2015

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

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Inventaire des maladies des plantes au Canada

IMPC Volume 95: 1 - 190 (2015)
Avril 2015

Contents: **DISEASE HIGHLIGHTS** - 2014 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.

Deidre Wasyliw, Compiler
Department of Biology
112 Science Place
Saskatoon, Saskatchewan, S7N 5E2
Tel. (306) 966-4455
Email: deidre.wasyliw@usask.ca

Deidre Wasyliw, Compilateur
Department of Biology
112 Science Place
Saskatoon, Saskatchewan, S7N 5E2
Tél. (306) 966-4455
Courriel: deidre.wasyliw@usask.ca

2015 CPDS SECTION EDITORS AND ADDRESSES

SECTION	EDITORS AND ADDRESSES
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CEREALS / CÉRÉALES	Dr. Andy Tekauz Agriculture and Agri-Food Canada Cereal Research Centre 195 Dafoe Road Winnipeg, Manitoba (retired) Email: mantek@mts.net
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VEGETABLES /LÉGUMES	Dr. Mary Ruth McDonald Department of Plant Agriculture University of Guelph 50 Stone Road East Guelph, Ontario N1G 2W1 Tel: (519) 824-4120 ext. 52791 Fax: (519) 763-8933 Email: mrmcdon@uoguelph.ca
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DIAGNOSTIC LABORATORIES/ LABORATOIRES DIAGNOSTIQUES

CEREALS/CÉRÉALES

Diagnostic Laboratories /Laboratoires Diagnostiques

CROP: Commercial Crops – Plant Health Laboratory Report
LOCATION: British Columbia

NAMES AND AGENCIES:
Vippen Joshi[1], P.Ag. (Plant Diagnostic Pathologist), Maria Jeffries[1], P.Ag. (Plant Health Coordinator) and Gayle Jesperson[2], P.Ag. (Plant Pathologist).
Corresponding author Vippen.Joshi@gov.bc.ca ,Plant Health Laboratory, Plant and Animal Health Branch BC Ministry of Agriculture,[1]Abbotsford Agriculture Centre, 1767 Angus Campbell Road Abbotsford BC V3G 2M3 **Telephone:** (604) 556-3128; **Facsimile:** (604) 556-3154,
Web page: www.al.gov.bc.ca/cropprot/lab.htm, [2]1690 Powick Road, Kelowna BC V1X 7G5

TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BRITISH COLUMBIA MINISTRY OF AGRICULTURE PLANT HEALTH LABORATORY IN 2014

ABSTRACT: The B.C. Ministry of Agriculture Plant Health Laboratory provides diagnoses and disease management information for diseases caused by fungi, bacteria, viruses, plant parasitic nematodes and insect pests of agricultural crops grown in British Columbia. In 2014, the laboratory received 960 samples of Christmas trees, field crops, greenhouse vegetable and floriculture crops, herbaceous and woody ornamentals, small fruit, tree fruit and specialty crop samples for diagnosis. A few new disease detections for B.C. included a rhabdovirus in *Euonymus japonicus*, crown and root rot associated with *Cylindrocarpon* sp. in rhubarb and *Cucumber green mottle mosaic virus* in greenhouse cucumber. These detections were confirmed by molecular tests. The high number of *Tobacco mosaic virus* detections in petunia and supertunia was due to an outbreak in the facility of a major wholesale plug supplier in El Salvador that distributed stock in North America. Quick actions taken by the industry prevented major losses and spread of this virus in the floriculture industry.

METHODS: The B.C. Ministry of Agriculture Plant Health Laboratory provides diagnoses and disease management information for diseases caused by fungi, bacteria, viruses, plant parasitic nematodes, and insect pests of agricultural crops grown in British Columbia. The following data reflect samples submitted to the laboratory by ministry staff, growers, agri-businesses, municipalities and master gardeners. Diagnoses were accomplished by microscopic examination, culturing on 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 (polymerase chain reactions (PCR) – conventional and/or real time – were used for some species-specific diagnoses.
Electron microscopic examination was performed on samples with unknown virus-like symptoms. Some specimens were referred to other laboratories for identification or confirmation of the diagnosis.

RESULTS AND COMMENTS: The year 2014 started with a normal wet spring but was followed by a long summer with below normal precipitation. Although weather conditions in the spring and fall were suitable for the development of fungal and bacterial diseases, high incidences of bacterial and fungal diseases did not develop. The lab received 960 samples between January 1 and November 30, 2014. Summaries of diseases and their causal agents diagnosed on crop samples submitted to the laboratory are presented in Tables 1-12 by crop category. The total number of submissions for each crop category is indicated at the bottom of each table. Problems not listed include: abiotic disorders such as nutritional stress, pH imbalance, water stress, drought stress, physiological response to growing conditions, 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. The data are based on observations of symptoms in the sample. New host/pathogen detections have not been confirmed by Koch's postulates. Where possible, such detections were confirmed by more than one test.

Table 1.0 Summary of diseases diagnosed on **Christmas tree** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Abies	Needle blight	*Rhizosphaera pini*	1
Abies procera	Needle blight	*Rhizosphaera pini*	1
	Needle blight	*Rhizosphaera kalkhoffii*	2

DISEASED SAMPLES	4
ABIOTIC AND OTHER SYMPTOMS	1
TOTAL SAMPLES	5

Table 2.0 Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Myosotis	Nematode damage	*Pratylenchus* sp.	1
	Root rot	Oomycete	1
Blechnum spicant	Root rot	Oomycete	1
Canna	Yellow streaking on leaf	*Canna yellow mottle virus*	1
Chrysanthemum	Ray speck	*Stemphylium* sp. and *Alternaria* sp.	1
Cosmos	White smut	*Entyloma* sp.	1
Dandelion	Botrytis blight	*Botrytis cinerea*	1
Euphorbia pulcherrima	Root rot	*Pythium* sp.	1
Heliotrope	Root rot	*Phytophthora* sp.	1
Hosta	Leaf Mosaic	*Hosta virus X*	4
	Leaf mottling	*Arabis mosaic virus*	1
	Leaf spot	*Cladosporium* sp.	5
Lavandula	Leaf blight	*Alternaria* sp.	1
Narcissus	Penicillium bulb rot	*Penicillium* sp.	1
Pelargonium	Root rot	*Pythium* sp.	1
	Root rot	*Thielaviopsis basicola*	1
Petunia	Tobacco mosaic	*Tobacco mosaic virus* (TMV)*	20
Phlox subulata	Botrytis blight	*Botrytis cinerea*	1
	Leaf blight	*Ramularia* sp.	2
	Leaf spot	*Alternaria* sp.	1
	Root rot	Oomycete	1
	Root rot	*Thielaviopsis basicola*	1
Phyllitis scolopendrium	Rhizoctonia blight	*Rhizoctonia solani*	1
Salvia	Bacterial blight	*Pseudomonas syringae*	1
Tagetes	White mold	*Sclerotinia sclerotiorum*	1

