (%)**[1]	**Incidence, *Pmed* (%)**[2]	**Other diseases**[3]
Yellow Creek 1	20	2	20	100	CLS, YLB
Yellow Creek 2	35	5	6	100	CLS
Valparaiso	30	4	10	97	CLS
Tisdale	20	2	11	89	CLS
Crooked River	20	2	10	90	CLS, CR
Arborfield	20	2	3	100	CLS, YLB
MacDowall	50	5	0	100	CLS, YLB
Rosthern	10	2	6	88	CLS
Langham	10	2	13	92	CLS

[1] ***Pscl*****:** The percentage of plants from which *P. sclerotioides* was isolated from leaves.
[2] ***Pmed*****:** The percentage of plants from which *P. medicaginis* was isolated from leaves.
[3] **CLS =** common leaf spot, **YLB =** yellow leaf blotch, **CR =** severe crown rot associated with winterkill.

Oilseeds & Special Crops / Oléagineux et Cultures Spéciales

CROP: Field bean
LOCATION: Manitoba

NAMES AND AGENCY:
Robert L. Conner[1], Debra L. McLaren[2], Waldo C. Penner[1] and Daniel J. Hausermann[2]
[1]Agriculture and Agri-Food Canada Research Station, Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5; **Telephone** (204) 822-7221; **Facsimile** (204) 822-7207; **E-mail**: robert.conner@agr.gc.ca
[2]Agriculture and Agri-Food Canada Research Centre, Box 1000 A, RR#3, Brandon, Manitoba R7A 5Y3

TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2009

METHODS: Crops of field bean were surveyed for root diseases at 40 different locations and for foliar diseases at 43 locations in Manitoba. During the root disease survey, the severity of halo blight (*Pseudomonas syringae* pv. *phaseolicola*) also was assessed as a percentage of leaf tissue with symptoms. The survey for root diseases and halo blight was conducted in the third and fourth week of July when plants were at the early bloom stage. For foliar diseases the survey was carried out during the last week of August to the second week in September when the plants were starting to mature. The crops surveyed were selected at random from regions in southern Manitoba, where most field bean crops are grown. For the root diseases, at least ten plants were sampled at each of three random sites in each crop surveyed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, seedling died back soon after emergence). Fifteen to 18 roots with disease symptoms per crop were collected for isolation of the causal organism in the laboratory in order to confirm the visual assessment. Foliar diseases were identified by symptoms. Levels of common bacterial blight (CBB) (*Xanthomonas axonopodis* pv. *phaseoli*) were estimated based on the percent incidence of leaf infection and a severity scale of 0 (no disease) to 5 (50-100% of the leaf area covered by lesions). Anthracnose (*Colletotrichum lindemuthianum*), rust (*Uromyces appendiculatus*) and white mould (*Sclerotinia sclerotiorum*) severity were each assessed as a percentage of infected plant tissue. In crops with anthracnose symptoms, pod samples were collected for isolation of the causal organism to confirm that the symptoms were caused by *C. lindemuthianum*.

RESULTS AND COMMENTS: Frequent showers occurred throughout the summer and daily temperatures were generally lower than normal. Two root diseases were observed (Table 1). Fusarium root rot (*Fusarium* spp.) was detected in all of the 40 crops surveyed for root disease, making it the most prevalent root disease of dry bean. Fields from which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 1.9 to 6.8 with an average of 4.3. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 24 of the 40 crops surveyed with severity ratings of 2.7 to 6.8 and an average severity of 4.3. Twenty-seven crops had average root rot ratings above a severity value of 4 (i.e., symptoms were present on 50% of the root system). Halo blight was observed in 10 of the 40 crops with severity values ranging from 1 to 15% and averaging 4.3%.

Three diseases were observed during the foliar disease survey (Table 2). Common bacterial blight was the most prevalent foliar disease and symptoms were observed in all 43 crops surveyed. The incidence of CBB leaf infection ranged from 1 to 40% with an average of 19.1%, while severity was consistently rated as 3.0. Incidences of 20% or above were observed in 26 crops. Anthracnose was not detected in any of the field bean crops. White mould symptoms were detected in 41 crops with an incidence of plant infection that ranged from 0.1 to 60% with an average of 14.5%. An incidence of white mould of 10% or higher was observed in 20 dry bean crops and this level would have affected crop yield. Bean rust was observed in only one dry bean crop with an average severity of 2%.

Table 1. Prevalence and severity of root diseases and halo blight in 40 crops of bean in Manitoba in 2009.

Disease	No. crops affected	Disease Severity	
		Mean[1]	Range
Fusarium root rot[2]	40	4.3	1.9-6.8
Rhizoctonia root rot[2]	24	4.3	2.7-6.8
Pythium root rot	0	0.0	0.0
Halo blight[3]	10	4.3%	1-15%

[1]Means are based on an average of the crops in which the diseases were observed.
[2]Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, seedlings died back soon after emergence).
[3]Halo blight severity was assessed as a percentage of leaf tissue displaying symptoms.

Table 2. Prevalence and severity of foliar diseases in 43 crops of field bean in Manitoba in 2009.

Disease	No. crops affected	Disease Severity[1]		Incidence of Leaf Infection	
		Mean[2]	Range	Mean[2]	Range
Common bacterial blight	43	3.0	3.0	19.1%	1-40%
Anthracnose	0	0.0%	0.0%		
Rust	1	2.0%	2.0%		
White mould	41	14.5%	0.1-60%		

[1]Anthracnose, rust and white mould severity were rated as the percentage of infected plant tissue; common bacterial blight severity was rated on a scale of 0 (no disease) to 5 (whole plant severely diseased).
[2]Means are based on an average of the crops in which the diseases were observed.

CROP: Dry Bean
LOCATION: Alberta

NAMES AND AGENCY:
R.S. Erickson and P.M. Balasubramanian
Agriculture and Agri-Food Canada, Lethbridge Research Centre, P.O. Box 3000, Lethbridge, Alberta, T1J 4B1
Telephone (403) 317-2226; **Facsimile** (403) 382-3156; **E-mail**: Scott.Erickson@agr.gc.ca

TITLE: SURVEY OF DISEASES OF DRY BEAN IN SOUTHERN ALBERTA IN 2009

METHODS: Twenty-five irrigated dry bean crops were surveyed for diseases during the second week of August, 2009 in the bean production areas surrounding Bow Island and Taber, Alberta. Each crop was sampled in a U-shaped pattern by selecting ten sites approximately 20 m apart, with each site consisting of a 3 m long section of row (Howard and Huang, 1983). The incidences of white mold, bacterial blights and bacterial wilt in each crop were calculated as percent infected plants by averaging scores from the ten sites. Each disease was scored at each site according to the following scale: (1) none (0% of plants infected), (2) trace (<1%), (3) light (1-10%), (4) moderate (11-25%), (5) high (26-50%), (6) very high (>50%).

RESULTS: Diseases of dry bean observed in 2009 were: white mold (*Sclerotinia sclerotiorum*), bacterial blights (*Xanthomonas axonopodis* pv. *phaseoli*, *Pseudomonas savastanoi* pv. *phaseolicola*) and bacterial wilt (*Curtobacterium flaccumfaciens* pv. *flaccumfaciens*). White mold was found in all 25 of the crops surveyed (Table 1), with disease incidence ranging from 1 to 52%. Most of the crops surveyed had light or moderate incidence of white mold. Grey mold (*Botrytis cinerea*) was not observed in any of the crops surveyed.

Bacterial blights were found in all 25 of the crops (Table 1) with incidence ranging from 1 to 100%. The frequency of crops with light, moderate and high incidence of bacterial blights was 24, 20 and 16%, respectively. The crops with very high incidence of bacterial blights had been damaged by hail storms. Although both common blight (*Xanthomonas axonopodis* pv. *phaseoli*) and halo blight (*P. savastanoi* pv. *phaseolicola*) were observed in the surveyed area, halo blight was observed less frequently.

Bacterial wilt was observed in 11 of the crops surveyed with incidences of 0 to 7%. The frequencies of crops with trace and light incidence of bacterial wilt were 28 and 16%, respectively.

DISCUSSION: The occurrence of fungal diseases of dry bean such as white mold and grey mold has been previously reported in crop surveys (Huang and Erickson, 2000). Bacterial diseases such as bacterial blights (Huang and Erickson, 2000) and bacterial wilt (Huang et al., 2007; Erickson and Balasubramanian, 2008) have also been reported. The survey of 2009 dry bean crops shows that these diseases are persistent in southern Alberta. Bacterial blights and white mold were the most prevalent diseases in 2009.

The results of this survey are similar to those of the survey conducted in 2007 (Erickson and Balasubramanian, 2008), and suggest the need for ongoing monitoring and research efforts on control of these economically important diseases.

REFERENCES:
Erickson, R.S. and Balasubramanian, P.M. 2008. Survey of diseases of dry bean in southern Alberta in 2007. Can. Plant Dis. Surv. 88: 99-100. (http://www.cps-scp.ca/cpds.htm)

Howard, R.J. and Huang, H.C. 1983. Survey of commercial fields of dry beans for white mold disease. p. 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.

Huang, H.C. and Erickson, R.S. 2000. Survey of diseases of dry bean in southern Alberta in1999. Can. Plant Dis. Surv. 80: 73-74. (http://www.cps-scp.ca/cpds.htm)

Huang, H.C., Erickson, R.S., Mündel, H.-H., Rasmussen, K.H. and Chelle, C.A. 2007. Distribution of seed-borne diseases of dry bean in southern Alberta in 2005. Can. Plant Dis. Surv. 87: 107-107. (http://www.cps-scp.ca/cpds.htm)

Table 1. Incidence of dry bean diseases in southern Alberta in 2009.

	Number of crops[1] with disease incidence of					
Disease	**None 0%**	**Trace (<1%)**	**Light (1-10%)**	**Moderate (11-25%)**	**High (26-50%)**	**Very High (>50%)**
White mold	0	2	11	8	3	1
Bacterial blights	0	1	6	5	4	9
Bacterial wilt	14	7	4	0	0	0

[1]out of a total of 25 crops surveyed.

CROP: Canola
LOCATION: Alberta

NAMES AND AGENCIES:
S.E. Strelkov[1], V.P. Manolii[1], I. Márquez Zequera[1, 2], E. Manolii[1], and S.F. Hwang[3],
Telephone: (780) 492-1969; **Facsimile:** (780) 492-4265; **E-mail:** stephen.strelkov@ualberta.ca
[1]Department of Agricultural, Food and Nutritional Science, University of Alberta, 410 Agriculture/Forestry Centre, Edmonton, AB T6G 2P5
[2]Centro de Investigación en Alimentación y Desarrollo, Culiacán, Sinaloa, México
[3]Alberta Agriculture and Rural Development, Crop Diversification Centre North, 17507 Fort Road NW, Edmonton, AB T5Y 6H3

TITLE: INCIDENCE OF CLUBROOT ON CANOLA IN ALBERTA IN 2009

METHODS: A total of 224 commercial canola (*Brassica napus* L.) crops in 10 counties in central Alberta were surveyed for the incidence of clubroot (Table 1), caused by the obligate parasite *Plasmodiophora brassicae* Woronin. The crops surveyed were all in fields where clubroot had not been previously identified. The survey was conducted in September 2009, with most crops visited after swathing. The roots of all plants within a 1 m^2 area at each of 10 locations along the arms of a 'W' sampling pattern were dug from the soil and examined for the presence of galls, which were taken as an indication of *P. brassicae* infection. Canola crops in which clubroot was found at more than seven of the 10 sampling points were classified as "heavily infested", those in which the disease was found at three to seven sampling points were classified as "moderately infested", and those in which clubroot was found at only one or two sampling points were classified as "lightly infested." Visits to fields were coordinated with the Agricultural Fieldman in each municipality.

RESULTS AND COMMENTS: Forty-nine of the 224 canola crops surveyed were found to be clubroot-infested, including a crop in the County of Thorhild, which represents the first confirmed case of clubroot in that municipality (Table 1). Within the infested crops, eight were heavily infested, 11 were moderately infested, and 30 were lightly infested. Another two clubroot-infested canola crops were identified in a survey conducted by the County of Leduc. Thus, a total of 51 new cases of clubroot were confirmed in Alberta in 2009.

Very dry conditions prevailed throughout much of Alberta in May and June of 2009, resulting in conditions that were not conducive to clubroot development. Indeed, in early July, no clubroot could be found on susceptible canola plants grown in heavily infested experimental field plots in northeast Edmonton and the County of Leduc. However, symptoms of clubroot started to appear by early August, after several heavy rains fell in early to mid-July. As a result of the generally dry conditions and late onset of disease, the clubroot survey was postponed until September to allow more time for symptom development; the survey was also focused mainly on central Alberta, to evaluate the disease situation in a dry year. Surveys by the counties were significantly reduced relative to 2008 (1).

In this context, more clubroot was found than anticipated, although the late onset of symptoms likely resulted in a smaller impact on yields. In 2004, the previous year in which such dry conditions prevailed in central Alberta, no new cases of the disease were identified (although the number of canola crops surveyed that year was smaller [2]). Perhaps the most significant finding in the 2009 survey was the fairly high number of clubroot-infested canola crops identified in the counties of Westlock, Wetaskiwin, and Ponoka (Table 1), which were previously regarded as being on the periphery of the main disease outbreak. This could reflect the continued spread of clubroot in Alberta, as could the identification of the first case of clubroot in the County of Thorhild. A total of 456 commercial fields in Alberta are now confirmed to be infested with clubroot. These fields are distributed over 17 counties throughout the province as well as a rural area of the City of Edmonton, although the outbreak remains most severe in central Alberta (Fig. 1).

ACKNOWLEDGEMENTS:
We would like to thank J. Babcock (Ponoka), H. Hamilton (Thorhild), H. Horner (Strathcona), P. King (Camrose), S. Majek (Wetaskiwin), T. McGinn (Lac Ste. Anne), S. Steffen (Ponoka), G. Thompson (Lac Ste. Anne), J. Tigert (Westlock), D. Trauman (Camrose), A. Van Beers (Leduc), A. Veenstra (Sturgeon) and T. Warren (Parkland) for their assistance with the surveys. Financial support by the Agriculture & Food Council, the Alberta Crop Industry Development Fund, the Alberta Canola Producers Commission and other industry partners is also gratefully acknowledged.

REFERENCES:
1. Strelkov, S.E., Manolii, V.P., Howard, R.J., Rennie, D.C., Hwang, S.F., Manolii, A.V., Liu, J., Cao, T., and Xiao, Q. 2009. Incidence of clubroot on canola in central Alberta in 2008. Can. Plant Dis. Surv. 89:110-112. (http://www.cps-scp.ca/cpds.html)

2. Strelkov, S.E., Tewari, J.P., Hartman, M., and Orchard, D. 2005. Clubroot on canola in Alberta in 2003 and 2004. Can. Plant Dis. Surv. 85:72-73. (http://www.cps-scp.ca/cpds.html)

Table 1. Distribution of clubroot-infested canola fields in 10 counties surveyed in Alberta in 2009.