Note* --An outbreak of TMV occurred in EI Salvador and North America and an estimated 15 million cuttings were suspected to be infected with this virus. In B.C. samples were submitted by three major greenhouses and some 20/127 were found to be infected.

DISEASED SAMPLES	52
ABIOTIC AND OTHER SYMPTOMS	117
TOTAL SAMPLES	169

Table 3.0 Summary of diseases diagnosed on **forest nursery** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Abies	Needle tip dieback	*Alternaria* sp.	1
Pinus	Botrytis blight	*Botrytis cinerea*	1
Pseudotsuga menziesii	Root rot	*Pythium* sp.	1

DISEASED SAMPLES	3
ABIOTIC AND OTHER SYMPTOMS	4
TOTAL SAMPLES	7

Table 4.0 Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Cucumber	Leaf mottling	*Cucumber green mottle mosaic virus**	2
Lettuce	Root rot	*Pythium* sp.	1

Note* - First detection In B.C.

DISEASED SAMPLES	3
ABIOTIC AND OTHER SYMPTOMS	1
TOTAL SAMPLES	4

Table 5.0 Summary of diseases diagnosed on **herbaceous perennial ornamental** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Ajuga	Botrytis blight	*Botrytis cinerea*	1
Buxus	Boxwood blight	*Cylindrocladium pseudonaviculatum*	4
	Foliar blight	*Clonostachys* sp.	1
	Volutella blight	*Volutella buxi*	4
Buxus suffruticosa	Foliar blight	*Clonostachys* sp.	1
	Volutella blight	*Volutella buxi*	1
Dianthus	Anthracnose	*Colletotrichum* sp.	1
	Foliar blight	*Alternaria* sp. and C*ladosporium* sp.	1
Euonymus japonicus	Vein yellowing and chlorosis	Rhabdovirus*	1
Helleborus	Root rot	*Phytophthora* sp.	1
Holboellia coriacea	Root rot	Oomycete	1
	Root rot	*Thielaviopsis basicola*	1
Ornamental grass	Ergot	*Claviceps purpurea*	1
Paeonia	Leaf spot	*Septoria* sp.	1
	Nematode damage	*Meloidogyne* sp.	1

Note * First detection of this virus in this host in B.C. Results were confirmed by electron microscopic examination of the symptomatic leaf tissue.

DISEASED SAMPLES	09
ABIOTIC AND OTHER SYMPTOMS	04
TOTAL SAMPLES	13

Table 6.0 Summary of diseases diagnosed on **mushroom** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Mushroom	Green mold	*Trichoderma aggresivium*	1

DISEASED SAMPLES	1
ABIOTIC AND OTHER SYMPTOMS	0
TOTAL SAMPLES	1

Table 7.0 Summary of diseases diagnosed on **small fruit (berry crop)** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Blackberry	Anthracnose	*Colletotrichum gloeosporioides*	1
	Anthracnose	*Sphaceloma necator*	1
	Botrytis fruit rot	*Botrytis cinerea*	1
	Cane blight	*Coniothyrium fuckelii*	1
	Fruit rot	*Alternaria* sp. and *Cladosporium* sp.	1
	Fruit rot	*Botrytis cinerea*	1
	Spur blight	*Didymella applanata*	1
Blueberry	Anthracnose	*Colletotrichum acutatum*	2
	Armillaria root rot	*Armillaria nabsnona*	4
	Armillaria root rot	*Armillaria* spp.	7
	Bacterial blight	*Pseudomonas syringae*	2
	Blueberry scorch	*Blueberry scorch virus*	5
	Blueberry shock	*Blueberry shock virus*	5
	Botrytis dieback	*Botrytis cinerea*	1
	Botrytis leaf spot	*Botrytis cinerea*	1
	Crown gall	*Rhizobium radiobacter*	2
	Fruit rot	*Botrytis cinerea*	3
	Fruit rot	*Botrytis cinerea* and *Rhizopus stolonifer*	1
	Godronia canker	*Godronia cassandrae*	3
	Leaf spot	*Botrytis cinerea*	2
	Leaf spot	*Colletotrichum acutatum*	1
	Leaf spot	*Colletotrichum gloeosporioides*	1
	Leaf spot	*Phomopsis* sp.	1
	Phomopsis canker	*Phomopsis* sp.	16
	Root rot	*Phytophthora* sp.	11
	Stem canker	*Coniothyrium* sp.	1
	Tip dieback	*Botrytis cinerea*	1
	Twig canker	*Cytospora* sp. and *Coniothyrium* sp.	1
	Bitter rot	*Colletotrichum acutatum*	1
	Bitter rot	*Colletotrichum gloeosporioides*	4
	Black rot	*Allantophomopsis* sp.	1
	Bud blight	*Coleophoma* sp.	2
	Canker	*Botryodiplodia* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Cranberry	Canker	*Godronia* sp. and *Phomopsis* sp.	1
	Canker	*Phomopsis* sp. and *Fusicoccum* sp.	1
	Cytospora canker	*Cytospora* sp.	2
	Foliar blight	*Phomopsis* sp.	1
	Fruit rot	*Allantophomopsis* sp.	1
	Fruit rot	*Botrytis cinerea*	1
	Fruit rot	*Coleophoma empetri*	1
	Godronia canker	*Godronia* sp.	4
	Leaf spot	*Allantophomopsis* sp.	9
	Leaf spot	*Allantophomopsis sp., Botryosphaeria sp. and Pestalotia* sp.	2
	Leaf spot	*Allantophomopsis* sp*. and Strasseria* sp.	1
	Leaf spot	*Allantophomopsis* sp. and *Coleophoma* sp.	2
	Leaf spot	*Allantophomopsis* sp. and *Godronia* sp.	1
	Leaf spot	*Botryosphaeria* sp.	1
	Leaf spot	*Botryosphaeria* sp*., Allantophomopsis* sp*.* and *Pestalotiopsis* sp.	1
	Leaf spot	*Coleophoma* sp. and *Phomopsis* sp.	1
	Leaf spot	*Phyllosticta* sp.	2
	Leaf spot	*Allantophomopsis* sp., *Macrophoma* sp. and *Strasseria* sp.	1
	Nematode damage	*Paratrichodorus renifer*	2
	Nematode damage	*Paratrichodorus* sp.	3
	Root rot	*Pythium* sp.	1
	Stem and leaf spot	*Colletotrichum gloeosporioides*	1
	Upright dieback	*Phomopsis* sp.	7
	Upright dieback	*Phomopsis* sp. and *Godronia* sp.	1
	Upright dieback	*Phomopsis* sp. and *Colletotricum* sp.	1
	Upright dieback and canker	*Phomopsis* sp. and *Cytospora* sp.	1
Raspberry	Cane blight	*Seimatosporium sp., Botrytis sp. and Didymella* sp.	1
	Crown gall	*Rhizobium radiobacter*	1
	Fruit rot	*Botrytis cinerea*	1
	Nematode damage	*Pratylenchus* sp.	7
	Root rot	*Phytophthora* sp.	3
	Root rot and nematode damage	*Phytophthora* sp. and *Pratylenchus* sp.	2
	Rust	*Gymnosporangium* sp.	1
	Spur blight	*Didymella applanata*	2
Strawberry	Fruit rot	*Botrytis cinerea*	1
	Leaf blotch	*Robillarda* sp. and *Gnomonia comari*	1
	Leaf spot	*Cladosporium* sp., *Alternaria* sp. and *Botrytis* sp.	1
	Powdery mildew	*Sphaerotheca macularis*	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Strawberry	Root rot	*Rhizoctonia fragariae*	1
	Root rot and nematode damage	*Phytophthora* sp. and *Pratylenchus* sp.	1
	Stem rot	*Gnomonia comari*	1
	Verticillium wilt	*Verticillium* sp.	3