County	Number of fields surveyed in 2009	Number of clubroot-infested fields identified in 2009	Total number of fields known to be infested
Camrose	23	3	7
Lac Ste. Anne	28	0	1
Leduc	22	8*	76
Parkland	23	4	49
Ponoka	20	7	10
Strathcona	21	5	15
Sturgeon	18	8	151
Thorhild	25	1	1
Westlock	24	7	17
Wetaskiwin	20	6	15

*In addition to the eight clubroot-infested fields identified in the University of Alberta survey, two other infested fields were found in a survey conducted by the County of Leduc, bringing the total number of new cases in that municipality to 10

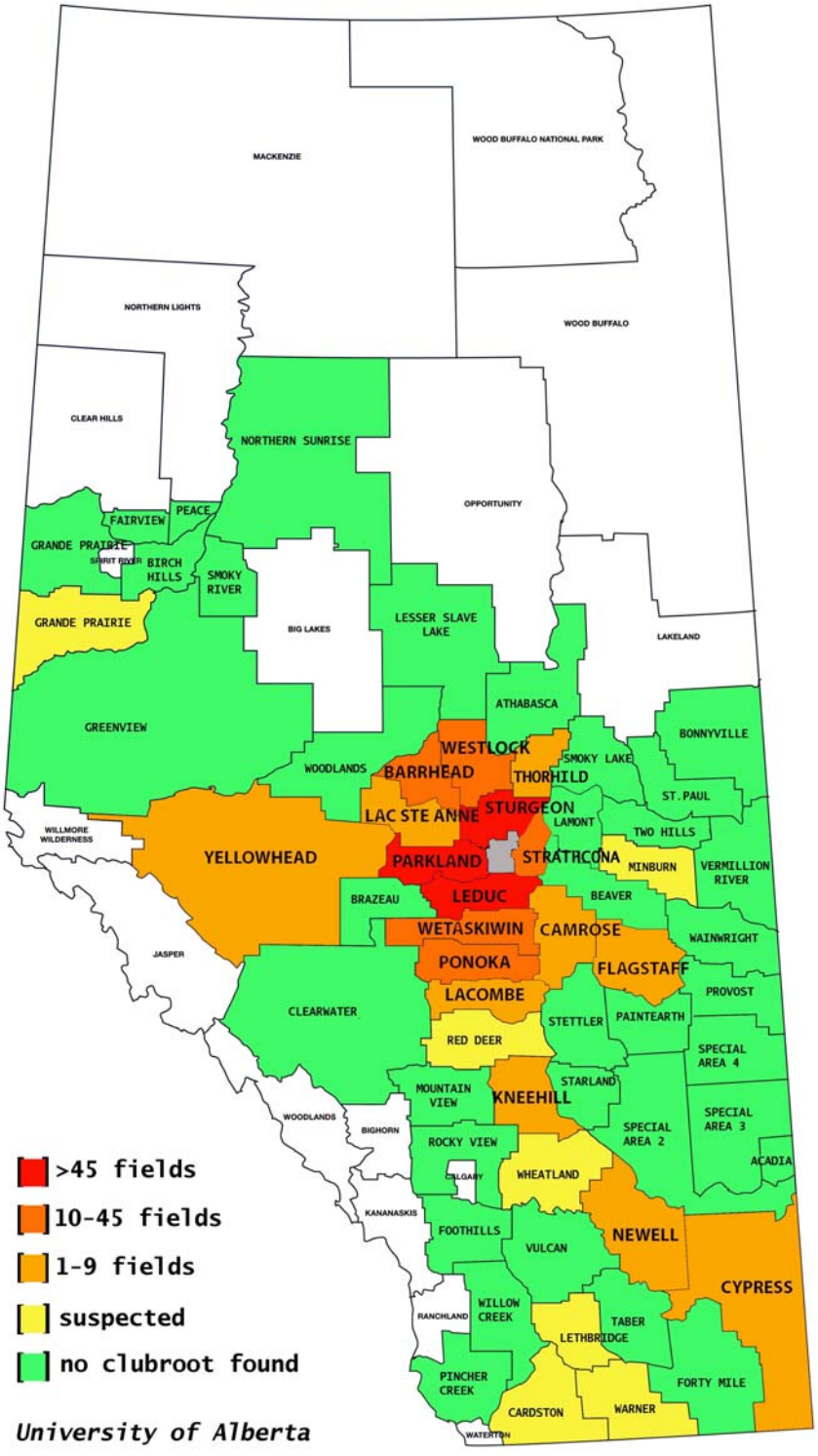


Figure 1. Occurrence of clubroot on canola in Alberta as of October 2009. The disease has been confirmed in a total of 456 fields representing 17 counties and a rural area of the City of Edmonton. In addition, suspected cases of clubroot have been reported from at least seven other municipalities.

CROP: Canola
LOCATION: Saskatchewan

NAMES AND AGENCIES:
F.L. Dokken-Bouchard[1], A.J. Bouchard[2], J. Ippolito[3], G. Peng[4], S. Strelkov[5], C.L. Kirkham[6] and H.R. Kutcher[6]
[1] Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina, Saskatchewan S4S 0B1
Telephone: (306) 787-4671; **Facsimile:** (306) 787-0428; **E-mail:** faye.dokkenbouchard@gov.sk.ca
[2] Viterra, 3404 11th Street W., Saskatoon, Saskatchewan, S7M 1K5
[3] Saskatchewan Ministry of Agriculture, Box 1690, 409 Main Street, Kindersley, Saskatchewan S0L 1S0
[4] Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, Saskatchewan S7N 0X2
[5] Department of Agricultural, Food and Nutritional Science, University of Alberta, 410 Agriculture/Forestry Centre, Edmonton, Alberta, T6G 2P5
[6] Agriculture and Agri-Food Canada, Box 1240, Melfort, Saskatchewan S7N 0X2

TITLE: DETECTION OF *PLASMODIOPHORA BRASSICAE* IN SASKATCHEWAN, 2008

METHODS: Soil samples (~1 L) were obtained from 30 of the 130 canola fields surveyed during a general canola disease survey between August 8 and September 3, 2008 (Dokken et al. 2009). The soil samples were taken from throughout the canola growing areas of the province, which were predominantly the dark brown and black soil zones. Soil samples were analysed using the PCR based diagnostic test of Cao et al. (2007) for the presence of *P. brassicae* Woronin. A bioassay of any soil sample indicated as positive for *P. brassicae* was conducted under controlled conditions using susceptible *Brassica* spp.

RESULTS AND COMMENTS: Symptoms of clubroot were not observed in any of the 130 fields surveyed in 2008; however, analysis of the 30 soil samples using the PCR test resulted in four samples that were positive for the presence of *P. brassicae*. Testing of the samples a second time using a second DNA extraction from the soil samples indicated only a single positive soil sample, originating from a field in west-central SK. A third PCR test on this sample confirmed the presence of *P. brassicae*. In April, 2009 a second soil sample was collected from the same field. The PCR test again indicated the presence of the pathogen. Bioassays were performed on the soil sample collected in April using *B. napus* canola (cv. Fortune RR) and *Brassica rapa* L. var. pekinensis (Chinese cabbage cv. Granaat) in the containment facility at AAFC, Saskatoon Research Centre and the University of Alberta, Edmonton, respectively. On the canola, sporadic, minute galls were observed on the roots after 6 to 8 weeks of growth in the infested soil. Analysis of these galls using the DNA diagnostic test confirmed the presence of *P. brassicae* in the roots of the plants. In a follow-up bioassay, planting canola into soil infested with several of the minute galls formed on canola plants in the previous bioassay, clear clubroot symptoms were confirmed on canola plants 5 weeks after seeding.

This is the first report of the presence of *P. brassicae* in Saskatchewan.

REFERENCES:
Cao, T., Tewari, J., and Strelkov, S.E. 2007. Molecular detection of *Plasmodiophora brassicae*, causal agent of clubroot of crucifers, in plant and soil. Plant Dis. 91: 80-87.

Dokken, F.L., Bouchard, A.J., Bassendowski, K.A., Boyle, T., Cowell, L.E., Gugel, R.K., Kirkham, C.L., Kutcher, H.R., Lewchuk, Z., Miller, S.G., Morrall, R.A.A., Vakulabharanam, V. and Sommerfeld, S. 2009. Survey of canola diseases in Saskatchewan, 2008. Can. Plant Dis. Surv. 89: 113-114. (http://www.cps-scp.ca/cpds.shtml)

CROP: Canola
LOCATION: Saskatchewan

NAMES AND AGENCIES:
F.L. Dokken-Bouchard[1], K.A. Bassendowski[2], T. Boyle[3], L.E. Cowell[4], R.K. Gugel[2], J. Ippolito[5], C.L. Kirkham[6], H.R. Kutcher[6], Z. Lewchuk[7], S.G. Miller[1], R.A.A. Morrall[8], S. Phelps[9], I. Schemenauer[10], S. Sommerfeld[10] and V. Vakulabharanam[1]
[1] Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina, Saskatchewan S4S 0B1
Telephone: (306) 787-4671; **Facsimile:** (306) 787-0428; **E-mail:** faye.dokkenbouchard@gov.sk.ca
[2] Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, Saskatchewan S7N 0X2
[3] Saskatchewan Ministry of Agriculture, Box 3003, Prince Albert, Saskatchewan S6V 6G1
[4] Viterra, Box 1870, Tisdale, Saskatchewan S0E 1T0
[5] Saskatchewan Ministry of Agriculture, 409 Main Street, Kindersley, Saskatchewan S0L 1SO
[6] Agriculture and Agri-Food Canada, Box 1240, Melfort, Saskatchewan SOE 1A0
[7] Saskatchewan Ministry of Agriculture, 38 5th Avenue N, Yorkton, Saskatchewan S3N 0Y8
[8] Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, Saskatchewan S7N 5E2
[9] Saskatchewan Ministry of Agriculture, 1192 - 102nd Street, North Battleford, Saskatchewan S9A 1E9
[10] Saskatchewan Ministry of Agriculture, 410 Saskatchewan Ave. W., Outlook, Saskatchewan S0L 2N0

TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2009

METHODS: A total of 158 canola crops were surveyed between August 21 and September 11 in the major canola production regions of Saskatchewan, including 156 of *Brassica napus*. Two mustard crops (*B. juncea*), one each in the south-west and west-central regions, were also included in the survey. Regions included north-west (19 fields), north-east (34), west-central (60), east-central (23), south-west (6), and south-east (16) Saskatchewan. Seven crops in the west-central, one in the east-central, and two in the south-west region were under irrigation. Crops were surveyed before swathing while plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp 1975). Disease assessments were made in each field by collecting 20 plants from each of five sites at least 20 m from the edge of the field and separated from each other by at least 20 m. Presence or absence of symptoms on each plant was determined to give percent disease incidence for sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma), foot rot (*Rhizoctonia* spp., *Fusarium* spp.), and fusarium wilt (*F. oxysporum* f.sp. *conglutinans*). For sclerotinia stem rot, each plant was scored for both main stem and upper branch/pod lesions. For blackleg, plants were scored for either severe basal stem cankers or any other type of blackleg stem lesion. For alternaria black spot (*Alternaria brassicae, A. raphani*), percent severity of lesions on the pods of each plant was assessed (Conn et al. 1990). When diseases were observed in the crop, but not in the sample of 100 plants, they were recorded as “trace” and counted as 0.1%. Mean disease incidence or severity values were calculated for each region. Mean incidence or severity values less than 0.1% were reported as “trace” [T] (Table 1).

RESULTS AND COMMENTS: Approximately 7.7 million acres (3.1 million ha) of canola were seeded in Saskatchewan in 2009 (Statistics Canada, 2009). Cool weather delayed seeding in most areas. West-central and north-west parts of the province experienced low moisture conditions in the spring and some areas did not receive adequate moisture during the critical crop season. Repeated frost occurrence until the last week of May in several parts of the province and cold spring weather delayed crop emergence and growth and even led some producers to re-seed their canola crops. Most of the province received good rainfall during the week of June 16th, which improved crop conditions. However, 83% of oilseeds were 3-4 weeks behind normal development throughout the 2009 season. Unseasonably warm weather in September resulted in greater than anticipated yields. However, cold weather and precipitation in October halted harvest in the province, leading to a large number of acres of canola not being harvested until November, particularly in the northern cropping regions.

Sclerotinia stem rot was observed in 72% of the crops surveyed. Incidence ranged from 0 to 73% for main stem lesions and from 0 to 72% for upper branch/pod lesions. Mean incidence was highest in the north-east (13% main stem and 13% upper branch/pod lesions) and lowest in the west-central (0.7%

main stem and 1% upper branch/pod lesions) regions. Mean total incidence of sclerotinia (main stem plus upper branch/pod lesions) for the nine irrigated crops (12%) was higher than the mean total incidence without irrigation (9%) but similar to previous seasons with greater precipitation (1999, 2000, 2004: 13 to 17%). The overall provincial mean (9%) was higher than in drier seasons (2001, 2002, 2003, 2005, 2006: 0.1 to 3%) and seasons when conditions were variable (2007–08: 5 to 7%) (Dokken et al. 2009). Despite the disease incidence, yield losses appeared to be minimal because infection occurred late in the season and over half of the lesions were on the upper branches rather than main stems.

Blackleg was observed in 38% of the crops surveyed, with incidence ranging from 0 to 17% for basal stem cankers and from 0 to 16% for lesions elsewhere on the stem. Mean incidence for the province (1.5%) was only slightly lower than in the previous 10 seasons with the exception of 1999 (11%) and 2002 (trace).

Aster yellows was observed in 25% of the crops surveyed, with incidence ranging from 0 to 4%. Mean incidence for the province was trace, which was lower than in 2008 (0.2%); the highest overall incidence of aster yellows recorded in Saskatchewan was 2% in 2007 (Pearse et al. 2008). Foot rot was observed in 36% of the crops surveyed, with mean incidence (2%) higher than in previous years. Alternaria black spot was reported in 51% of the crops surveyed. While prevalence was lower than in 2008, the mean severity (0.5%) was higher (2008=trace). Fusarium wilt symptoms were reported at an average 4% severity in 3% of the crops surveyed in 2009; however no plant samples were taken to confirm these observations. Downy mildew and white rust were observed on one mustard crop included in the survey. Clubroot symptoms were not observed in any of the surveyed fields.

REFERENCES:

Conn, K.L., Tewari, J.P., and Awasthi, R.P. 1990. A disease assessment key for Alternaria blackspot in rapeseed and mustard. Can. Plant Dis. Surv. 70:19–22. (http://www.cps-scp.ca/cpds.shtml)

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

Dokken, F.L., Bouchard, A.J., Bassendowski, K.A., Boyle, T., Cowell, L.E., Gugel, R.K., Kirkham, C.L., Kutcher, H.R., Lewchuk, Z., Miller, S.G., Morrall, R.A.A., Vakulabharanam, V. and Sommerfeld, S. 2009. Survey of canola diseases in Saskatchewan, 2008. Can. Plant Dis. Surv. 89: 113–114. (http://www.cps-scp.ca/cpds.shtml)

Pearse, P.G., Bassendowski, K.A., Cross, D.J., Gugel, R.K., Kirkham, C.L., Kutcher, H.R., Morrall, R.A.A., and Yasinowski, J.M. 2008. Survey of canola diseases in Saskatchewan, 2007. Can. Plant Dis. Surv. 88:103–104. (http://www.cps-scp.ca/cpds.shtml)

Statistics Canada. 2009. Field Crop Reporting Series – September estimate of production of principal field crops. Catalogue no. 22-002-X: p11.

Table 1. Canola diseases in Saskatchewan in 2009.

REGION[1] (NO. OF CROPS)	MEAN % DISEASE INCIDENCE						MEAN % SEVERITY
	Sclerotinia[2]		Blackleg[3]		Aster yellows	Foot rot	Alternaria black spot
	Main	Upper	Basal	Other			
North-west (19)	1	2	0.4	1	0.2	0.8	0.2
North-east (34)	13	13	2	0.1	T	3	1
West-central (60)	0.7	1	0.3	0.6	T	2	0.4
East-central (23)	6	7	2	1	T	2	0.4
South-west (6)	6	6	0	0.7	0	0.3	2
South-east (16)	0.6	2	0.2	3	0	0	T
Overall mean (158)	4	5	0.7	0.8	T	2	0.5

[1] Fields were surveyed in major canola production regions in the following rural municipalities: North-west = 438, 468, 469, 471, 472, 498, 499, 501, 502; North-east = 372, 373, 394, 395, 397–399, 401, 426–428, 430, 456–460, 487, 488, 490, 491, 493; West-central = 223, 228, 253, 254, 257, 259, 283–285, 287, 290, 317–319, 344–347, 349–352, 377–381, 409, 410; East-central = 190, 219, 220, 246, 251, 252, 279, 280, 304, 307, 308, 334–336, 343, 367; South-west =193, 194, 224, 255, 256; South-east = 37, 67, 68, 96, 99, 123, 125, 127–129, 153, 155, 156, 184–186.

[2] Sclerotinia stem rot lesions were scored as either main stem lesions or as upper branch/pod lesions.

[3] Blackleg lesions were scored as either severe basal stem cankers or as any other type of stem lesion.

CROP: Canola
LOCATION: Manitoba

NAME AND AGENCY:
D. L. McLaren[1], A. Kubinec[2], T. L. Henderson[1], D.J. Hausermann[1] and T. J. Kerley[1]
[1]Agriculture and Agri-Food Canada, P.O. Box 1000A, R.R.#3, Brandon, MB R7A 5Y3.
Telephone: (204) 578-3561; **Facsimile:** (204) 728-3858; **E-mail:** Debra.mclaren@agr.gc.ca
[2]Manitoba Agriculture, Food and Rural Initiatives, P.O. Box 1149, Carman, MB R0G 0J0.

TITLE: DISEASES OF CANOLA IN MANITOBA IN 2009

METHODS: In August and September of 2009, 140 canola crops were surveyed in the southwest (48), northwest (23), eastern/interlake (20) and central (49) regions. All crops were *Brassica napus*. They were assessed for the prevalence (percent crops infested) and incidence (percent plants infected per crop) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), aster yellows (phytoplasma), foot rot (*Fusarium* spp. and *Rhizoctonia* sp.), blackleg (*Leptosphaeria maculans*), fusarium wilt (*Fusarium* spp.) and clubroot (*Plasmodiophora brassicae*). For sclerotinia stem rot, each plant was scored for both main stem and upper branch/pod lesions. Blackleg lesions that occurred on the upper portions of the stem were assessed separately from basal stem cankers. The prevalence and percent severity of alternaria pod spot (*Alternaria* spp.) were also determined. In addition to the visual assessment of canola diseases, 60 soil samples were collected throughout Manitoba for DNA analysis to detect the clubroot pathogen. The 60 fields targeted for soil sampling were a minimum of 20 miles from each other.

In each canola crop, 100 plants were selected in a regular pattern starting at a corner of the field or at a convenient access point. The edges of the fields were avoided. Twenty plants were removed from each of five points of a “W” pattern in the field. Points of the “W” were at least 20 paces apart. All plants were pulled up, removed from the field and examined for the presence of diseases.

RESULTS: A number of diseases were present in each of the four regions of Manitoba, but clubroot symptoms were not observed in any of the fields surveyed in 2009. Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province (Table 1). The prevalence of sclerotinia-infested crops ranged from a high of 100% in the eastern/interlake region to 81% in the southwest region, with a provincial mean of 91%. This was similar to the prevalence of 94% in 2008 (4). Mean disease incidence ranged from 37% in the eastern/interlake to 7% in the southwest region with a provincial mean of 18%.

Blackleg basal cankers occurred in 56% of the crops surveyed in 2009 with disease incidence ranging from 8% in the central region to 2% in both the northwest and southwest regions, with a provincial mean of 4%. In 2008, blackleg basal cankers were found in 17% of surveyed crops with a mean disease incidence of 3% (4) for the province. The prevalence of blackleg basal cankers increased substantially in 2009, with values of 76%, 22% and 44% in the central, northwest and southwest regions, respectively, compared with 33%, 13% and 8% in the same regions in 2008. Disease incidences in these regions remained the same, or increased from 1% to 2% over the two-year period. The prevalence of basal cankers in the eastern/interlake region in 2009 was 75% with a disease incidence of 4%. However, no survey of canola crops was conducted in this region in 2008.

The mean prevalence of blackleg stem lesions was 56%, and was similar to that of the previous year (54%). In contrast, 65%, 61%, and 65% of crops were infested with stem lesions in 2005 (1), 2006 (2), and 2007 (3), respectively. The mean incidence in 2009 was 4%, which was slightly less than that observed in 2008 (7%).

The mean prevalence of aster yellows in the crops surveyed in 2009 was 15%. This represents an increase from 2008 when the prevalence was 4%. The amount of aster yellows observed in 2008 and 2009 was substantially less than in 2007 when the mean prevalence was 80% (3). In 2009, aster yellows was observed in all regions with a mean disease incidence of 0.2%.

The mean prevalence of alternaria pod spot in 2009 was 85%, 47%, 23% and 22% for crops surveyed in the eastern/interlake, central, southwest and northwest regions, respectively (Table 1). The severity of alternaria pod spot was low (Table 2) with means <3%.

Of the 140 canola crops examined in Manitoba, fusarium wilt was observed in 4%, with a mean incidence of <1%. No fusarium wilt was observed in the northwest region (Table 1). This disease was found in 21%, 18%, 15% and 9% of fields in 2005, 2006, 2007 and 2008, respectively, illustrating a reduction in disease prevalence from 2005 to the present. This is likely due to the use of resistant canola cultivars.

Foot rot occurred in 2% of canola crops surveyed with a disease incidence of <1% in the central, eastern/interlake and northwest regions. No foot rot was observed in the southwest region.

Table 1. Number of canola crops surveyed and disease prevalence in Manitoba in 2009.

Crop Region	No. of Crops	Sclerotinia stem rot		Blackleg basal cankers		Blackleg stem lesions		Alternaria pod spot		Aster yellows		Fusarium wilt	
		P[1]	DI[2]	P	DI	P	DI	P	Sev.[3]	P	DI	P	DI
Central	49	96	19	76	8	76	5	47	1	14	<1	2	<1
East./Inter.	20	100	37	75	4	60	2	85	1	20	<1	10	<1
Northwest	23	96	20	22	2	43	7	22	<1	13	<1	0	0
Southwest	48	81	7	44	2	40	1	23	<1	15	<1	4	<1

[1] Mean percent prevalence.
[2] Mean percent disease incidence.
[3] Mean percent severity.

Table 2. Distribution of incidence (sclerotinia, blackleg, aster yellows, and fusarium wilt) and severity (alternaria pod spot) classes in 140 crops of *Brassica napus* in Manitoba in 2009.

	Percentage of crops with					
	Sclerotinia stem rot	Blackleg basal cankers	Blackleg stem lesions	Aster Yellows	Fusarium wilt	Alternaria pod spot
0%	9	44	44	85	96	60
1-5%	25	29	41	15	4	40
6-10%	18	13	8	0	0	0
11-20%	16	9	3	0	0	0
21-50%	22	5	2	0	0	0
>50%	10	0	2	0	0	0

REFERENCES:

McLaren, D.L., Graham, A.D., Kaminski, D.A. and Lange, R. 2006. Canola diseases in Manitoba: Distribution, prevalence and incidence in 2005. Can. Plant Dis. Surv. 86: 96-97. (http://www.cps-scp.ca/cpds.htm)

McLaren, D.L., Henderson, T.L., Hausermann, D.J. and Kerley, T.J. 2007. Distribution, prevalence and incidence of canola diseases in Manitoba (2006). Can. Plant Dis. Surv. 87: 114-115. (http://www.cps-scp.ca/cpds.htm)

McLaren, D.L., Henderson, T.L., Hausermann, D.J. and Kerley, T.J. 2008. Distribution, prevalence and incidence of canola diseases in Manitoba (2007). Can. Plant Dis. Surv. 88: 105-106. (http://www.cps-scp.ca/cpds.htm)

McLaren, D.L., Henderson, T.L., Hausermann, D.J. and Kerley, T.J. 2009. Distribution, prevalence and incidence of canola diseases in Manitoba (2008). Can. Plant Dis. Surv. 89: 115-116. (http://www.cps-scp.ca/cpds.htm)

ACKNOWLEDGEMENTS: We thank the Manitoba Canola Producers for their continued support of our survey work and the Manitoba Canola Growers Association for their financial assistance. The assistance of Derwyn Hammond, Brian Jack, Stephanie Jersak, Hilmar Johnson, Lionel Kaskiw, Ingrid Kristjanson and Kristen Phillips is gratefully acknowledged.

CROPS: Faba bean (*Vicia faba* subsp. *minor* L.); Broad bean (*Vicia faba* subsp. *major* L.)
LOCATIONS: Alberta and Manitoba

NAMES AND AGENCIES:
K.F. Chang[1], R.L. Conner[2], D.L. McLaren[3], S.F. Hwang[4], and S. Strelkov[5]
[1]Field Crop Development Centre, Alberta Agriculture & Rural Development (AARD), 5030-50 Street, Lacombe, AB T4L 1W8
Telephone (403) 782-8596; **Facsimile:** (403) 782-6120; **E-mail:** kan.fa.chang@gov.ab.ca
[2]Agriculture and Agri-Food Canada, Morden Research Centre, MB R6M 1R1
[3]Agriculture and Agri-Food Canada, Brandon Research Centre, MB R7A 5Y3
[4]Crop Diversification Centre North, AARD, 17507 Fort Road, Edmonton, AB T5Y 6H3
[5]Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB

TITLE: OCCURRENCE OF FABA BEAN ROOT ROT IN ALBERTA AND MANITOBA IN 2009

INTRODUCTION: There were fewer growers of faba bean in Alberta and Manitoba in 2009 than in previous years. The crop typically produces a higher yield than field pea and other pulses and is grown for livestock feed, so it still has great potential for future growth. Broad bean is mainly sold in local markets as a fresh vegetable for human consumption.

METHODS: In Alberta, 13 commercial and two experimental crops of faba bean were surveyed for root rot in late August and early September in areas near Barrhead, Gibbons, Mannville, Enchant and Coaldale. In addition, three crops of broad bean near Edmonton were also surveyed for root rot. In Manitoba, root rot severity was assessed in a total of 16 faba bean crops. The faba bean crops in Manitoba were located near Warner, Morris, Morden, Brandon, Dauphin and Souris. Growth stages of the crops in Manitoba ranged from early flowering (growth stage 203) (Knott 1990) to late pod fill (growth stage 208) while all the crops surveyed in Alberta were at the pod fill stage (growth stage 207). In the commercial crops surveyed, 100 plants were randomly collected at five equally spaced sites along the arms of a "W" sampling pattern in each field. In the experimental crops at Gibbons and Mannville, however, only 50 plants were randomly selected for analysis. Microorganisms were isolated from the roots using the method described by Chang et al. (2004, 2005). Root rot severity was determined using a scale of 0 (no disease) to 9 (death of plant) described by McLaren et al. (2009). Nodulation in the root samples was rated using a 0-4 scale in which 0 = no nodules, 1 ≤5 nodules/plant, 2 ≤10 nodules/plant, 3 ≤20 nodules/plant and 4>20 nodules/plant.

RESULTS AND COMMENTS: In Alberta, growing conditions were generally dry throughout the summer. In most faba bean crops, root rot was unevenly distributed and severity ratings were low (Table 1). However, root rot was severe in one broad bean field near Edmonton. The affected plants in the broad bean crop were stunted with small, yellowing leaves and brown roots that had little or no nodulation. The majority of these diseased plants produced fewer pods and smaller seeds than the healthy plants from the same crop.

In the Alberta crops, the survey results showed that *Fusarium* spp. were the most prevalent root pathogens with isolation frequencies from the 18 faba bean crops that ranged from 29 to 90% and averaged 72% (Table 2). Although *Pythium* species were detected in 17 faba bean crops, they were isolated at low frequencies that averaged 22%, but ranged as high as 67%. A substantial number of *Rhizoctonia solani* isolates were collected from 12 crops, but only 18% of the roots from the affected crops were infected by this fungus.

In Manitoba, frequent showers occurred throughout the summer and daily temperatures were generally lower than normal. Three root diseases were observed (Table 1). Fusarium root rot (*Fusarium* spp.) was detected in all 16 crops surveyed, making it the most prevalent root disease of faba bean in Manitoba. Crops in which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 2.2 to 5.3 with an average of 3.5. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in eight of the 16 crops surveyed with severity ratings of 2.2 to 5.3 and an average of 3.8. *Pythium* species were detected in three of the 16 crops that had disease severity values that ranged from 4.2 to 5.3 and averaged 4.7.

However, in the three faba bean crops in which *Pythium* spp. were isolated the pathogen was detected at low frequencies that ranged from 6 to 10% of the roots sampled (Table 2). Similarly in the eight fields in which *R. solani* was found, the pathogen was isolated from only 2 to 8% of the roots and averaged 5%. In contrast *Fusarium* species were detected on average in 72% of the roots with a range of 26 to 94% in individual crops.

Six crops in Manitoba had average root rot severity values above 4 (i.e., symptoms were present on 50% of the root system) and this would have had an adverse impact on yield.

Root nodulation ratings ranged from 1.0 to 4.0 with an average of 3.0 over all crops surveyed in Manitoba, and ranged from 0.0 to 4.0 with an average of 3.2 in the crops in Alberta. No obvious relationship was detected between root rot severity and root nodule formation in either province.

Fusarium spp. were the most prevalent pathogens associated with root rot in faba bean and occurred at similar frequencies in Alberta and Manitoba. *Pythium* spp. were more commonly isolated than *R. solani* and these pathogens were more frequently isolated in Alberta than in Manitoba. Pathogenicity tests are underway to clearly identify the species of pathogens that are most damaging to faba bean roots.

ACKNOWLEDGEMENTS: This survey was partially supported by the Alberta Pulse Growers Commission. We gratefully acknowledge the technical assistance provided by Robyne Bowness and Trina Dubitz from AARD, Waldo C. Penner and Dennis B. Stoesz of AAFC-Morden, and Tom L. Henderson, Daniel J. Hausermann and Teri J. Kerley of AAFC-Brandon. We thank Tammy Jones of the Alberta Pulse Growers Commission and Brent Reid of the Dugald office of Manitoba Agriculture, Food and Rural Initiatives for providing information on faba bean crop locations. We also thank Darcie Hills of AAFC-Morden for her assistance in preparing this report.

REFERENCES:

Chang, K.F., Bowness, R., Hwang, S.F., Turnbull, G., Howard, R.J., and Blade, S.F. 2004. The occurrence of field pea diseases in central and southern Alberta in 2003. Can. Plant Dis. Surv. 84: 104-106. (http://www.cps-scp.ca/cpds.htm)

Chang, K.F., Bowness, R., Hwang, S.F., Turnbull, G.D., Howard, R.J., Lopetinsky, K., Olson, M., and Bing, D.J. 2005. Pea diseases in central Alberta in 2004. Can. Plant Dis. Surv. 85: 89-90. (http://www.cps-scp.ca/cpds.htm)

Knott, C.M. 1990. A key for stages of development of faba bean (*Vicia faba*). Ann. Appl. Biol. 116: 391-404.

McLaren, D.L., Conner, R.L., Hausermann, D.J., Henderson, T.L., Penner, W.C. and Kerley, T.J. 2009. Diseases of field pea in Manitoba in 2008. Can. Plant Dis. Surv. 89: 132-133. (http://www.cps-scp.ca/cpds.htm)

Table 1. Prevalence and severity of root diseases in 34 crops of faba bean in Alberta and Manitoba in 2009.

Disease	No. crops affected	Disease Severity		Nodulation	
		Mean[1]	Range	Mean[2]	Range
Alberta					
Fusarium root rot	18	1.5	0.0-8.0	3.2	0.0-4.0
Rhizoctonia root rot	12	1.6	0.0-8.0	2.8	0.0-4.0
Pythium root rot	17	1.4	0.0-8.0	3.2	0.0-4.0
Manitoba					
Fusarium root rot	16	3.5	2.2-5.3	3.0	1.0-4.0
Rhizoctonia root rot	8	3.8	2.2-5.3	3.1	1.0-4.0
Pythium root rot	3	4.7	4.2-5.3	3.0	1.0-4.0

[1]Means are based on an average of crops in which the diseases were observed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, seedlings died soon after emergence).
[2]Nodulation was rated on a scale of 0 (no nodules) to 4 (at least 20 nodules/plant).

Table 2. Prevalence of different root pathogens in 34 crops of faba bean in Alberta and Manitoba in 2009.

Disease	No. crops affected	Isolation Frequency (%)	
		Mean[1]	Range
Alberta			
Fusarium spp.	18	72	29-90
Rhizoctonia solani	12	18	0-42
Pythium spp.	17	22	0-67
Manitoba			
Fusarium spp.	16	72	26-94
Rhizoctonia solani	8	5	2-8
Pythium spp.	3	8	6-10

[1]Means are based on an average of the crops in which the pathogens were observed.

CROP: Flax
LOCATION: Manitoba

NAME AND AGENCY:
K. Y. Rashid[1], M.L. Desjardins[2], and S. Duguid[1]
[1] Agriculture and Agri-Food Canada, Research Station
Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5.
Telephone: (204) 822-7220; **Facsimile**: (204) 822-7207; **E-mail**: Khalid.rashid@agr.gc.ca
[2] Manitoba Agriculture, Food and Rural Initiatives, Crop Diagnostic Centre.
201-545 University Crescent, Winnipeg, Manitoba R3T 5S6.

TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2009

METHODS: A total of 47 flax crops were surveyed in 2009, 22 in southern Manitoba, and 25 in southern and eastern Saskatchewan. Forty-four crops were surveyed during the last weeks in August, and three crops in September. Ninety percent of the crops were the brown seed-colour linseed flax, and only 10 % were yellow seed-colour flax. Crops surveyed were selected at random along pre-planned routes in the major areas of flax production. 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 fusarium wilt (*Fusarium oxysporum lini*), pasmo (*Septoria linicola*), powdery mildew (*Oidium lini*), rust (*Melampsora lini*), alternaria blight (*Alternaria* spp.), and aster yellows were recorded. Stand establishment, vigour, and maturity were rated on a scale of 1 to 5 (I = very good/early, and 5 = very poor/very late).