DISEASED SAMPLES 173
ABIOTIC AND OTHER SYMPTOMS 279
TOTAL SAMPLES 452

Table 8.0 Summary of diseases diagnosed on **specialty crop** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Basil	Downy mildew	*Peronospora belbahrii*	1
Humulus	Downy mildew	*Pseudoperonospora humuli*	1
Wasabi	Club root	*Plasmodiophora brassicae*	1
	Crown and root rot	*Phytophthora* sp.	2
	Root rot	*Pythium irregulare*	1

DISEASED SAMPLES 6
ABIOTIC AND OTHER SYMPTOMS 1
TOTAL SAMPLES 7

Table 9.0 Summary of diseases diagnosed on **tree fruit** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Apple	European canker	*Nectria galligena*	1
	Fire blight	*Erwinia amylovora*	1
	Leucostoma canker	*Cytospora* sp.	1
Apricot	Crown rot	*Phytophthora* sp.	1
	Peach leaf curl	*Taphrina deformans*	1
Cherry	Bacterial canker	*Pseudomonas syringae* pv. *syringae*	2
	Cherry leaf spot	*Phloeosporella padi*	1
	Fruit rot	*Alternaria alternata*	1
	Rhizopus rot	*Rhizopus stolonifer*	1
Kiwi- seedling	Root rot	*Thielaviopsis basicola*	2
	Root rot	*Phytophthora* sp.	1
Peach	Bacterial canker	*Pseudomonas syringae*	1
	Powdery mildew	*Sphaerotheca pannosa*	1
Pear	Pear trellis rust	*Gymnosporangium fuscum*	3

DISEASED SAMPLES 18
ABIOTIC AND OTHER SYMPTOMS 13
TOTAL SAMPLES 31

Table 10.0 Summary of diseases diagnosed on **golf green, sod and sports field** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Green	Foliar blight	*Leptosphaerulina* sp.	1
	Fusarium patch	*Microdochium nivale*	1
	Nematode damage	*Longidorus* sp. and *Paratylenchus* sp.	1
	Nematode damage	*Meloidogyne* sp., *Helicotylenchus* sp. and *Mesocriconema* sp.	1
	Poor growth	*Meloidogyne* sp. and *Tylenchus* sp.	1
Sod	Downy mildew	*Sclerophthora* sp.	1
	Foliar blight	*Leptosphaerulina* sp.	1

DISEASED SAMPLES	5
ABIOTIC AND OTHER SYMPTOMS	0
TOTAL SAMPLES	5

Table 11.0 Summary of diseases diagnosed on **vegetable** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Beet	Alternaria leaf spot	*Alternaria* sp.	2
	Cercospora leaf spot	*Cercospora beticola*	1
	Root rot	*Fusarium* sp.	1
	Seedling root rot	*Colletotrichum* sp.	1
	Storage rot	*Botrytis* sp., *Fusarium* sp. and *Rhizoctonia* sp.	1
Bok choy	Downy mildew	*Hyaloperonospora parasitica*	1
Cabbage	Soft rot	*Pseudomonas syringae*	1
Carrot	Black root rot	*Thielaviopsis basicola*	2
	Black rot	*Alternaria radicina*	1
	Cavity spot	*Pythium* sp.	1
	Crater rot	*Rhizoctonia solani*	1
	Nematode damage	*Meloidogyne* sp. and *Pratylenchus* sp.	1
	Root rot	*Rhizoctonia solani*	1
Fenugreek	Black root rot	*Thielaviopsis basicola*	1
	Root rot	Oomycete	1
Garlic	Blue mold	*Penicillium* sp.	3
	Bulb rot	*Fusarium proliferatum*	1
	Embellisia skin blotch	*Embellisia allii*	5
	Embellisia skin blotch	*Embellisia allii and Penicillium* sp.	1
	Nematode damage	*Paratylenchus* sp., *Heterodera* sp. and *Ditylenchus* sp.	1
	Purple blotch	*Alternaria* sp.	1
	White rot	*Sclerotium cepivorum*	3
Lettuce	Powdery mildew	*Erysiphe cichoracearum*	1
	Root rot	*Pratylenchus* sp.	1
	Root rot	*Cylindrocarpon* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Onion	Downy mildew	*Peronospora destructor*	1
Pea	Fusarium wilt	*Fusarium oxysporum*	3
	Root rot	*Pythium sylvaticum*	2
Pepper	Alternaria rot	*Alternaria* sp.	2
	Botrytis rot	*Botrytis cinerea*	2
Potato	Black dot	*Colletotrichum coccodes*	3
	Black pit	*Alternaria alternata*	1
	Black scurf	*Rhizoctonia solani*	5
	Corky ring spot	*Tobacco rattle virus*	1
	Elephant hide	*Rhizoctonia* sp. and abiotic factors	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Potato scab	*Streptomyces scabies*	1
	Silver scurf	*Helminthosporium solani*	5
	Soft rot	*Pectobacterium carotovorum* ss. *carotovorum*	2
	Tuber rot	*Fusarium* sp.	1
	Verticillium wilt	*Verticillium* sp.	2
Rhubarb	Crown and root rot	*Cylindrocarpon* sp.	2
	Crown rot	*Cylindrocarpon liriodendri*	1
	Nematode damage	*Pratylenchus* sp.	1
	Nematode damage	Pratylenchus sp. and *Paratylenchus* sp.	1
Squash	Leaf blight	*Alternaria cucumerina*	1
Turnip	Storage rot	*Rhizoctonia* sp. and *Geotrichum* sp.	1

DISEASED SAMPLES	67
ABIOTIC AND OTHER SYMPTOMS	17
TOTAL SAMPLES	84

Table 12.0 Summary of diseases diagnosed on **woody ornamental** samples submitted to the B.C. Ministry of Agriculture Plant Health Laboratory in 2014.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Abies	Needle blight	*Rhizosphaeria kalkhoffii*	1
Acer	Anthracnose	*Discula* sp.	1
	Armillaria root rot	*Armillaria nabsnona*	1
	Leaf spot	*Alternaria alternata*	1
	Trunk canker	*Hypoxylon mammatum*	1
	Twig canker	*Phomopsis* sp.	1
Acer macrophyllum	Canker	*Hypoxylon* sp.	1
Acer rubrum	Anthracnose	*Kabatiella* sp.	2
	Bacterial blight	*Pseudomonas syringae*	1
	Leaf spot	*Hendersonia* sp.	1
Acer saccharum	Anthracnose	*Discula* sp.	1
Aesculus	Leaf blotch	*Guignardia aesculi*	1
Alnus	Root rot	*Phytophthora* sp.	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Arbutus	Leaf spot	*Phyllosticta* sp.	1
	Leaf spot	*Seimatosporium arbuti*	1
	Speckled tar spot	*Rhytisma arbuti*	1
Arctostaphylos	Root rot	*Thielaviopsis basicola*	1
Buxus	Foliar blight	*Clonostachys* sp.	3
	Phomopsis dieback	*Phomopsis* sp.	1
	Root rot	*Phytophthora* sp.	1
	Volutella blight	*Volutella buxi*	6
Calluna	Thread blight	*Rhizoctonia solani*	1
Camellia	Twig dieback	*Colletotrichum gloeosporioides*	1
	Leaf spot	*Pestalotia* sp.	1
Caragana	Black root rot	*Thielaviopsis basicola*	5
	Root rot	*Phytophthora* sp.	1
Carpinus betulus	Silver leaf	*Chondrostereum purpureum*	1
	Stem canker	*Coniothyrium* sp.	1
Catalpa	Anthracnose	*Colletotrichum gloeosporioides*	1
	Leaf spot	*Phyllosticta* sp.	1
Cercis canadensis	Botryosphaeria dieback	*Botryosphaeria* sp.	1
Chamaecyparis	Root rot	*Phytophthora* sp.	1
Cornus	Anthracnose	*Discula destructiva*	2
Cornus argentea	Twig dieback	*Phoma* sp.	1
Cornus nuttallii	Anthracnose	*Discula destructiva*	1
	Powdery mildew	*Microsphaera* sp.	1
Corylus avellana	Eastern filbert blight	*Anisogramma anomala*	1
	Leaf spot	*Phyllosticta* sp.	1
Corylus cornuta	Leaf spot	*Septoria ostryae*	1
Crataegus	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	1
Euonymus	Leaf spot	*Colletotrichum* sp.	1
	Twig dieback	*Phomopsis* sp.	1
Euonymus alatus	Twig dieback	*Phomopsis* sp.	1
Hydrangea	Root rot	*Pythium* sp. and *Rhizoctonia* sp.	1
	Root rot	*Rhizoctonia* sp.	1
	Stem lesion	*Phoma* sp.	1
Ilex crenata	Root rot	*Armillaria nabsnona*	1
Juniperus	Foliar blight	*Lophodermium* sp.	2
Lonicera caerulea	Stem canker	*Phoma* sp.	1
Magnolia	Bacterial blight	*Pseudomonas syringae*	2
Magnolia soulangeana	Root rot	*Pythium* sp.	1
Malus	Alternaria leaf spot	*Alternaria* sp.	4
	Apple scab	*Venturia inaequalis*	3
	Bacterial blight	*Pseudomonas syringae*	1
	Leaf spot	*Alternaria alternata*	1