In addition, 28 samples of flax plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Initiatives by agricultural representatives and growers.

RESULTS AND COMMENTS: Seventy-two percent of the flax crops surveyed in 2009 were rated excellent for stand and the remainder were good to fair. Sixty percent of the crops surveyed were maturing early, and 55% had excellent to good vigour. Only 25% of the crops were late-seeded and were expected to mature late because of abundant moisture and good growing conditions during the season. Frequent rains and normal temperatures resulted in good yields in most flax crops in Manitoba and Saskatchewan. The 2009 disease survey showed only minor differences between Manitoba and Saskatchewan in the incidence and severity of the major flax diseases in the crops surveyed, except with powdery mildew. Mildew was more prevalent in Saskatchewan than in Manitoba due perhaps to its late onset and the late maturity of crops in Saskatchewan.

Pasmo, the most prevalent disease in 2009, was observed in all crops surveyed (Table 1). The prevalence and severity on stems were higher than in previous years (1, 2, 3, 4), due perhaps to frequent rains favouring disease development in July and August. Pasmo severity ranged from trace to 20% of the stem area affected in most infested crops and was >30% in only a few crops (Table 1).

Some root infections and fusarium wilt were observed in 45% of flax crops in 2009. Incidence was very low (trace to 5%) in most crops (Table 1). Prevalence of these diseases in 2009 was lower than in previous years due perhaps to below-normal temperatures which do not favour root infection (1, 2, 3).

Powdery mildew was observed in 50% of flax crops in Manitoba but in 80% of crops surveyed in Saskatchewan (Table 1); severity ranged from trace to 10% leaf area affected in most crops to 20-40% leaf area affected in 16% of crops in Saskatchewan. Incidence and severity were similar to previous years in Manitoba but higher in Saskatchewan (1, 2, 3).

Rust was not observed in any of the crops surveyed in 2009, nor in the flax rust trap nurseries planted at Morden and Portage la Prairie in Manitoba, and at Saskatoon and Indian Head in Saskatchewan.

Aster yellows (phytoplasma) was observed in 14% of flax crops with incidence ranging from trace to 1% affected plants. Alternaria blight was observed in 36% of the crops with a severity range from trace to

10% leaf area affected. No signs of sclerotinia stem infections were evident in any of the crops surveyed in 2009. Grasshopper infestations were also low but were observed in 34% of all flax crops.

Of the 28 flax samples submitted to the Crop Diagnostic Centre, four were identified with alternaria blight, three with fusarium wilt, one with pasmo, two with nutrient deficiencies, five with environmental injury, and 13 with chemical injury.

ACKNOWLEDGEMENTS: The assistance of T. Cabernel and M. Penner is gratefully acknowledged.

REFERENCES:

1. Rashid, K. Y., M.L. Desjardins, and S. Duguid 2009. Diseases of flax in Manitoba and Saskatchewan in 2008. Can. Plant Dis. Surv. 89:117-118. (http://www.cps-scp.ca/cpds.htm)
2. Rashid, K. Y., M.L. Desjardins, and S. Duguid 2008. Diseases of flax in Manitoba and Saskatchewan in 2007. Can. Plant Dis. Surv. 88:111-112. (http://www.cps-scp.ca/cpds.htm)
3. Rashid, K. Y., M.L. Desjardins, S. Duguid, and D. A. Kaminski 2007. Diseases of flax in Manitoba and Saskatchewan in 2006. Can. Plant Dis. Surv. 87:118-119. (http://www.cps-scp.ca/cpds.htm)
4. Rashid, K. Y., M.L. Desjardins, S. Duguid, and D. A. Kaminski 2006. Diseases of flax in Manitoba and Saskatchewan in 2005. Can. Plant Dis. Surv. 86:102-103. (http://www.cps-scp.ca/cpds.htm)

Table 1. Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 47 crops of flax in Manitoba and Saskatchewan in 2009.

Fusarium Wilt				**Pasmo**				**Powdery Mildew**			
Disease Class		**Crops**		**Disease Class**		**Crops**		**Disease Class**		**Crops**	
Incid.[1]	**Sever.[2]**	**No**	**%**	**Incid.[1]**	**Sever.[2]**	**No**	**%**	**Incid.[1]**	**Sever.[2]**	**No**	**%**
0%	0%	26	55	0%	0%	0	0	0%	0%	16	34
1-5%	1-5%	14	30	1-10%	1-5%	23	49	1-10%	1-5%	18	39
5-20%	5-10%	7	15	10-30%	5-10%	14	28	10-30%	5-10%	9	19
2-40%	10-20%	0	0	30-60%	10-20%	9	19	30-60%	10-20%	3	6
>40%	10-40%	0	0	>60%	20-50%	2	4	>60%	20-50%	1	2

[1] Disease incidence = Percentage of infected plants in each crop.
[2] Disease severity = Percentage of roots affected by fusarium wilt, of stems affected by pasmo, and of leaves affected by powdery mildew.

CROP: Lentil
LOCATION: Saskatchewan

NAMES AND AGENCIES:
R.A.A. Morrall[1], B. Carriere[2], B. Ernst[3], and D. Schmeling[4]
[1]Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon SK, S7N 5E2
Telephone: 306-966-4410, **Facsimile:** 306-966-4461, **E-mail:** robin.morrall@usask.ca
[2]Discovery Seed Labs Ltd., 450 Melville Street, Saskatoon SK, S7J 4M2
[3]Prairie Diagnostic Seed Lab, 1105 Railway Avenue, Weyburn SK, S4H 3H5
[4]Lendon Seed Lab., 147 Hodsman Road, Regina SK, S4N 5W5

TITLE: SEED-BORNE PATHOGENS OF LENTIL IN SASKATCHEWAN IN 2009

METHODS: Results were summarized of agar plate tests conducted by three companies between September and mid-December 2009 on seed samples from Saskatchewan. The tests were conducted to detect pathogens causing ascochyta blight (*Didymella* [*Ascochyta*] *lentis*), anthracnose (*Colletotrichum truncatum*), botrytis stem and pod rot (grey mould) and seedling blight (*Botrytis* spp.), and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). All samples were tested for *Ascochyta* and slightly fewer for *Colletotrichum*, *Botrytis* and *Sclerotinia*. For *Ascochyta* mean % seed infection and % samples free of infection were calculated for each crop district [CD] in Saskatchewan (6). Analogous statistics were also calculated for the combined infection of seed with either *Botrytis* or *Sclerotinia*. For *Colletotrichum* only the % infected samples for the whole province was calculated; anthracnose is not highly seed-borne on lentil and is, thus, always at low levels on seed (1, 3).

The seed samples could not all be classified according to cultivar or whether the crops had been treated with seed treatments or foliar fungicides. However, using ascochyta-resistant cultivars and spraying with foliar fungicides to control ascochyta blight and anthracnose are widespread practices in lentil cultivation in Saskatchewan.

RESULTS AND COMMENTS: The data summarized were from seed samples assumed to be mainly from the 2009 crop. In Saskatchewan 2009 was characterized by abnormally cool conditions from April to August, which delayed emergence and development of all crops (6). Areas in the south and west were dry or very dry in the spring but after late June most regions received adequate moisture. Although not as much as for other crops, the lentil harvest started two weeks late in the major production areas. In September it was hot and dry, crops matured well, and most lentil harvesting was completed. October was cold and wet and all harvesting ceased until November when drier weather returned.

With the exception of some areas drought-stricken in the spring, both yield and quality of lentil in Saskatchewan were high (7). Acreage increased by 35% over 2008 to 1 million ha (2.4 million acres). The overall mean yield per acre increased by 5% over 2008 to 1,560 kg/ha (1,400 lbs/acre), 24% above the 10-year average. Ninety-three percent of the lentil crop is expected to be in the top two grades (7).

During the 3.5-month period of testing covered by this report 609 samples were processed by the three companies, about 40% more than reported in 2008 and 2007 (2, 3). However, the number is still substantially lower than figures reported in wet years such as 2004 (5). Low numbers reflect obvious high quality of harvested seed, but also factors such as market potential of the crop, availability of disease resistant cultivars, and agronomic practices.

Levels of seed-borne *Ascochyta* in individual lentil samples ranged from 0% to 38.25% (in a sample from CD 3BN) with a provincial mean of 0.3%, similar to the three previous years (2) and substantially lower than in 2004 and 2005 (4,5). Means for crop districts varied from 0 to 1.5 in CD 3BN (Table 1). However, means can give a poor picture of the overall health of harvested seed. A more useful reflection of seed health is provided by the percentage of ascochyta-free samples. This was high in all CDs from which there were more than a few seed samples (Table 1) and the provincial mean was 91%. Even in CD 3BN, which had the highest mean infection level, the percentage of ascochyta-free samples was 67%.

Colletotrichum was found in only 7% of lentil samples, similar to percentages found in several recent years, and less than in a year such as 2004 (5). *Botrytis* levels in seed varied from 0% to 14.0% (in a sample from CD 8B) and *Sclerotinia* levels from 0% to 3.25% (in samples from CD 2A and 6B). Generally levels of either of these two seed-borne pathogens were low; high values in three CDs (Table 1) were based on small numbers of samples. However, the fact that only about half of all samples were free of either *Botrytis* or *Sclerotinia* [a proportion that was much larger in 2007 and 2008 (2, 3)] reflects the effects of cool conditions and plentiful late-season moisture on the 2009 lentil crop. These conditions favor rank growth of lentil plants and lodging, especially in low areas of fields. In turn this provides conditions that favour direct mycelial infection of the plants from sclerotia of *Botrytis* and *Sclerotinia* on the soil surface, as well as infection of senescent flower parts by air-borne spores.

In addition to the seed-borne pathogens which laboratories normally test for in lentil, tests in 2009 commonly revealed low to moderate levels of *Stemphylium* sp., the cause of stemphylium blight and occasional infection by *Fusarium avenaceum*, a cause of seedling blight (1).

REFERENCES:

1. Bailey, K.L., Gossen, B.D., Gugel, R.K. and Morrall, R.A.A. (*Editors*) 2003. Diseases of Field Crops in Canada. 3rd ed. Canadian Phytopathological Society, Saskatoon, SK. 290 pp.

2. Morrall, R.A.A., Carriere, B., Ernst, B., Nysetvold T. and Schmeling, D. 2009. Seed-borne pathogens of lentil and chickpea in Saskatchewan in 2008. Can. Plant Dis. Survey 89: 121-123. (http://www.cps-scp.ca/cpds.htm)

3. Morrall, R.A.A., Baraniski, S., Carriere, B., Ernst, B., Nysetvold, T., Schmeling, D. and Thomson, L. 2008. Seed-borne pathogens of lentil in Saskatchewan in 2007. Can. Plant Dis. Survey 88: 113-114. (http://www.cps-scp.ca/cpds.htm)

4. Morrall R.A.A., Carriere B., Ernst B., Pearse C., Schmeling D. and Thomson L. 2006. Seed-borne pathogens of lentil in Saskatchewan in 2005. Can. Plant Dis. Survey 86: 104-106. (http://www.cps-scp.ca/cpds.htm)

5. Morrall, R.A.A., Carriere, B., Ernst, B., Pearse, C., Schmeling, D. and Thomson, L. 2005. Seed-borne pathogens of lentil in Saskatchewan in 2004. Can. Plant Dis. Survey 85: 84-86. (http://www.cps-scp.ca/cpds.htm)

6. Saskatchewan Ministry of Agriculture. 2009. Final Crop Report December, 2009. Regina, SK. 12 pp. (http://www.agriculture.gov.sk.ca/Statistics-Crops)

7. Saskatchewan Ministry of Agriculture. 2010. 2009 Specialty Crop Report. Regina, SK. 20 pp. (http://www.agriculture.gov.sk.ca/Statistics-Crops)

Table 1. Numbers of lentil samples tested from September to December, 2009 by three commercial companies, and levels of infection with Ascochyta, Botrytis and Sclerotinia in relation to Saskatchewan Crop Districts.

Crop District	*Ascochyta lentis*			*Botrytis cinerea + Sclerotinia sclerotiorum*		
	Number of samples tested	Mean % infection	% samples with 0% infection	Number of samples tested	Mean % infection	% samples with 0% infection
1A	10	0	100	10	0.2	60
1B	0	-	-	0	-	-
2A	41	0.1	95	41	0.9	27
2B	143	0.1	85	134	0.6	48
3AN	21	0	100	11	0.5	48
3AS	45	0.8	93	40	0.3	60
3BN	84	1.5	77	79	0.2	67
3BS	14	0	100	13	0.1	69
4A	1	0	100	1	0	100
4B	3	0	100	3	0.2	67
5A	9	0.2	75	9	3.2	11
5B	4	1.0	50	4	1.2	0
6A	41	0	100	38	1.3	24
6B	89	0.1	97	85	0.8	34
7A	82	0.1	85	78	0.1	86
7B	25	0	100	24	0.5	54
8A	0	-	-	0	-	-
8B	3	0	100	3	5.1	33
9A	1	0	100	1	2.3	0
9B	3	0	100	1	0	100
TOTAL	609	0.3	91	565	0.6	52

CROP: Field Pea
LOCATION: Saskatchewan

NAMES AND AGENCIES:
F.L. Dokken-Bouchard[1], S. Banniza[2], S. Chant[3], D. Cruise[4], G. Gross[5], J. Ippolito[6], C.L. Kirkham[7], H.R. Kutcher[7], Z. Lewchuk[8], S.G. Miller[1], E. Moats[9], R.A.A. Morrall[10], D. Risula[1].
[1] Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina, Saskatchewan S4S 0B1
Telephone: (306) 787-4671; **Facsimile:** (306) 787-0428; **E-mail:** faye.dokkenbouchard@gov.sk.ca
[2] Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon, SK S7N 5A8
[3] Saskatchewan Ministry of Agriculture, 350 Cheadle Street W, Swift Current, SK S9H 4G3
[4] Saskatchewan Ministry of Agriculture, 45 Thatcher Drive E, Moose Jaw, SK S6J 1L8
[5] Saskatchewan Ministry of Agriculture, 410 Saskatchewan Avenue W, Outlook, SK S0L 2N0
[6] Saskatchewan Ministry of Agriculture, 409 Main Street, Kindersley, SK S0L 1SO
[7] Agriculture and Agri-Food Canada, Box 1240, Melfort, SK S7N 0X2
[8] Saskatchewan Ministry of Agriculture, 38 5th Avenue N, Yorkton, SK S3N 0Y8
[9] Saskatchewan Ministry of Agriculture, 110 Souris Avenue, Weyburn, SK S4H 2Z9
[10] Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, SK S7N 5E2

TITLE: SURVEY OF FIELD PEA DISEASES IN SASKATCHEWAN, 2009

METHODS: A total of 141 Saskatchewan field pea crops were randomly chosen for survey between July 27 and August 22. Regions surveyed included north-west (4 fields), north-east (23), west-central (38), east-central (19), south-west (27), and south-east (25) Saskatchewan. Crops were surveyed before harvest while pea plants were between BBCH growth stages 69 and 89 (Lancashire et al. 1991). Disease assessments were made qualitatively in each crop by observing several representative plants to ascertain general health and presence or absence of symptoms. Prevalence of the following diseases was recorded: root rot (*Aphanomyces euteiches* f. sp. *pisi* / *Fusarium* spp. / *Pythium* spp. / *Rhizoctonia solani*), ascochyta leaf and pod spot (*Ascochyta pisi*), powdery mildew (*Erysiphe pisi*), sclerotinia stem rot (*Sclerotinia sclerotiorum*), septoria leaf blotch (*Septoria pisi*), and bacterial blight (*Pseudomonas syringae* pv. *pisi*). Percentages of the crops surveyed showing symptoms of each of these diseases were calculated for each region (Table 1). Prevalence and estimated severity of the following diseases were also determined: mycosphaerella blight / ascochyta foot rot (*Mycosphaerella pinodes* / *Phoma medicaginis* var. *pinodella*) and downy mildew (*Peronospora viciae*). Percentages of crops surveyed showing zero, trace, light, moderate, or severe levels of these diseases were calculated for each region (Table 2).