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Philadelphus	Root rot	*Thielaviopsis basicola*	1
	Stem dieback	*Colletotrichum* sp.	1
Pieris japonica	Die-back	*Phomopsis* sp.	1
Pinus latifolia	Needle cast	*Lophodermium* sp.	1
Populus	Shoot blight	*Venturia populina*	1
Prunus	Crown rot	*Phytophthora* sp.	1
	Nematode damage	*Pratylenchus* sp.	1
	Root rot	*Phytophthora* sp.	1
Prunus cerasus	Root rot	*Thielaviopsis basicola*	1
Prunus maackii	Root rot	*Phytophthora* sp.	1
Rhododendron	Anthracnose	*Colletotrichum* sp.	1
	Foliar blight	*Phytophthora* sp.	1
	Leaf spot	*Phomopsis* sp.	1
	Leaf spot and blight	*Rhytisma* sp., *Colletotrichum* sp. and *Diaporthe* sp.	1
Rosa	Downy mildew	*Peronospora sparsa*	1
Salix	Black canker	*Glomerella cingulata*	2
	Twig dieback	*Phoma* sp.	1
Sambucus	Black root rot	*Thielaviopsis basicola*	1
Sequiodendron	Needle blight	*Pestalotiopsis* sp.	1
Skimmia rubella	Black root rot	*Thielaviopsis basicola*	1
Syringa	Leaf spot	*Phyllosticta* sp.	1
	Root rot	*Phytophthora* sp.	1
Taxus	Root rot	*Phytophthora* sp.	2
	Shoot and leaf blight	*Phyllosticta hysterella*	1
Taxus baccata	Root rot	*Phytophthora* sp.	1
Thuja	Coryneum blight	*Seiridium cardinale*	1
	Foliar blight	*Pestalotiopsis* sp.	2
	Root rot	*Phytophthora* sp.	1
Thuja excelsa	Coryneum blight	*Seiridium cardinale*	1
	Keithia blight	*Didymascella thujina*	1
Thuja occidentalis	Foliar blight	*Pestalotiopsis* sp.	2
Thuja plicata	Foliar blight	*Pestalotiopsis* sp.	3
Ulmus brandon	Stem canker	*Phoma exigua*	1
Viburnum	Leaf spot	*Phyllosticta* sp.	1
Weigela	Root rot	*Rhizoctonia* sp.	1
	Stem lesion	*Lophodermium* sp.	1

DISEASED SAMPLES	115
ABIOTIC AND OTHER SYMPTOMS	42
TOTAL SAMPLES	157

CROPS: Commercial Ornamental Nursery and Landscape Crops - Diagnostic Laboratory Report
LOCATION: British Columbia

NAMES AND AGENCY: Janice Elmhirst[1] and Valerie Karlsson[2]
[1]Elmhirst Diagnostics & Research, 5727 Riverside Street, Abbotsford BC V4X 1T6
Telephone: 604-820-4075; **Mobile phone**: 604-832-9495; **Email**: janice.elmhirst@shaw.ca
[2]Karlsson Crop Consulting, 32481 Beaver Drive, Mission BC V2V 5R3

TITLE: DISEASES DIAGNOSED ON ORNAMENTAL NURSERY AND LANDSCAPE CROPS IN 2014

ABSTRACT: Diseases of commercial nursery and landscape ornamental crops and causal agents identified by Elmhirst Diagnostics & Research and Karlsson Crop Consulting in coastal British Columbia in 2014 are listed. *Cercospora rosicola* was confirmed on three hybrid rose varieties at a commercial nursery in 2014. There is one previous report of this fungus causing leaf spot of rose in British Columbia (Toms, H. N. W., CPDS 1964 Vol. 44, Issue 3, page 176) cited in Ginns, J. H. 1986. Compendium of Plant Disease and Decay Fungi in Canada 1960–1980: 6a BC [1816]. This article also includes the first report of box blight (*Cylindrocladium buxicola*) on *Sarcococca* in British Columbia. The disease was confirmed in a landscape planting of *Sarcococca hookeriana* var. *humilis* adjacent to infected boxwood. All of the plants have been removed.

METHODS: Elmhirst Diagnostics & Research (EDR) provides diagnosis of diseases of commercial horticultural crops in British Columbia caused by fungi, bacteria, viruses, plant parasitic nematodes, arthropod and mite pests and abiotic factors. Laboratory diagnostic services are provided in conjunction with on- site diagnostic consultations. Diagnosis is performed primarily by association of known symptoms with the presence of a pathogen known to cause the symptoms, identified by microscopic examination. If the diagnosis is uncertain or further identification or confirmation is needed, fungal and bacterial pathogens are isolated in pure culture for further examination of morphological characteristics, or plant tissue or cultured specimens are sent to other laboratories for identification by ELISA, PCR or DNA sequencing.

RESULTS AND COMMENTS: A summary of diseases and causal agents diagnosed on ornamental crops is presented in Table 1. Problems caused by abiotic factors, *i.e.,* nutrient or pH imbalance, water stress, physiological response to growing conditions, genetic abnormalities and environmental and chemical stresses including herbicide damage, are not included.

Table 1: Diseases diagnosed in 2014 on commercial ornamental nursery crops in British Columbia by Elmhirst Diagnostics & Research and Karlsson Crop Consulting.

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Arctostaphylos uva-ursi	Anthracnose	*Colletotrichum gloeosporioides*	1
Arctostaphylos uva-ursi	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Buxus sempervirens 'Suffruticosa'	Box blight	*Cylindrocladium buxicola*	1
Buxus sempervirens 'Suffruticosa'	Volutella blight	*Volutella buxi*	1
Buxus sinica x sempervirens 'Green Velvet'	Box blight	*Cylindrocladium buxicola*	1
Buxus sinica x sempervirens 'Green Velvet'	Volutella blight / fungal leaf spot	*Volutella buxi* / *Fusarium* sp.	2
Calluna vulgaris	Rhizoctonia blight / dieback	*Rhizoctonia solani* / *Fusarium solani*	1
Calluna vulgaris	Web blight	*Rhizoctonia solani*	1

(Table 1 contd.)			
Camellia sp.	Fungal leaf spot	*Pestalotia* sp.	1
Choisya ternata 'Sundance'	Fungal leaf spot	*Botrytis cinerea*	1
Colocasia esculenta 'Blue Hawaii'	Crown and root rot	*Pythium* sp. / *Fusarium* sp.	1
Corylus cornuta	Fungal leaf spot	*Septoria corylina*	1
Cupressus sp.	Phomopsis blight	*Phomopsis juniperovora*	1
Daphne x *transatlantica* 'Jim's Pride'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Dianthus caryophyllus	Stem rot	*Fusarium* sp.	1
Erica carnea 'Kramer's Red'	Leaf dieback / stem canker / root rot	*Rhizoctonia solani* / *Phytophthora* sp.	1
Erica x *darleyensis* 'Arthur Johnson'	Fungal blight / dieback	*Rhizoctonia solani*	1
Escallonia laevis 'Gold Brian'	Tip blight / grey mold	*Botrytis cinerea*	1
Euonymus fortunei	Bacterial leaf spot	*Pseudomonas syringae*	1
Euonymus japonicus	Bacterial leaf spot	*Pseudomonas syringae*	1
Euonymus japonicus	Vein-clearing, "oak-leaf" distortion	Euonymus virus (rhabdovirus) (suspected)	1
Forsythia x intermedia	Botrytis blight	*Botrytis cinerea*	1
Gardenia jasminoides 'Summer Snow'	Fungal leaf spot	*Cladosporium* sp.	1
Gaultheria shallon	Anthracnose	*Colletotrichum acutatum*	1
Hosta 'Hotspur', 'Moonstruck'	Transparent leaf edges / bacterial soft rot	*Erwinia* sp.	2
Hydrangea macrophylla	Leaf spot	*Ascochyta hydrangeae*	1
Juniperus horizontalis 'Gold Strike'	Root rot / shoot blight	*Phytophthora* sp./ *Phomopsis* sp.	1
Juniperus squamata 'Blue Star'	Root rot	*Phytophthora* sp.	1
Lavandula stoechas	Stem canker / stem rot	*Botrytis cinerea*	1
Lavatera maritima	Rust	*Puccinia malvacearum*	1
Lonicera caerulea edulis 'Honey Bee'	Crown and root rot	*Phytophthora* sp.	1
Magnolia x soulangeana 'Susan'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Pachysandra terminalis	Volutella blight / root rot	*Volutella pachysandrae* / *Pythium* sp.	1
Phyllitis scolopendrium	Fungal leaf spot / root rot	*Rhizoctonia* sp.	1
Picea glauca albertiana 'Conica'	Root rot / environmental damage	*Pythium* sp. / *Phytophthora* sp.	1
Picea glauca 'Jean's Dilly'	Needle blight / environmental damage	*Sclerophoma pithyophila*	1
Rheum x cultorum 'Strawberry'	Crown and root rot / bacterial soft rot	*Pythium* sp. and bacterial soft rot	1
Rhododendron sp.	Powdery mildew	*Erysiphe azaleae*	1
Rhododendron (azalea) 'Golden Lights', 'Northern Lights'	Crown and root rot	*Phytophthora* sp.	2
Rhododendron x 'PJM'	Crown and root rot	*Phytophthora cinnamomi*	1

(Table 1 contd.) *Rosa* x *hybrida* 'Bros. Grimm Fairy Tale', 'Livin' Easy', 'Easy Does It'	Cercospora leaf spot	*Cercospora rosicola*	3
Rosmarinus officinalis 'Wilma's Gold'	Bacterial blight	*Pseudomonas syringae*	1
Sarcococca hookeriana var. *humilis*	Box blight	*Cylindrocladium buxicola*	1
Schlumbergera sp.	Root rot	*Pythium sp. / Phytophthora sp.*	1
Thuja occidentalis 'Golden Tuffet', 'Rheingold'	Root rot / environmental damage	*Phytophthora* sp.	2
Thuja occidentalis 'Smaragd', 'Emerald'	Root rot / environmental damage	*Pythium* sp. / *Phytophthora* sp.	2
Thuja occidentalis 'Smaragd', 'Emerald'	Twig blight / tip blight	*Phomopsis* spp. / *Pestalotiopsis funerea*	2
Ungi molinae	Fungal leaf spot	unidentified ascomycete	1
Total			**56**

CROPS: Commercial crops – Diagnostic Laboratory Report
LOCATION: Saskatchewan

NAMES AND AGENCIES:
C.O. Peluola[1], F. L. Dokken-Bouchard[2], D.T. Stephens[2], T. Sliva[1], S. Kassir[1] and B. Aryal[1]
[1]Crop Protection Laboratory, Crops and Irrigation Branch, Saskatchewan Ministry of Agriculture, 346 McDonald St., Regina, Saskatchewan S4N 6P6
Telephone: (306) 798-0100; **Facsimile:** (306) 787-8803; **E-mail:** cecilia.peluola@gov.sk.ca
[2]Crops and Irrigation Branch, Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina, Saskatchewan S4S 0B1

TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED IN 2014 TO THE SASKATCHEWAN MINISTRY OF AGRICULTURE CROP PROTECTION LABORATORY

ABSTRACT: Saskatchewan's Crop Protection Laboratory received 612 disease/disorder samples in 2014. The causes were fungi, bacteria, viruses, herbicide injury and environmental stress. Forty-eight percent of the samples were Dutch elm disease or Dothiorella wilt of elm. Common problems diagnosed included root rot of pulses and cereals, herbicide injury on oilseeds and excess soil moisture or 'wet feet' on major field crops.

METHODS: The Saskatchewan Ministry of Agriculture's Crop Protection Laboratory (CPL) provides diagnostic services to the agricultural industry on all crop health problems. Services include disease, insect and weed identification, as well as testing of weed seeds for herbicide resistance. The CPL also provides a Dutch elm disease (DED) service to the general public, under which American elm (*Ulmus americana*) and Siberian elm (*U. pumila*) samples are tested. Samples are submitted to the CPL by personnel from the Saskatchewan Ministry of Agriculture, the Saskatchewan Ministry of Environment, individual growers, crop insurance adjustors, agribusiness representatives and market/home gardeners. Samples have also been received from clients located in Alberta, Manitoba and British Columbia. Diagnosis of fungal plant diseases is performed primarily through visual assessment of plant symptoms, microscopic examination and the isolation of fungal organisms on artificial media. When additional confirmation is needed, disease samples are sent to research laboratories for identification of associated pathogens by other means, such as polymerase chain reaction (PCR). Viral and bacterial diagnoses are based on visible symptoms. ELISA testing is used to identify wheat streak mosaic virus (WSMV), however this virus was not detected in 2014.