RESULTS AND COMMENTS: Approximately 3 million acres (1.2 million ha) of field pea were seeded in Saskatchewan in 2009 (Statistics Canada, 2009). Cool weather and precipitation delayed seeding and crop emergence in most areas. West-central and north-western parts of the province experienced dry conditions in the spring and some areas did not receive adequate precipitation throughout the cropping season, particularly in west-central Saskatchewan. Repeated frost until the last week of May in several parts of the province further delayed emergence and growth. Crop reporters estimated that 65% of pea crops were in good to excellent condition by June 1. By July 7, most of the pea crop was either vegetative (57%) or flowering (40%), with only 2% either still emerging or just starting to flower. By July 20, 75% of field pea crops were estimated to be in good to excellent condition by crop reporters. Harvest had started in some areas when the pea survey began on July 27, and by the last survey date on August 22, an estimated 18% of pea crops had been combined. Unseasonably warm weather during September resulted in greater than anticipated yields. By October 5, 99% of the pea crops in Saskatchewan had been harvested (Saskatchewan Ministry of Agriculture, 2009).

Root rot was reported in 36% of the pea crops surveyed. No other surveys of pea root rot have been conducted recently in Saskatchewan; however, some growers have reported concerns about root rot, particularly in crops under stress. Root rot was identified in all pea crops surveyed in Manitoba in 2008, but the survey was conducted earlier in the season (McLaren et al. 2009). Because our survey was conducted later in the season, it is possible that some of the crops sustained earlier root rot infections that

were no longer visible by late July. Root rot was also reported to be severe in some crops despite dry field conditions in a recent survey of pea diseases in central Alberta (Chang et al. 2007).

Ascochyta leaf and pod spot was most prevalent in the south-west with symptoms observed in 44% of pea crops surveyed in that region, but it was not observed in the north-east or west-central regions. This coincides with pea seed testing data. For the last eight years, *A. pisi* has been more commonly isolated from seed from southern Saskatchewan and only from scattered foci in central and eastern areas (Morrall et al. 2009). A previous survey for *A. pisi* showed that ascochyta leaf and pod spot was present in Saskatchewan and the pathogen could be isolated from disease lesions (Dokken et al. 2007). It is possible that regional differences in disease prevalence are due to environmental conditions or pea cultivars chosen.

Powdery mildew was reported on 9% of the crops surveyed in the province, and was not found in the north-west or east-central regions. The low prevalence is likely due to adoption of resistant cultivars by growers, and is consistent with previous pea surveys in Manitoba in 2008 (McLaren et al. 2009). Sclerotinia stem rot was reported in 21% of the pea crops surveyed in the province, but was not found in the south-west region. Septoria blotch and bacterial blight were reported in 23% and 4%, respectively, of pea crops surveyed. Both of these diseases were observed at trace or low levels in the most recent field pea disease survey in Saskatchewan (Chongo et al. 2003).

Mycosphaerella blight was the most prevalent disease observed, which is consistent with findings in previous foliar disease and seed testing surveys in Saskatchewan (Chongo et al. 2003; Morrall et al. 2009) as well as previous surveys from other provinces (Chang et al. 2007; McLaren et al. 2009). Symptoms were found in the upper canopy of 82% of the crops surveyed with severity ranging from trace to moderate and in the lower canopy of 95% of crops surveyed with severity ranging from trace to severe.

Downy mildew was found in the upper canopy of 26% and the lower canopy of 30% of crops surveyed. Severity ranged from trace to moderate in the upper canopy and trace to severe in the lower canopy. Surveyors observed systemically infected plants (stunted, malformed, covered with mildew) in five of the diseased crops. Lower than normal temperatures and frequent rain showers likely contributed to the greater disease severity observed in 2009 than in previous years in western Canada. Downy mildew is endemic in central Alberta and was more severe in 2008 than 2006 or 2004 (Chang et al. 2009). It was also reported in the most recent field pea disease survey in Saskatchewan (Chongo et al. 2003).

REFERENCES:

Chang, K.F., Bowness, R., Hwang, S.F., Turnbull, G.D., Bing, D.J., DeMilliano, E., and Howard, R.J. 2007. Occurrence of pea diseases in central Alberta in 2006. Can. Plant Dis. Surv. 87:122–123. (http://www.cps-scp.ca/cpds.shtml)

Chang, K.F., Hwang, S.F., Turnbull, G.D., Liu, F., Strelkov, S.E., and Bing, D.J. 2009. Occurrence of downy mildew on field pea in central Alberta in 2008. Can. Plant Dis. Surv. 89:127–128. (http://www.cps-scp.ca/cpds.shtml)

Chongo, G., Banniza, S., Warkentin, T., and Morrall, R.A.A. 2003. Disease survey in field pea in Saskatchewan in 2002. Can. Plant Dis. Surv. 83:124–125. (http://www.cps-scp.ca/cpds.shtml)

Dokken, F.L., Banniza, S., Warkentin, T., and Morrall, R.A.A. 2007. Occurrence of *Ascochyta pisi* on field pea in Saskatchewan. Can. J. Plant Pathol. 29: 218. (Abstr.) (http://www.cps-scp.ca/journallinks.shtml)

Lancashire, P.D., Bleiholder, H., Van Den Boom, T., Langelüddeke, P., Stauss, R., Elfriede Weber, and Witzenberger, A. 1991. A uniform decimal code for growth stages of crops and weeds. Annal. Appl. Biol. 119:561–601.

McLaren, D.L., Conner, R.L., Hausermann, D.J., Henderson, T.L., Penner, W.C., and Kerley, T.J. 2009. Field pea diseases in Manitoba in 2008. Can. Plant Dis. Surv. 89: 132–133. (http://www.cps-scp.ca/cpds.shtml)

Morrall, R.A.A., Carriere, B., Ernst, B., Nysetvold, T., and Schmeling, D. 2009. Seed-borne pathogens of pea in Saskatchewan in 2008. Can. Plant Dis. Surv. 89: 129–131. (http://www.cps-scp.ca/cpds.shtml)

Saskatchewan Ministry of Agriculture. 2009. Crop report. (www.agriculture.gov.sk.ca)

Statistics Canada. 2009. Field Crop Reporting Series – September estimate of production of principal field crops. Catalogue no. 22-002-X: p11.

Table 1. Prevalence of field pea diseases in Saskatchewan in 2009.

REGION (NO. OF CROPS)	PERCENTAGE (%) OF CROPS SURVEYED WITH DISEASE SYMPTOMS						Other Diseases Observed
	Root Rot	Ascochyta leaf and pod spot	Powdery Mildew	White Mould	Septoria blotch	Bacterial Blight	
North-west (4)	0	25	0	25	75	0	
North-east (23)	65	0	13	74	22	4	
West-central (38)	18	0	8	11	21	3	Virus, rust, *Fusarium*
East-central (24)	46	13	0	17	0	0	*Botrytis* blight
South-west (27)	26	44	15	0	48	11	
South-east (25)	36	8	12	8	8	8	
Overall mean (141)	36	13	9	21	23	4	See above

Table 2. Severity of field pea diseases in Saskatchewan in 2009.

REGION (NO. OF CROPS)	Canopy	PERCENTAGE (%) OF CROPS SURVEYED WITH ZERO, TRACE, LIGHT, MODERATE, OR SEVERE LEVELS OF DISEASE									
		Mycosphaerella Blight					Downy Mildew				
		0	T	L	M	S	0	T	L	M	S
North-west (4)	Upper	0	25	75	0	0	100	0	0	0	0
	Lower	25	50	25	0	0	100	0	0	0	0
North-east (23)	Upper	26	48	22	4	0	61	26	9	4	0
	Lower	4	4	43	30	17	52	9	26	9	4
West-central (38)	Upper	11	61	26	3	0	68	26	5	0	0
	Lower	0	8	55	29	8	74	24	3	0	0
East-central (24)	Upper	13	58	29	0	0	63	21	17	0	0
	Lower	0	13	58	17	13	58	29	13	0	0
South-west (27)	Upper	19	48	30	4	0	85	11	0	4	0
	Lower	4	44	37	15	0	89	4	4	4	0
South-east (25)	Upper	24	64	12	0	0	84	16	0	0	0
	Lower	16	64	4	16	0	64	36	0	0	0
Overall mean (141)	Upper	18	54	26	2	0	74	21	4	1	0
	Lower	5	27	39	21	7	70	19	8	2	1

CROP: Pea
LOCATION: Saskatchewan

NAMES AND AGENCIES:
R.A.A. Morrall[1], B. Carriere[2], B. Ernst[3] and D. Schmeling[4]
[1]Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon SK, S7N 5E2
Telephone: 306-966-4410, **Facsimile:** 306-966-4461, **E-mail:** robin.morrall@usask.ca
[2]Discovery Seed Labs Ltd., 450 Melville Street, Saskatoon SK, S7J 4M2
[3]Prairie Diagnostic Seed Lab, 1105 Railway Avenue, Weyburn SK, S4H 3H5
[4]Lendon Seed Lab., 147 Hodsman Road, Regina SK, S4N 5W5

TITLE: SEED-BORNE PATHOGENS OF PEA IN SASKATCHEWAN IN 2009.

METHODS: The results of agar plate tests on pea seed samples from Saskatchewan provided by three companies were summarized. The tests were conducted between early September and mid- or late December, 2009. It was assumed that the majority of samples were from the 2009 crop. The tests were conducted to detect the pathogens causing ascochyta blights (*Mycosphaerella* [*Ascochyta*] *pinodes*, *Didymella* [*Ascochyta*] *pisi* and *Phoma medicaginis* var. *pinodella* = *A. pinodella*), botrytis blight (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). Not all samples were tested for *Botrytis* and *Sclerotinia* but all were tested for the ascochyta blight pathogens. For *Ascochyta* spp. mean % seed infection and % samples free of infection were calculated for each Saskatchewan crop district [CD] (6). However, this was not done for *Botrytis* and *Sclerotinia* because the low mean infection levels in all CDs would make comparisons meaningless.

It is unknown which of the seed samples came from pea crops that had been treated with registered fungicides used as seed treatments or foliar protectants against one seed-borne or foliar diseases. Although the use of foliar fungicides on pea was once uncommon in Saskatchewan because of economic factors, improvements in commodity prices and new fungicide registrations have led to increasing use, especially in northern crop districts where pea has a longer history of cultivation.

RESULTS AND COMMENTS: In Saskatchewan 2009 was characterized by abnormally cool conditions from April to August, which delayed emergence and development of all crops (6). Areas in the south and west were dry or very dry in the spring but after late June most regions received adequate moisture. Except in the southwest, the pea harvest started two weeks late in the major production areas. In September it was hot and dry, crops matured well, and most pea harvesting was completed. October was cold and wet and all harvesting ceased until November when drier weather returned. With the exception of some areas drought-stricken in the spring, both yield and quality of pea in Saskatchewan were good (7). The acreage of green pea increased slightly over 2008 but that of yellow pea declined by 10%. However mean yield per acre increased by about 4% over 2008 in both classes.

The number of samples tested by the three companies was 245, fewer than the number reported by four companies for 2008 (3) and only about 50% of the number reported for 2007 (2). Increases and decreases of this type may reflect visible seed quality, commodity prices, and planting intentions for the subsequent year. As in previous years (2, 3, 5) samples in 2009 were received from most areas of the province, but the majority originated in the more traditional pea growing regions of CDs 5-9.

Levels of seed-borne ascochyta in individual samples varied from 0% to 24.0% (in a sample from CD 3AS) and mean levels for crop districts varied from near 0 to 9.9% (Table 1). Some CD mean values were based on too few samples to be meaningful. The overall provincial mean level of infection (3.4%) was similar to 2008 (3), higher than in 2007 and 2006 (2, 5) but much lower than in 2005 (4). The percentage of samples in which no *Ascochyta* was detected was 17%, in contrast to 24% in 2008 and 39% in 2007 (2, 3), but similar to figures for the previous three years (5).

For the ninth consecutive year (2, 3) *A. pinodes* was the dominant species in central and northern CDs, while *A. pisi* was more commonly isolated from southern and west-central Saskatchewan. However, for the first time *A. pisi* was isolated more frequently than *A. pinodes* on a province-wide basis. *Ascochyta pisi* was particularly abundant in seed samples from all parts of CD 3 (Table 2). The reasons for the geographic separation of species are unclear, but it is consistent with field observations in 2009 (1).

REFERENCES:

1. Dokken-Bouchard, F.L., Banniza, S., Chant, S., Cruise, D., Gross G., Ippolito, J., Kirkham, C.L., Kutcher, H.L., Lewchuk, Z., Miller, S.G., Moats, E., Morrall, R.A.A. and Risula, D. Survey of field pea diseases in Saskatchewan, 2009. Can. Plant Dis. Survey 90: 139-141. (http://www.cps-scp.ca/cpds.htm)

2. Morrall, R.A.A., Baraniski, S., Carriere, B., Ernst, B., Nysetvold, T., Schmeling, D. and Thomson, L. 2008. Seed-borne pathogens of pea in Saskatchewan in 2007. Can. Plant Dis. Survey 88: 117-119. (http://www.cps-scp.ca/cpds.htm)

3. Morrall, R.A.A., Carriere, B., Ernst, B., Nysetvold, T., and Schmeling, D. 2009. Seed-borne pathogens of pea in Saskatchewan in 2008. Can. Plant Dis. Surv. 89: 129–131. (http://www.cps-scp.ca/cpds.shtml)

4. Morrall, R.A.A., Carriere, B., Ernst, B., Pearse, C., Schmeling, D. and Thomson, L. 2006. Seed-borne pathogens of pea in Saskatchewan in 2005. Can. Plant Dis. Survey 86: 109-111. (http://www.cps-scp.ca/cpds.htm)

5. Morrall, R.A.A., Carriere, B., Ernst, B., Pearse, C., Schmeling, D. and Thomson, L. 2007. Seed-borne pathogens of pea in Saskatchewan in 2006. Can. Plant Dis. Survey 87: 125-127. (http://www.cps-scp.ca/cpds.htm)

6. Saskatchewan Ministry of Agriculture. 2009. Final Crop Report December, 2009. Regina, SK. 12 pp. (http://www.agriculture.gov.sk.ca/Statistics-Crops)

7. Saskatchewan Ministry of Agriculture. 2010. 2009 Specialty Crop Report. Regina, SK. 20 pp. (http://www.agriculture.gov.sk.ca/Statistics-Crops)

Table 1. Number of pea seed samples tested from September to December, 2009 by three commercial companies and levels of infection with *Ascochyta* in relation to Saskatchewan Crop Districts

Crop District	No. of samples tested	Mean % infection	% samples with 0% infection
1A	1	0	100
1B	2	0.5	50
2A	3	0.5	33
2B	24	1.6	25
3AN	7	4.7	0
3AS	12	9.9	17
3BN	15	1.9	27
3BS	7	5.1	0
4A	0	-	-
4B	2	1.0	0
5A	8	2.4	25
5B	8	2.5	13
6A	21	3.4	10
6B	61	2.3	15
7A	7	2.1	0
7B	10	3.0	0
8A	23	4.0	0
8B	8	4.8	0
9A	12	1.0	67
9B	13	1.0	29
TOTAL	245	3.4	17

Table 2. Mean levels of *Ascochyta pinodes* and of *Ascochyta pisi* in pea seed samples tested from September 2009 to mid-February 2010 by one commercial company in relation to Saskatchewan Crop Districts

Crop district	Mean % infection with *Ascochyta pinodes*	Mean % infection with *Ascochyta pisi*
1A	-	-
1B	0.3*	1.0*
2A	-	-
2B	1.3	1.5
3AN	0.3*	3.8*
3AS	0.1	15.9
3BN	0.4	2.5
3BS	0*	4.7*
4A	-	-
4B	0*	1.0*
5A	1.0	1.5
5B	2.8	1.6
6A	1.7	3.1
6B	1.3	1.3
7A	0.9	2.2
7B	1.4	0.8
8A	4.0	0.3
8B	3.5	0.8
9A	1.9	0.2
9B	0.7	0.1
OVERALL	1.7	2.3

* Based on fewer than 10 samples

CROP: Field pea
LOCATION: Manitoba

NAMES AND AGENCIES:
D.L. McLaren[1], R.L. Conner[2], D.J. Hausermann[1], T.L. Henderson[1], W. C. Penner[2] and T.J. Kerley[1]
[1] Agriculture and Agri-Food Canada Research Centre, Box 1000 A, RR#3, Brandon, Manitoba R7A 5Y3
Telephone: (204) 578-3561; **Facsimile:** (204) 728-3858; **E-mail:** debra.mclaren@agr.gc.ca
[2] Agriculture and Agri-Food Canada Research Station (AAFC), Unit 100-101, Route 100, Morden, Manitoba, R6M 1Y5

TITLE: FIELD PEA DISEASES IN MANITOBA IN 2009

METHODS: Field pea crops in Manitoba were surveyed for root and foliar diseases at 40 different locations. The crops surveyed were randomly chosen from regions in south-central and southwest Manitoba, where field pea is commonly grown. The survey for root diseases was conducted during late June and early to mid July when most plants were at the 12-17 node stage. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant, the seedling died back quickly after emergence). Five to ten symptomatic roots were collected per field for isolation of fungi in the laboratory in order to confirm the visual disease identification. *Fusarium* species were identified based on the methods of Nelson et al. (1983). Foliar diseases were assessed during late July and early August when most plants were at the round pod stage. A minimum of 30 plants (10 plants at 3 sites) was assessed in each field. Foliar diseases were identified by symptoms. The severity of foliar diseases observed was estimated using a scale of 0 (no disease) to 9 (whole roots/plants severely diseased). Powdery mildew was rated as the percentage of leaf area infected.