RESULTS: A total of 612 disease/disorder samples were submitted to the CPL from April 1 to November 20, 2014. Out of this, 45% (274 samples) were elm samples submitted for DED testing. Categories and percentages of samples received (excluding DED samples) were: cereals (40%), special crops (37%), oilseeds (13%), ornamental shade trees (other than elm) (7%), forages (2%), vegetables (0.6%) and fruit (0.4%). Samples that 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 CPL in 2014 are presented in Tables 1-7 by crop category.

Table 1: Summary of diseases diagnosed on **cereal** crop samples submitted to the Saskatchewan Crop Protection Laboratory in 2014

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Barley	Root rot	*Fusarium* spp., *Cochliobolus sativus*	1
	Chemical injury		5
	Environmental injury	Excess moisture/wet feet	24
	Nutrient deficiency	Nitrogen loss/wet feet	1
Durum wheat	Stem rust	*Puccinia coronata*	1
	Chemical injury		5
	Environmental injury	Excess moisture/wet feet	4
	Nutrient deficiency		2
Oat	Crown rust (leaf)	*Puccinia coronata*	1
	Chemical injury	Group 9 herbicides and others	3
Wheat	Fusarium head blight	*Fusarium* spp.	3
	Tan spot	*Pyrenophora tritici-repentis*	1
	Leaf rust	*Puccinia triticina*	1
	Spot blotch	*Cochliobolus sativus*	1
	Common root rot	*Cochliobolus sativus, Fusarium* sp.	18
	Prematurity blight		1
	Chemical injury	Group 1, 4 or 9 herbicide injury	15
	Chemical injury	Suspected sprayer contamination	2
	Environmental injury	Excess moisture/ wet feet	17
	Nutrient deficiency	Nitrogen deficiency	1
	Physiological leaf spot		5

Table 2: Summary of diseases diagnosed on **specialty crop samples** submitted to the Saskatchewan Crop Protection Laboratory in 2014

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Lentil	Root rot	*Fusarium* spp. *Rhizoctonia solani* *Aphanomyces* sp. / *Pythium* spp.	30
	Anthracnose	*Colletotrichum truncatum*	5
	Environmental injury	Excess moisture/ wet feet	16
	Stemphylium blight	*Stemphylium botryosum*	2
Field pea	Chemical injury	Group 2, 4 or 9 herbicide	5
	Root rot/ seed and stem rot	*Fusarium* spp., *Aphanomyces* sp. / *Pythium* spp., *Rhizoctonia solani*	40
	Mycosphaerella blight	*Mycosphaerella pinodes*	3
	Environmental injury	Excess moisture / wet feet	22
	Fusarium wilt	*Fusarium oxysporum*	1
	Ascochyta leaf and pod spot	*Ascochyta pisi*	4
	White mold	*Sclerotinia sclerotiorum*	1
Chickpea	Grey mold	*Botrytis cinerea*	1
Faba bean	Root rot	*Fusarium* spp., *Rhizoctonia solani*	2
	Chemical injury	Herbicide	2
	Ascochyta blight	*Ascochyta fabae*	2
	Chocolate spot	*Botrytis fabae or B. cinerea*	4
Coriander	Chemical injury	Herbicide	1
	Blossom blight	*Ascochyta* sp.	1
	Powdery mildew	*Erysiphe polygoni*	1

Table 3: Summary of diseases diagnosed on **shade tree samples** submitted to the Saskatchewan Crop Protection Laboratory in 2014

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
American elm	Dutch elm disease	*Ophiostoma novo-ulmi*	134
	Dothiorella wilt	*Dothiorella ulmi*	18
	Elm leaf blight	Undetermined	1
Ash (*Fraxinus* sp.)	Environmental injury	Marginal leaf blotch	1
Maple (*Acer* sp.)	Venturia blight	*Venturia acerina*	1
Spruce (*Picea* sp.)	Environmental injury		1
	Herbicide damage		2
Blue spruce	Environmental /herbicide damage		1
White spruce	Needle cast	*Lophodermium* sp.	1
Pine (*Pinus* sp.)	Needle cast	*Lophodermium* sp.	1
Common Lilac (*Syringa* sp.)	Bacterial blight	*Pseudomonas syringae pv. syringae*.	1
Mayday (*Prunus* sp.)	Leaf blight	Undetermined	1
Linden (*Tilia* sp.)	Leaf blight	Undetermined	1

Table 4: Summary of diseases diagnosed on **oilseed crop samples** submitted to the Saskatchewan Crop Protection laboratory in 2014

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Sulphur deficiency		2
	Blackleg	*Leptosphaeria* spp.	8
	Environmental injury	Excess water/wet feet	2
	Root rot	*Rhizoctonia* sp. / *Fusarium* spp.	6
	Root rot maggot		1
	Fertilizer injury		1
	Grey stem and white spot	*Pseudocercosporella capsellae*	1
	Herbicide injury		19
Flax	Herbicide damage	Group 2 and 9 herbicide	5
	Nutrient deficiency	Nitrogen loss / wet feet	3
	Failed emergence		2
	Root rot	Environmental stress, Fusarium spp	1

Table 5: Summary of diseases diagnosed on **forage crop samples** submitted to the Saskatchewan Crop Protection Laboratory in 2014

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Crown rot	*Rhizoctonia solani*	1
		Fusarium spp.	1
Perennial rye grass	Physiological leaf spot		1
	Environmental injury		1
	Ergot	*Claviceps purpurea*	1
Crested wheat grass	Fusarium head blight	*Fusarium* spp.	2

Table 6: Summary of diseases diagnosed on **vegetable samples** submitted to the Saskatchewan Crop Protection Laboratory in 2014

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Potato	Pink rot	*Phytophthora erythroseptica*	1
	Pythium leak	*Pythium* sp.	1
Tomato	Septoria leaf spot	*Septoria lycopersici*	1
Crested wheat grass	Fusarium head blight	*Fusarium* spp.	2

Table 7: Summary of diseases diagnosed on **fruit samples** submitted to the Saskatchewan Crop Protection Laboratory in 2014

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Fire blight	*Erwinia amylovora*	1
Watermelon	Angular leaf spot	*Pseudomonas lachrymans*	1

CROP: Diagnostic Laboratory Report
LOCATION: Manitoba

NAME AND AGENCY:
M.L. Desjardins[1], M. Pradhan[1], V. Bisht[2], Holly Derksen[2]
[1]Manitoba Agriculture, Food and Rural Development, Crop Diagnostic Centre, 545 University Crescent, Winnipeg MB R3T 5S6 **Telephone:** (204) 945-7707; **Facsimile:** (204) 945-4327; **E-mail:** manika.pradhan@gov.mb.ca
[2]Manitoba Agriculture, Food and Rural Development, Crops Knowledge Centre, Crops Branch, Box 1149, Carman MB R0G 0J0

TITLE: 2014 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

ABSTRACT: Diseases and disorders of plants analyzed by the Manitoba Crop Diagnostic Centre were recorded for the year 2014. Samples received by the laboratory covered most crops grown in Manitoba and included ornamentals.