RESULTS AND COMMENTS: Three root diseases were observed (Table 1). Fusarium root rot *(Fusarium solani* f. sp. *pisi and F. avenaceum*) was the most prevalent and was observed in all fields surveyed. In 2007 and 2008, 88% and 100% of crops, respectively, had symptoms of fusarium root rot (McLaren et al. 2008, 2009).

Fusarium avenaceum was more frequently isolated from symptomatic roots than *F. solani* f. sp. *pisi* in both 2008 and 2009. Fusarium wilt (*F. oxysporum*) and rhizoctonia root rot (*Rhizoctonia solani*) were detected in 34 and 5 fields, respectively, in 2009. Severity means for all root diseases were higher in 2009 than in the previous year. The early months of summer were cool and although the optimal temperatures for growth of root pathogens such as *F. solani* are 25-30ºC, the disease will develop at 18ºC and above (Kraft and Pfleger, 2001).

Four foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*) was the most prevalent, as in previous years (McLaren et al. 2008, 2009), and was present in all fields surveyed. Sclerotinia stem rot (*Sclerotinia sclerotiorum*) was detected in three fields. The prevalence of sclerotinia-infested crops was 7.5% in 2009 compared with 16.2% reported in 2008 (McLaren et al. 2009). Powdery mildew (*Erysiphe pisi*) was observed in one of the surveyed fields. Because all newly registered pea cultivars are required to have resistance to powdery mildew, the low prevalence of this disease can be attributed, in part, to the adoption of new cultivars by growers. However, this disease was observed very late in the growing season on a few susceptible lines at AAFC-Morden which suggests that there may have been crops with powdery mildew that were not detected at the time of the survey. Foliar diseases, such as septoria blotch (*Septoria pisi*), bacterial blight (*Pseudomonas syringae* pv. *pisi*) and downy mildew (*Peronospora viciae*) were not observed in the surveyed fields. Anthracnose (*Colletotrichum pisi*) was observed at trace levels in two fields (Table 2).

REFERENCES:

Kraft, J.M. and Pfleger, F.L. 2001. Compendium of Pea Diseases and Pests. 2nd ed. American Phytopathological Society, APS Press, St. Paul, MN. 67 pp.

McLaren, D.L., Conner, R.L., Hausermann, D.J., Henderson, T.L., Penner, W.C. and Kerley, T.J. 2009. Field pea diseases in Manitoba in 2008. Can. Plant Dis. Surv. 89:132-133. (http://www.cps-scp.ca/cpds.htm)

McLaren, D.L., Conner, R.L., Hausermann, D.J., Henderson, T.L., Penner, W.C. and Kerley, T.J. 2008. Field pea diseases in Manitoba in 2007. Can. Plant Dis. Surv. 88:120-121. (http://www.cps-scp.ca/cpds.htm)

Nelson, P.E., Toussoun, T.A. and Marasas, W.F.O. 1983. Fusarium Species : An Illustrated Manual for Identification. Pennsylvania State University Press. University Park and London. 193 pp.

Table 1. Prevalence and severity of root diseases in 40 crops of field pea in Manitoba in 2009.

		Disease severity (0-9)[1]	
Disease	**No. crops affected**	**Mean**	**Range**
Fusarium root rot	40	2.1	0.5-4.2
Fusarium wilt	34	2.1	0.7-4.2
Rhizoctonia root rot	5	1.6	0.9-2.4

[1]All diseases were rated on a scale of 0 (no disease) to 9 (whole roots severely diseased).

Table 2. Prevalence and severity of foliar diseases in 40 crops of field pea in Manitoba in 2009.

		Disease severity (0-9)[1]	
Disease	**No. crops affected**	**Mean**	**Range**
Mycosphaerella blight	40	3.3	1.0-7.6
Sclerotinia stem rot	3	0.8	0.7-1.0
Powdery mildew	1	<1	<1
Anthracnose	2	0.7	0.3-1.0

[1]Powdery mildew was rated as the percentage of leaf area infected; other diseases were rated on a scale of 0 (no disease) to 9 (whole plant severely diseased). Mean values are based only on fields where the disease was present.

CROP: Sunflower
LOCATION: Manitoba

NAME AND AGENCY:
K. Y. Rashid[1] and M.L. Desjardins[2]
[1] Agriculture and Agri-Food Canada, Research Station
Unit 100-101, Route 100, Morden, Manitoba R6M 1Y5.
Telephone: (204) 822-7220; **Facsimile**: (204) 822-7207; **E-mail**: Khalid.rashid@agr.gc.ca
[2] Manitoba Agriculture, Food and Rural Initiatives, Crop Diagnostic Centre.
201-545 University Crescent, Winnipeg, Manitoba R3T 5S6.

TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2009

METHODS: A total of 33 sunflower crops were surveyed in 2009 in Manitoba. Seventy three percent were confectionery hybrids and 27% were oilseed hybrids, showing no significant changes in the oilseed acreage over the past few years (1, 2, 3). Twenty-two crops were surveyed in the last two weeks of August, six in September, and five in the first week of October. The crops were surveyed along pre-planned routes in the major areas of sunflower production. 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 percent incidences of downy mildew (*Plasmopara halstedii*), sclerotinia wilt or head and stem infections (*Sclerotinia sclerotiorum*), rhizopus head rot (*Rhizopus* spp.), and verticillium wilt (*Verticillium dahliae*) were estimated. Disease severity for rust (*Puccinia helianthi*), leaf spots (*Septoria helianthi* and *Alternaria* spp.), powdery mildew (*Erysiphe cichoracearum*) and stem diseases (*Phoma* spp. *& Phomopsis* spp.) were estimated as percent leaf or stem area infected. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1). Stand establishment, vigour, and maturity were rated on a scale of 1 to 5 (I = very good/early, and 5 = very poor/very late).

In addition, 17 samples of sunflower plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Initiatives by agricultural representatives and growers.

RESULTS AND COMMENTS: Ninety-four percent of the sunflower crops surveyed in 2009 had excellent to good stands while the rest had fair to poor stands. Fifty-two percent of the crops were maturing early, and only 18% maturing very late. Seventy-three percent of the crops had good to excellent vigour, and only 27% had poor vigour (Table 1). The 2009 growing season started late with abundant moisture and good growing conditions but soil moisture levels and temperatures were not favourable for high downy mildew infections. Normal temperatures and moisture levels in July and August and relatively dry and frost-free conditions in September helped the crops to develop and mature normally. However above normal temperatures in September were favourable for the development of severe sclerotinia head rot in most sunflower crops. Traces of infestation with the sunflower beetle (*Zygogramma exclamationis*) were observed in a few crops. However, traces to 10% infestations by grasshoppers were observed in 24% of the crops. Infestations at trace to 5% levels with seed weevil (*Smicronyx fulvus*) were observed in 40% of the crops, and with sunflower midge (*Contarinia schulzi*) in 18% of the crops.

Sclerotinia wilt was present in 91% of the crops surveyed in 2009 with incidence ranging from trace to 40% infected plants (Table 1). Sclerotinia head rot and mid-stem infection, both caused by ascospore infections, were present in 52% of all crops, but in 100% of the 11 crops surveyed in September-October, with incidence ranging from trace to 40%. The prevalence and incidence of head rot in 2009 were much higher than in in the last few years especially towards the end of the season (1, 2, 3, 4).

Rust was present in 70% of the crops surveyed, with severity ranging from trace to 40% leaf area affected (Table 1). Preliminary analysis of rust isolates collected indicates the prevalence of race-group 700 with a few isolates of 777, which is virulent on all differential sunflower lines. Rust infections started early and developed rapidly in some fields especially in southwest Manitoba. Incidence and severity were similar to 2008 but higher than in 2007 (1,2), probably due to early infections in north-central North Dakota and early arrival of inoculum in Manitoba.

Verticillium wilt was present in 85% of the crops surveyed, with incidence ranging from trace to 20% (Table 1). Incidence was higher in 2009 than in 2007-2008 but similar to previous years (1, 2, 3, 4).

Downy mildew was observed in 50% of crops with incidence ranging from trace to 20% (Table 1). Preliminary analysis of the isolates collected indicates the predominance of races 733 and 730. The prevalence and incidence of downy mildew in 2009 were similar to 2008 but lower than in 2007 (1) due perhaps to normal soil moisture levels at the seedling stage.

Traces to 5% leaf area infected by *Septoria helianthi* and *Alternaria* spp. were observed in 30% of the crops surveyed (Table 1). These are similar severity and prevalence values to previous years (1, 2, 3, 4). Stem lesions caused by *Phoma* and *Phomopsis* were present in a few crops with trace to 5% stem area affected. Traces to 5% leaf area affected by powdery mildew were observed in a few crops.

Of the 17 samples submitted to the Crop Diagnostic Centre, three were identified as infected with rust, three with *Alternaria* spp., one with downy mildew, one with *Phoma* sp., and nine as chemical injury.

ACKNOWLEDGMENTS: The assistance of T. Cabernel and M. Penner is gratefully acknowledged.

REFERENCES:

1. Rashid, K. Y., and M.L. Desjardins, 2009. Diseases of sunflower in Manitoba in 2008. Can. Plant Dis. Surv. 89: 134-135. (http://www.cps-scp.ca/cpds.htm)

2. Rashid, K. Y., and M.L. Desjardins, 2008. Diseases of sunflower in Manitoba in 2007. Can. Plant Dis. Surv. 88:124-125. (http://www.cps-scp.ca/cpds.htm)

3. Rashid, K. Y., and M.L. Desjardins, and D. A. Kaminski 2007. Diseases of sunflower in Manitoba in 2006. Can. Plant Dis. Surv. 87:130-131. (http://www.cps-scp.ca/cpds.htm)

4. Rashid, K. Y., M.L. Desjardins, and D. A. Kaminski 2006. Diseases of sunflower in Manitoba and Saskatchewan in 2005. Can. Plant Dis. Surv. 86:114-115. (http://www.cps-scp.ca/cpds.htm)

Table 1. Prevalence and index of diseases in 33 crops of sunflower in Manitoba in 2009.

Disease	Crops Affected		Disease Index[1]	
	No. of crops	% of crops	Mean	Range
Sclerotinia wilt	30	91%	1.3	T – 4
Sclerotinia head rot/stem rot	17	52%	2.0	T – 4
Verticillium wilt	28	85%	1.1	T – 2
Downy mildew	16	50%	1.2	T – 3
Rust	23	70%	2.3	1 – 4
Leaf spots (Septoria & Alternaria)	10	30%	0.5	T – 1
Lateness[2]	6	18%	2.6	1 – 4
Poor stand	2	6%	1.4	1 – 3
Poor vigour	9	27%	2.1	1 – 4

[1] Disease index on a scale of T to 5: Trace (T) = < 1%, 1= 1-5%, 2= 5-20%, 3= 20-40%, 4= 40-60%, and 5= > 60% disease levels. Index is for disease incidence with downy mildew, verticillium wilt, sclerotinia; and for disease severity measured as percent leaf and stem area affected with rust and leaf spots.

[2] Indexes for lateness, stand, and vigour are based on a 1-5 scale (1= early/very good and 5= very late/very poor).

Vegetables / Légumes

CROP / CULTURE : Endive (*Cichorium endivia*) and chickpea (*Cicer arietinum*)
LOCATION / RÉGION: Saskatoon, Saskatchewan

NAMES AND AGENCY / NOM ET ÉTABLISSEMENTS:
Chrystel Olivier and Brian Galka
Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, SK, S7N 0X2, Canada.
Telephone: (306) 956-7686; **Facsimile**: (306) 956-7247; **E-mail**: chrystel.olivier@agr.gc.ca

TITLE / TITRE: **FIRST REPORT OF ASTER YELLOWS PHYTOPLASMA IN ENDIVE AND CHICKPEA IN SASKATCHEWAN**

INTRODUCTION AND METHODS: Phytoplasmas are non-culturable bacterium-like pathogens that cause hundreds of diseases in various plants worldwide and are transmitted by phloem-feeding insects (Firrao et al. 2005). Phytoplasmas have been divided into 28 groups based on the sequences of the 16SrI ribosomal DNA (Wei et al. 2007). The 16SrI group aster yellows (AY), is present in many field, vegetable and ornamental crops throughout Canada (Olivier et al. 2009a). Common symptoms of AY diseases are leaf chlorosis and rolling, stunting, virescence and phyllody, and little or no production of seed and fruit by infected plants (Firrao et al. 2005).

In 2008, one plant of endive and one plant of chickpea located at the Agriculture and Agri-Food Canada Saskatoon Research Farm showed abnormal growth. The endive was stunted and chlorotic and phyllody symptoms could be seen in new leaves. The flowers did not mature and remained green. The chickpea was stunted and chlorotic but did not show phyllody or virescence. Leaves from both plants were collected, freeze-dried and stored at -20ºC. DNA extraction and PCR testing were performed according to the method described in Olivier et al. (2009b). Phytoplasma strain identification was performed by sequencing the DNA from the PCR products (Plant Biotechnology Institute, National Research Council, Saskatoon, Saskatchewan, Canada). DNA sequences were then compared with sequences recorded in Genbank using the BLAST program.

RESULTS AND COMMENTS: DNA belonging to the phytoplasma strain 16SrI-B of the AY group, was detected in both plants. Strain 16SrI-B, '*Candidatus* Phytoplasma asteris', is the most common and widespread phytoplasma that naturally infects over 80 species of plants worldwide and can be transmitted by approximately 30 leafhopper species to 200 plant species (Lee et al. 2004). Endive is known to be a host of AY in the USA (O'Mara et al. 1993) and in Europe (Marcone and Ragozzino 1995). In Australia and the Middle-East, chickpea is a known host for phytoplasma strain 16SrII-B (*Candidatus* Phytoplasma aurantifolia'), belonging to the Peanut Witches' Broom group (Al-Saady et al. 2006; Akhtar et al. 2008; Saqib et al. 2005). However, there was no report of chickpea being a host of the 16SrI-B strain.

This is the first report of the presence of the phytoplasma strain 16SrI-B in endive in Canada and the first report of chickpea being a host for the same strain.

REFERENCES:
Akhtar, K.P., Shah, T.M., Atta, B.M., Dickinson, M., Jamil, F.F., Haq, M.A., Hameed, S. and Iqbal, M.J. 2008. Natural occurrence of phytoplasma associated with chickpea phyllody disease in Pakistan – a new record. Plant Pathol., 57: 771.

Al-Saady, N.A., Al-Subhi, A.M., Al-Nabhani, A. and Khan, A.J. 2006. First report of a group 16SrII phytoplasma infecting chickpea in Oman. Plant Dis., 90: 973.

Firrao, G., Gibb, K. and Streten, C. 2005. Short taxonomic guide to the genus '*Candidatus* Phytoplasma'. J. Plant Pathol., 87**:** 249 - 263.

Lee, I-M., Gundersen-Rindal, D.E., Davis, R.E., Bottner, K.D., Marcone, C. and Seemuller, E. 2004. '*Candidatus* Phytoplasma asteris', a novel phytoplasma taxon associated with aster yellows and related diseases. Int. J. Syst. Evol. Microbiol. 54: 1037 - 1048.

Marcone, C. and Ragozzino, A. 1995. Detection of phytoplasma in *Brassica* spp. in Southern Italy and their characterization by RFLP analysis. Z. Pflanzenk. Pflanzen. 103: 82 - 84.

Olivier, C.Y., Lowery, D.T. and Stobbs, L.W. 2009a. Phytoplasma diseases and their relationships with insect and plant hosts in Canadian horticultural and field crops. Can. Entomol., 141: 425 - 462.

Olivier, C.Y., Lowery, D.T., Stobbs, L.W., Vincent, C., Galka, B., Saguez, J., Bittner, L., Johnson, R., Rott, M., Masters, C. and Green, M. 2009b. First report of Aster Yellow phytoplasmas ('*Candidatus* phytoplasma asteris') in Canadian grapevines. Plant Dis. 93: 6.

O'Mara, J., Stevens, J. and Gast, K.L.B. 1993. Commercially specialty cut-flower production-aster yellows. Coop. Ext. Serv., Kansas State University, # MF-1086, 6p.

Saqib, M., Bayliss, K.L., Dell, B., Hardy, G.E.S. and Jones, M.G.K. 2005. First record of a phytoplasma-associated disease of chickpea (*Cicer arietinum*) in Australia. Australas. Plant Path. 34: 425 - 426.

Wei, W., Davis, R.E., Lee, I-M. and Zhao, Y. 2007. Computer-simulated RFLP analysis of 16SrRNA genes: identification of ten new phytoplasma groups. Int. J. Syst. Evol. Micr. 57: 1855 -1867.

Fruits, Nuts and Berries, Ornamentals and Turfgrass / Fruits, Fruits à Écale et Baies, Plantes Ornementales et Gazon

CROP / CULTURE: Lowbush blueberry (*Vaccinium angustifolium*, *V. myrtilloides*)
LOCATION / RÉGION: Nova Scotia

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENTS:
P.D. Hildebrand, W.E. Renderos, and S.A.E. Fillmore
Agriculture and Agri-Food Canada,
Atlantic Food and Horticulture Research Centre
32 Main Street, Kentville, NS B4N 1J5
Telephone: (902) 679-5716; **Facsimile**: (902) 679-2311; **E-mail**: paul.hildebrand@agr.gc.ca

TITLE / TITRE: SEVERITY OF SEPTORIA LEAF SPOT AND STEM CANKER AND LEAF RUST IN LOWBUSH BLUEBERRY FIELDS PRUNED BY MOWING OR BURNING

INTRODUCTION: The commercial lowbush blueberry is managed on a biennial cycle in which fields are pruned to ground level in late fall or early spring by mowing or by burning with tractor-drawn oil-fired burners or, less frequently, with straw. New sprout stems emerge and elongate through the summer and fruit are harvested in the following year. Biennial pruning is done to promote higher yields on nonbranched stems which also aids in mechanical harvesting. In recent years, growers have become concerned that septoria leaf spot and stem canker is causing premature defoliation and reduced yields in fruiting fields. Also, leaf rust is believed to be causing premature defoliation in sprout fields that reduces flower bud set and yields in the following year.

Septoria leaf spot and stem canker of lowbush blueberry is caused by a species of *Septoria* that has not been fully characterized. The fungus overwinters in leaf litter and produces pycnidiospores that are rain splashed onto blueberry foliage over a 4-5 week period beginning in late May. Blueberry sprouts in pruned fields emerge in early June and continue to elongate apically until early August. As a result, only the lower portions of sprout stems are exposed to inoculum. Initial symptoms appear in late June on the undersurface of leaves as minute water soaked spots. With time the spots increase in size, coalesce and penetrate to the upper surface where they appear as irregular red/brown spots and cause leaves to drop. Infections also occur on the stems, but remain latent until spring of the following year. These lesions initially appear as purple/red spots that later enlarge, become slightly sunken, turn brown and produce a few pycnidia, but the stems are usually not killed. Spores from pycnidia on stems and overwintered leaves from the previous sprout season are subsequently rain-splashed onto foliage of the current season. Because most of the foliage on fruiting stems develops simultaneously, leaf infections occur more or less uniformly throughout the canopy. If infection is severe, premature leaf drop may occur before harvest and affect yields.

Leaf rust is caused by *Thekopsora minima* (synonym *Pucciniastrum vaccinii*) (3) and is most commonly observed on the foliage of sprout fields. The fungus overwinters in infected blueberry leaf litter where it produces teliospores that are wind blown to young needles of eastern hemlock (1, 2) during June. Aeciospores are produced on the needles and are released through late June and early July and are wind dispersed back to blueberry fields. Symptoms on blueberry initially appear in late July on the upper leaf surface as red spots and on the undersurface as water soaked spots bearing yellow uredinia. Urediniospores cycle repeatedly on the blueberry and with time, the spots intensify in number causing leaves to drop. Severe premature defoliation may occur by early to mid September resulting in reduced yields the following year. Leaf rust is not considered to be a problem in fruiting fields because the crop is usually harvested before the disease has an impact.

In the late 1980's and early 1990's, blueberry growers began shifting their pruning practice from burning to mowing due to concerns over environmental pollution and the high cost of furnace oil used in the

burners. The purpose of this survey was to determine if the severity of septoria leaf spot and stem canker and leaf rust are affected by pruning method.

METHODS: In July 2006, 30 random stems along a 'W' pattern were cut at ground level from each of 7 random fruiting fields that had always been burn pruned and 8 fields that had been mowed for at least 10 years. Fields from the counties of Cumberland, Hants, Digby and Annapolis were sampled. In 2008, 11 of the fields visited in 2006 were sampled again with the addition of 5 different fields. Not all of the original fields could be sampled because the growers chose to switch from burning to mowing. The fields were surveyed in mid July in both years. Lesion (> 1 mm in length) numbers on stems were counted with the aid of a stereomicroscope and leaf spot severity was assessed on 5 random leaflets per stem. Leaf spot severity was assessed according to a pictorial scale in which 0=0, 1=0.1, 2=0.2, 3=0.4, 4=0.8, 5=1.6, 6=3.2, 7=6.4, 8=12.8, 9=25.6, and 10=51.2% of the leaf area was affected by spotting. Growers were contacted to obtain yields.

In 2007, 11 of the same fields which were sampled in 2006 were sampled for leaf rust in mid September. In addition, 4 different fields were also sampled. None of these fields received applications of the fungicide chlorothalonil (Bravo 500®), which is commonly used to control leaf rust. Forty random sprout stems were cut at ground level during mid September and one random leaflet on the upper half of each stem was assessed for leaf rust severity according to a pictorial severity scale in which 0=0, 1=0.2, 2=0.8, 3=3.2, 4=12.8, and 5=51.2% of the leaf area was affected by spotting. Severity of defoliation also was assessed according to a scale where 0=0, 1=1-20, 2=21-40, 3=41-60, 4=61-80 and 5=81-100% of the stem was defoliated.

The data were subjected to the analysis of variance procedure in Genstat 5 and the Wald test was used for assessing significance of differences between means.

RESULTS AND DISCUSSION: Levels of septoria leaf spot and stem canker were more severe in 2006 than in 2008, but there were no treatment by year interactions and so the data were averaged over the two years. Fields that had been burn pruned had substantially fewer stems infected with the *Septoria* pathogen and fewer lesions per stem, but the severity of leaf spotting and yield were not significantly different between the two pruning methods (Table 1). Burn pruning evidently reduced the amount of overwintering leaf inoculum resulting in fewer infections on the sprout stems as they emerged. These infections remained latent until the following year when the stems were collected and assessed. However, leaf infections in the year of sampling were similar in burned and mowed fields indicating that inoculum levels in that year must have been similar. Despite the fact that burn pruning reduced the amount of overwintering inoculum in the sprout phase, some infections on the sprout leaves undoubtedly occurred thereby providing inoculum for the following year. High numbers of pycnidia are typically produced on overwintered infected leaves and so high inoculum levels likely were present again at the beginning of the fruiting year.

In order for burn pruning to be more effective, it appears that more intense, uniform burns throughout fields would be required not only to prune the old stems, but also to consume all of the infected leaf litter. Anecdotal reports from growers who have implemented intense burns indicate that the disease can be substantially reduced in the sprout and subsequent fruiting phase resulting in higher yields. However the extra fuel that is required to achieve this may not be cost effective, especially if this is the only disease that is targeted for control. Novel and more efficient approaches to sanitizing fields are required.

Severity of rust on foliage in sprout fields was not affected by prune method, whereas defoliation was reduced by burning, but not substantially (Table 2). This effect is not unexpected. Unlike the *Septoria* pathogen which is rain splashed and would not spread over long distances, *T. minima* is wind dispersed. Initially, aeciospores from hemlock trees and subsequently urediniospores from blueberry fields are likely blown over long geographic distances and introduced into burned and mowed fields alike, leading to similar levels of disease. That defoliation of sprout stems was reduced in burned fields is likely due to a reduction in leaf infections by the *Septoria* pathogen and not to leaf rust. Thus, implementing burn pruning with the aim of reducing leaf rust would not be cost effective.

REFERENCES:

1. Bristow, P.R. and Stretch, A.W. 1995. Leaf rust (Highbush section). *In:* Caruso, F.L. and D.C. Ramsdell (eds). Compendium of Blueberry and Cranberry Diseases. APS Press. pp. 20-23.

2. Nickerson, N.L. 1995. Leaf rust (Lowbush section). *In:* Caruso, F.L. and D.C. Ramsdell (eds). Compendium of Blueberry and Cranberry Diseases. APS Press. p. 27.

3. Sato, S., Katsuya, K., and Hiratsuka, Y. 1993. Morphology, taxonomy and nomenclature of *Tsuga*-Ericaceae rusts. Trans. Mycol. Soc. Japan 34:47-62.

Table 1. Effect of pruning method on subsequent incidence and severity of septoria leaf spot and stem canker in fruiting fields of lowbush blueberry. Data are averages of fields surveyed in 2006 and 2008. Values in parentheses are ranges.

Prune method	Infected stems (%)	Lesions/stem	Leaf severity rating	Yield (kg/ha)
Burn	7.8 (0.0 - 24.0)	0.11 (0.0 - 0.36)	2.7 (1.1 - 4.8)	3211 (1027 - 5686)
Mow	27.2 (10.0 - 69.1)	0.67 (0.2 - 2.17)	2.3 (1.4 - 4.6)	3830 (717 - 7443)
F Probability	<0.001	<0.001	0.75	0.67

Table 2. Effect of pruning method on leaf rust severity and defoliation of lowbush blueberry stems in sprout fields in 2007. Values in parentheses are ranges.

Prune method	Leaf severity rating	Defoliation rating
Burn	2.9 (1.5-3.7)	2.2 (1.1-3.3)
Mow	2.5 (1.7-3.3)	2.5 (1.9-3.6)
F Probability	0.898	<0.001

CROP/CULTURE: Grape (*Vitis vinifera*)
LOCATION/RÉGION: British Columbia

NAMES AND AGENCY/NOMS ET ORGANISME:
D.T. O'Gorman, P. Haag and P.L. Sholberg
Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, BC, V0H 1Z0
Telephone: (250) 494-6364; **Facsimile: (**250) 494-0755; **E-mail:** daniel.ogorman@agr.gc.ca

TITLE/TITRE: FIRST REPORT OF EUTYPA DIEBACK AND OTHER EMERGING GRAPEVINE DISEASES IN THE OKANAGAN VALLEY.

INTRODUCTION: A survey was conducted in 2009 to help identify the cause of new and unusual vine decline symptoms on grapevines in the Okanagan Valley of British Columbia. As in the past several years, symptoms such as delayed and stunted growth, short internodes, trunk dieback, dead arm and cankers were most obvious in the early part of the season. However, later in the summer shoot tip and tendril dieback, yellowing and premature leaf drop were also seen. A variety of trunk and root diseases can be responsible for these symptoms and several (botryosphaeria canker, black foot and esca) along with associated pathogens were recently identified for the first time in Canada (O'Gorman et al. 2009).

METHODS: Symptomatic vines complete with roots were collected and brought back to the laboratory. In order to expose necrotic tissue, cross sections of the vines were taken from roots and from the trunk, both above and below the graft union. Small pieces of plant tissue (5-10 mm) were shaved from margins of necrotic areas and surface sterilized in 0.53% NaOCl, rinsed in sterile distilled water and plated on acidified potato dextrose agar. Emerging fungal isolates were transferred to new plates for identification using colony morphology and microscopic characteristics. To assess the pathogenicity of isolates, small plugs of fungal cultures were used to inoculate surface sterilized green grapevines shoots.

To confirm the fungal identification, DNA was extracted from a pure culture or directly from plant tissue and the internal transcribed spacer (ITS) regions of the ribosomal RNA genes were amplified and sequenced. DNA sequence data were imported into SeqMan Pro analysis software (Lasergene 7.1: DNASTAR Inc., Madison, WI) for manual editing and BLAST searches of the GenBank database (National Center for Biotechnology Information: http://www.ncbi.nlm.nih.gov/).

RESULTS AND COMMENTS: This year's survey included 18 vineyards and we identified five different trunk and root diseases from symptomatic vines. Three of these, esca, botryosphaeria canker and black foot were reported in a previous survey, but the remaining two diseases, eutypa dieback and phomopsis cane and leaf spot, have not previously been reported on grape in the Okanagan Valley of British Columbia. The identity of the pathogens was based on fungal morphology, species specific PCR assays and BLAST searches of ITS sequences.

Eutypa dieback: Our survey identified two vineyards where eutypa dieback was a problem. Both vineyards were older plantings of Chardonnay and Pinot Noir. Initial identification of *Eutypa lata* was accomplished via DNA extracted directly from tissue removed from large cankers (Fig. 1B.) and amplified using species specific PCR primers (Lecomte et al. 2000). Fungal isolations, colony morphology and ITS sequence data confirmed the PCR results. *Eutypa milliaria* (= *E. lata*) has been reported in Canada on alder, dogwood, hickory and maple, (Conners, 1967; Farr et al. 2008; and Ginns, 1986) and *E. armeniacae* (= *E. lata*) on grape in Ontario (Toole and Patrick, 1977; and Ginns, 1986). However, despite the fact that eutypa dieback is a significant disease in other grape growing regions of the world, this is the first report of *E. lata* causing grapevine dieback in British Columbia.

Phomopsis cane and leaf spot: The pathogen *Phomopsis viticola*, responsible for cane and leaf spot, was isolated in a one-year-old planting of Gewürztraminer vines. Significant vine decline symptoms had been observed in the vineyard over the past two seasons. Esca and black foot disease were also isolated from young vines in the same block. *Phomopsis viticola* can invade and cause necrosis and splitting on the shoots. Lesions and bleaching of canes can also be observed as can chlorotic regions with small dark spots on the leaves (Pearson and Goheen 1988) but, these symptoms were not obvious on the samples

collected. *Phomopsis viticola,* is considered cosmopolitan in nature and has previously been identified in Ontario's Niagara region (Coleman, 1928; Chamberlain, et al., 1964; and Toole and Patrick, 1977) but we found no prior reference to it in British Columbia.

Black foot disease: Although black foot disease is reported to be caused primarily by C*ylindrocarpon liriodendri* (Halleen, 2006) we found *C. destructans and* several other *Cylindrocarpon* spp. associated with black foot-infected vines. Isolates were obtained from root tissue as well as from the trunk section below the graft union on Chardonnay and Gewürztraminer vines. Along with the many symptoms mentioned above, the affected vines also showed black, sunken, necrotic lesions on the roots and blackened vascular tissue in both the roots and trunk. Infected vines ranged in age from two to 15 years.

Esca: Esca was identified in two vineyards. *Phaeomoniella chlamydospora* was isolated at both sites and identified based on colony morphology and ITS sequence data. The pathogen was isolated from necrotic vascular tissue from above the graft union on young Gewürztraminer and Syrah vines. One vineyard that tested positive for the esca pathogen also had vines testing positive for *Cylindrocarpon* and *Phomopsis.*

Botryosphaeria canker: Six vineyards with plantings ranging in age from one to 20 years had vines testing positive for botryosphaeria canker and a total of four pathogen species were identified. *Botryosphaeria parva* and *B. dothidea* were isolated from cankers and necrotic vascular tissue. Two isolates of a related *Diplodia* species belonging to the Family *Botryosphaeriaceae* were also isolated from large cankers on symptomatic vines (Fig. 1A.). Neither *Diplodia* isolate produced spores and BLAST searches conducted with the two identical DNA sequences aligned equally with both *D. corylia* and *D. juglandis* (identity value = 99.7%). The *Diplodia* and the *Botryosphaeria* species were all able to produce necrosis when inoculated into green grapevine cuttings (Fig. 2A., B. and C.). Additionally, *B. sarmentorum* was routinely identified from spore trap samples but not from diseased vines.

Botryosphaeria canker, caused by *B. parva* and *B. dothidea*, was reported in 2009 in Canada by O'Gorman et al. However the isolation of the related *Diplodia* sp. from symptomatic vines is novel. Additional morphological examination and multi-gene analysis may be needed to further characterize the *Diplodia* isolates collected.

REFERENCES:

Chamberlain, G.C., Willison, R.S., Townshend, D.J.I. and de Ronde, J.H. 1964. Two fungi associated with dead-arm disease of grapes. Can. J. Bot. 42: 351–355.

Coleman, L.C. 1928. The dead-arm disease of grapes in Ontario. A preliminary study. Scientific Agric. 8, 281–305.

Conners, I.L. 1967. An Annotated Index of Plant Diseases in Canada and Fungi Recorded on Plants in Alaska, Canada and Greenland. Res. Branch Canada Dept. Agric. Publ.1251: 381pp.

Farr, D. F., Rossman, A. Y., Palm, M. E., and McCray, E. B. 2008. Fungal Databases. Online. Systematic Mycology and Microbiology Laboratory, USDA-ARS, Washington, DC.

Ginns, J.H. 1986. Compendium of plant disease and decay fungi in Canada 1960-1980. Res. Branch Agric. Can. Publ. 1813: 416 pp.

Halleen, F., Schroers, H.J., Groenewald, J.Z., Rego, C., Oliveira, H. and Crous, P.W. 2006. *Neonectria liriodendri* sp. nov., the main causal agent of black foot disease of grapevines. Stud. Mycol. 55: 227–234.

Lecomte, P., Péros, J. P., Blancard, D., Bastien, N. and Délye, C. 2000. PCR assays that identify the grapevine dieback fungus *Eutypa lata*. Applied and Environmental Microbiology 66:4475–4480.

O'Gorman, D.T., Haag P. and Sholberg P.L. 2009. New diseases causing decline of wine grapes in the Okanagan valley. Can. Plant Dis. Surv. 89:140-143 (http://www.cps-scp.ca/cpds.htm).

Pearson, R.C. and Goheen, A.C. (*Eds*). 1988. Compendium of Grape Diseases. APS Press, St. Paul MN. 93 pp.

Toole. B. and Patrick, Z.A. 1977. Dead and dying arm disease of grape in the Niagara Peninsula. Proc. Can. Phytopathol. Soc. 44: 46.

A. **B.**

Figure 1. Comparison of cankers caused by *Diplodia* sp. and *Eutypa lata.* Cross section of: **(A)** a 20 year old Chardonnay vine revealing a discoloured canker caused by the *Diplodia* isolate and; **(B)** a large canker on a 17 to 18 year old Chardonnay vine caused by *E. lata*

A. **B.**

C. **D.**

Figure 2. Pathogenicity of canker pathogens, *Botryosphaeria dothidea* and *Diplodia sp.* in green tissue. Inoculation of green Chardonnay shoots with: **(A)** *Diplodia*, revealing a discoloured necrotic tissue surrounding the inoculation wounds and **(B)** longitudinal sections of the same vines; **(C)** *B. dothidea* and; **(D)** noninoculated controls.

Forest Trees / Arbres Forestiers

CROP / CULTURE: Maple (*Acer spp)*
LOCATION / RÉGION: Nova Scotia

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENTS:
M.A.Roop, A. B. Gray and C. D.Goodwin
Nova Scotia Agricultural College, Box 550, Truro, NS, B2N 5E3
Telephone: 902-895-7369; **E-mail:** mroop@nsac.ca

TITLE / TITRE: SUSCEPTIBILITY OF MAPLE TREES TO TAR SPOT DISEASE: A SURVEY IN THE TRURO AREA

INTRODUCTION: Tar spot of maple (*Acer spp* L.) is caused by fungi of the genus *Rhytisma* Fr. (Sinclair et al, 1987). Known worldwide, it has recently become a major disease of maple in north-eastern North America (Hsaing et al, 2008). Severity of the disease can range from unsightly nuisance to premature defoliation. In Nova Scotia streetscapes, three species of maple are common. Norway maple (*Acer platanoides* L.) shows significant tar spot infection and trees are often severely defoliated. Red maple (*Acer rubrum* L.) has proven useful in the urban landscape for its tolerance to poorly aerated soils. Susceptibility to tar spot varies within this species. The third species, sugar maple (*Acer saccharum* Marsh.), seems to show fewer tar spot symptoms than other maples. This project focused on evaluating the susceptibility to tar spot of the three species of maple in the Truro/Bible Hill area. Norway, sugar and red maple were evaluated on four types of landscape sites: industrial, institutional, recreational and residential. The relationship between trunk girth as an estimate of age, and tar spot severity was also examined.

METHODS: In Truro/Bible Hill (Colchester County) Nova Scotia, four types of landscape sites were chosen. In order to obtain information with regard to host plant health, sanitation and possible environmental effects on the pathogen, Norway, sugar and red maple were evaluated on four types of sites: industrial (Truro Industrial Park), institutional (Nova Scotia Agricultural College, NSAC), recreational (Victoria Park) and residential (Smith Avenue and Arthur Street). Twenty random leaf samples of each tree species were collected from each of the four sites (4 reps/tree species of 4 types of site) in September 2008, and disease severity was recorded by estimating the percent leaf area affected. Age was estimated by measuring the circumference of each tree at 1.5 m above the soil line and using the following mathematical equation: Growth Factor X Diameter r = Tree Age. The growth factors used were Norway: 2.0, Red: 3.0, Sugar: 5.0 (Anonymous, 2008). The experiment was analyzed as a 3 X 4 factorial with four replicates. The data were subjected to analysis of variance (SAS), and where appropriate, means were separated using Tukey's test. The relationship between tree age and tar spot severity was examined by correlation analysis (Minitab).

RESULTS AND COMMENTS: Disease susceptibility was influenced by tree location (Fig. 1). Tar spot severity was highest in the Truro Industrial Park; Victoria Park had significantly lower disease severity than Truro Industrial Park, but not significantly different from the residential site. The disease severity in the residential site was significantly lower than in the Truro Industrial Park, but was not significantly different from the NSAC or Victoria Park sites. Disease severity was lowest at NSAC when compared to the Truro Industrial Park and Victoria park sites but was not significantly different from the residential site. This may be linked to overall sanitation and maintenance upkeep, i.e. regular fertilizing, liming, pruning, aerating, topdressing and raking and removal of fallen leaves. The Truro Industrial Park had very little tree maintenance and sanitation. Victoria Park had a moderate tree maintenance and sanitation program. Parts of the park kept in lawns had more rigorous maintenance, but other parts comprised of natural woodland had no removal of infected leaves. On the residential site, there was also a mixture of sanitation and maintenance. The NSAC site had the highest level of sanitation and maintenance and thus had a very low level of infection.

Disease severity was higher on Norway and red maple than on sugar maple (Fig. 2). In North America, *R. acerinum* (Pers.) Fr. infects introduced Norway maples and *R. americanum* Hudler & Banik infects native red maples (Hsing and Tian (2007). Our attempts to isolate *Rhytisma* and identify the species were unsuccessful, but it may be that the predominant *Rhytisma* species in the current Truro/Bible Hill epiphytotic is *R. acerinum.*

It is also possible that cuticle thickness is related to the different susceptibilities of the maple species. Hagen and Chabot (1986) studied cuticle thickness with regard to penetration resistance to sap sucking insects and they found that maples overall had thin cuticles, but that sugar maple had a thicker cuticle than other maples. The presence of a thicker cuticle in sugar maple may make it less susceptible to tar spot as is the case in other plant diseases (Percival et al, 1993)

There was no correlation between tree age and tar spot severity on maple when the data were averaged over species (Fig. 3). There was a slightly stronger relationship (not significant) between age and severity in red maple alone (Fig. 4).

REFERENCES:

Anonymous. 2008. Estimating the Age of a Forest Stand. Environmental Systems Analysis. Accessed 22 September 2008; http://www.esatoday.com/arestimate.html.

Hagen, R., and Chabot, J. 1986. Leaf anatomy of maple (*Acer)* and host use by Lepidoptera larvae. Oikos., 47: 335-345.

Hsiang, T., Tian, L. 2007. Sporulation and Identity of Tar Spot of Maple in Canada. Acta Silv. Lign. Hung. Spec. Edition. 71-74.

Hsiang, T., Tian, L., and Sopher, C. 2008. Tar Spot of Maple: Where did it come from and is it getting worse? Hort. Rev. 26: 35-37.

Percival, D., Sulivan, J., and Fisher, K., 1993. Effect of cluster exposure, berry contact and cultivar on cuticular membrane formation and occurrence of bunch rot (*Botrytis cinera* Pers.: Fr.) with 3 *Vitis vinifera* L. cultivars. *Vitis.* 87-93.

Sinclair, W., Loyn, H,, Johnson, W. 1987. Diseases of Trees and Shrubs. In: Diseases of Trees and Shrubs. Cornell University Press.: Ithaca, NY. 54-54.

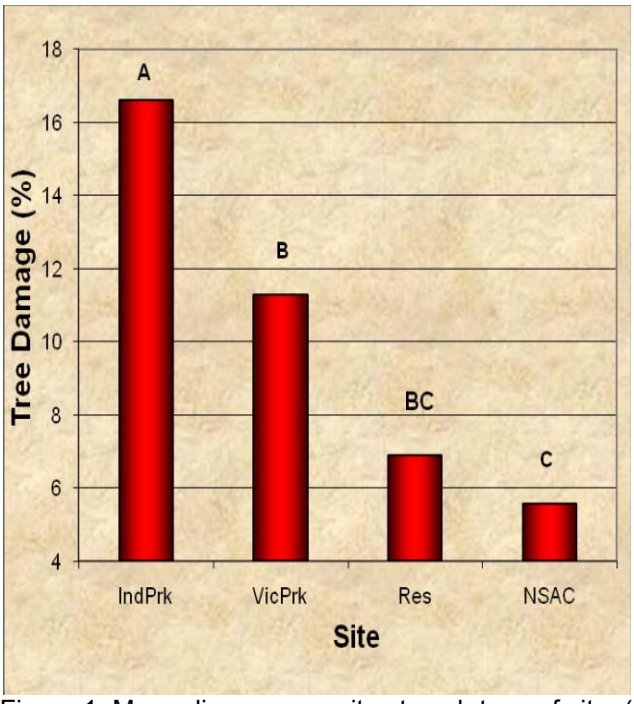


Figure 1: Mean disease severity at each type of site. (IndPrk = Truro Industrial Park; VicPrk = Victoria Park; Res = Residential and NSAC = Nova Scotia Agricultural College campus). Bars with the same letter(s) are not significantly different (P=0.05).

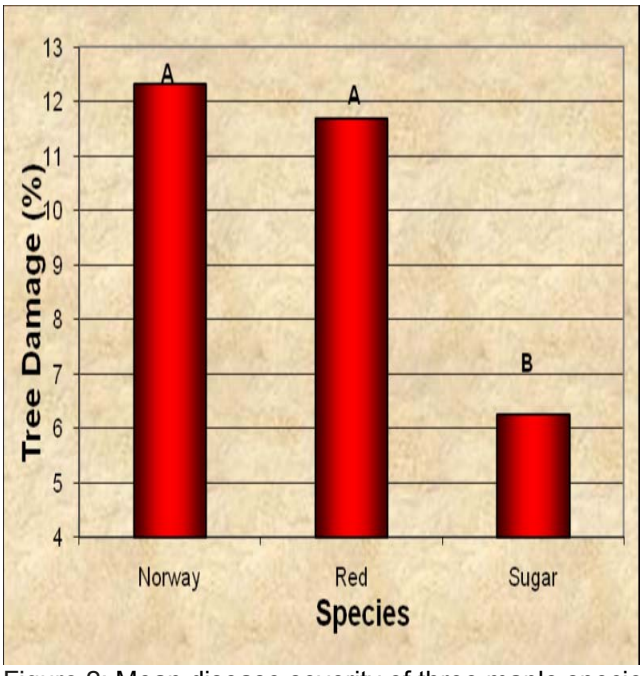


Figure 2: Mean disease severity of three maple species. Bars with the same letter are not significantly different (P=0.05).

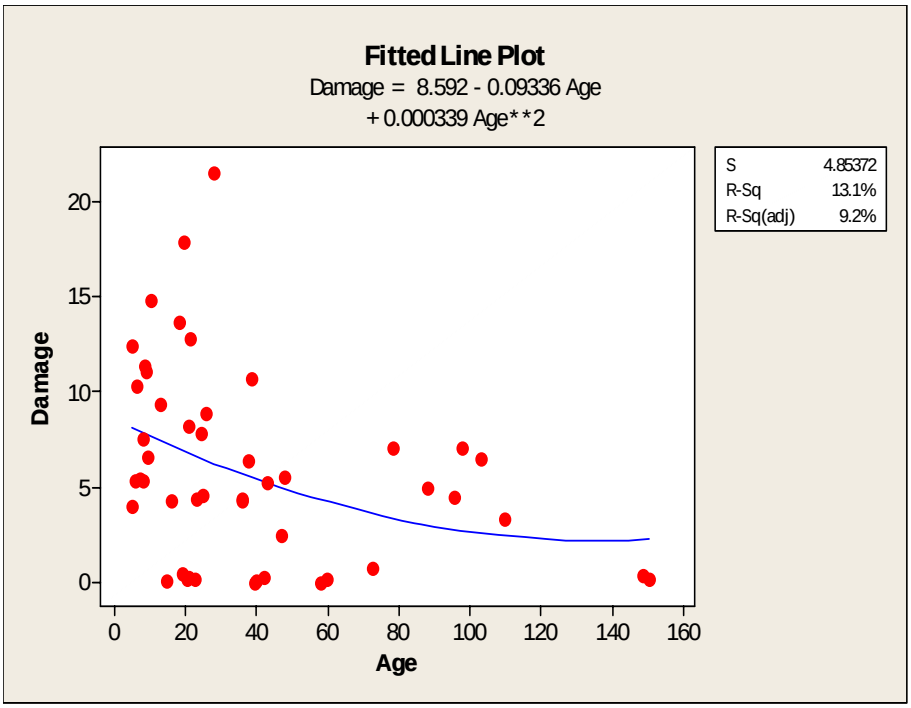


Figure 3: Relationship between age and disease severity in all species.

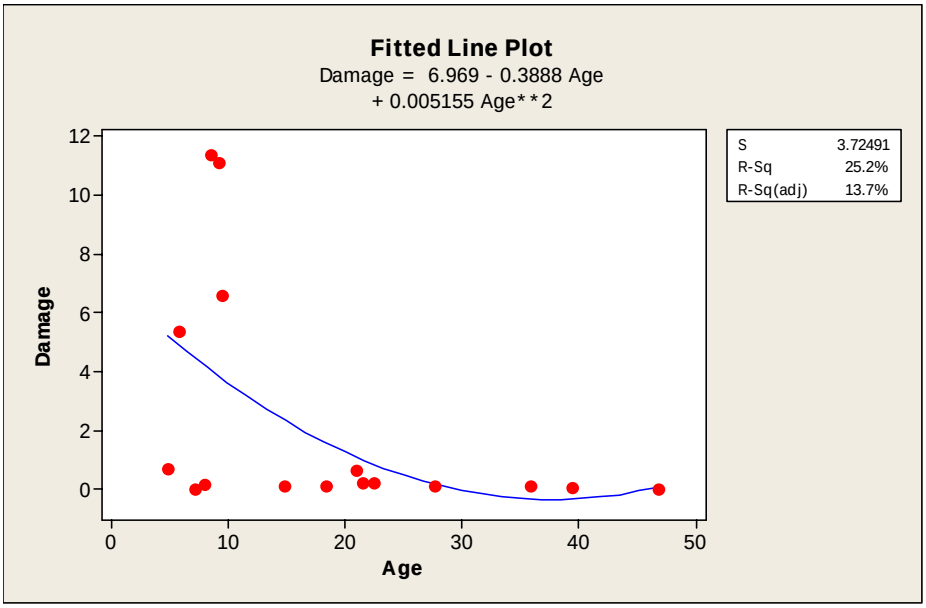


Figure 4: Relationship between age and disease severity in red maple.

LIST OF CPDS AUTHORS IN ALPHABETICAL ORDER

LIST OF FIGURES