METHODS: The Manitoba Agriculture, Food and Rural Development (MAFRD) Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by MAFRD extension staff, farmers, agri-business and the general public. Samples of elm, suspicious for Dutch elm disease (DED), are submitted by city staff and the general public, for testing under the city of Winnipeg Dutch Elm Disease Management Program. Diagnosis is based on visual examination for symptoms, microscopy, culturing onto artificial media, and ELISA testing for some pathogens.

RESULTS: 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 30, 2014. For the 2014 year, disease issues of note were the first detection of plectosporium blight in pumpkin, first detection of leaf and stem spot of quinoa caused by *Pleospora chenopodii* and first detection of verticillium wilt in canola caused by *Verticillium longisporum*. A total of 130 elms were submitted under the Dutch Elm Disease Management Program with 81 found positive for DED.

Table 1. Summary of diseases diagnosed on **herbaceous ornamentals** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Petunia	Root rot	*Pythium* sp.	1
	Stem blight	*Botrytis cinerea*	1

Table 2. Summary of diseases diagnosed on **greenhouse crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Cucumber	Fruit rot	*Fusarium semitectum*	1
	Stem rot	*Sclerotinia sclerotiorum*	1
Dahlia	Powdery mildew	*Erysiphe* sp.	1
Pepper	Nutrient deficiency		1
Tomato	Stem canker	*Rhizoctonia solani*	1
	Stem rot	*Sclerotinia sclerotiorum*	1
	Physiological disorder		1
	Nutrient deficiency		2
	Herbicide injury		2
Zucchini (seedlings)	Blight	*Botrytis cinerea*	1

Table 3. Summary of diseases diagnosed on **cereal crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Wheat	Bacterial leaf blight	*Pseudomonas syringae* pv. *syringae*	13
	Black head moulds	*Epicoccum nigrum*, *Alternaria* spp.	2
	Black point	*Alternaria* sp., *Cladosporium* sp., *Epicoccum nigrum*	2
	Common root rot	*Cochliobolus sativus*	2
	Fusarium head blight	*Fusarium* spp.	9
	Glume blotch	*Septoria* sp.	3
	Leaf spot	*Septoria* sp.	5
	Powdery mildew	*Blumeria graminis*	2
	Root rot	*Fusarium* spp., Pythium sp., *Rhizoctonia solani*	7
	Root rot	*Rhizoctonia solani*	1
	Tan spot	*Pyrenophora tritici-repentis*	21
	Wheat streak mosaic	Wheat Streak Mosaic Virus (WSMV)	1
	Physiological disorders	Undetermined	2
	Physiological leaf spot	Chloride deficiency	6
	Herbicide injury		6
	Nutrient deficiency		4
Barley	Anthracnose	*Colletotrichum graminicola*	1
	Black head moulds	*Epicoccum* sp., *Alternaria* sp.	1
	Common root rot	*Cochliobolus sativus*	1
	Leaf spot	*Septoria* sp.	2
	Net blotch	*Drechslera teres*	2
	Root rot	*Pythium* sp.	1
	Spot blotch	*Bipolaris sorokiniana*	1
	Tan spot	*Pyrenophora tritici-repentis*	1
	Herbicide injury		1
	Environmental injury		1
	Physiological disorder	Undetermined	2
Oat	Bacterial blight	*Pseudomonas syringae*	3
	Fusarium head blight	*Fusarium* spp.	2
	Pyrenophora leaf blotch	*Pyrenophora avenae*	4
	Root rot	*Fusarium* spp.	1
	Septoria leaf spot	*Septoria* sp.	2
	Physiological disorder	Undetermined	1
	Blast	Environmental stress	3
	Environmental injury		1
	Herbicide injury		1
Rye	Leaf spot	*Septoria* sp.	1
	Herbicide injury		1

Table 4. Summary of diseases diagnosed on **vegetable crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bean	Common bacterial blight	*Xanthomonas axonopodis* pv. *phaseoli*	1
	Halo blight	*Pseudomonas syringae* pv. *phaseolicola*	1
	Root rot	*Rhizoctonia solani, Fusarium* spp.	1
Cabbage	Blackleg	*Phoma lingam*	1
Okra	Root rot	*Fusarium oxysporum, Pythium* sp.	1
Onion	Bacterial rot	Undetermined	1
	Neck rot	*Botrytis allii*	1
	Purple blotch	*Alternaria porri*	1
Pea	Root rot	*Fusarium* spp.	1
Pumpkin	Plectosporium blight	*Plectosporium tabacinum*	1
	Fruit abortion	Physiological stress	1
Rutabaga	Blackleg	*Phoma lingam*	1
Squash	Bacterial fruit spot	*Pseudomonas syringae*	1
Tomato	Anthracnose	*Colletotrichum coccodes*	1
	Early blight	*Alternaria solani*	1
	Herbicide injury		2
Zucchini	Fruit rot	*Phomopsis* sp., *Fusarium* sp.	1

Table 5. Summary of diseases diagnosed on **potato crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	4
Black dot (tuber)	*Colletotrichum coccodes*	5
Blackheart	Physiological disorder	1
Blackleg	*Pectobacterium carotovorum* subsp. *atrosepticum*	1
Black scurf (tuber)	*Rhizoctonia solani*	1
Brown spot	*Alternaria alternata*	1
Early blight, foliar	*Alternaria solani*	1
Fusarium dry rot	*Fusarium sambucinum*	1
Internal sprouting	*Physiological disorder*	1
Leak	*Pythium ultimum*	7
Pink eye	Unknown	6
Pink rot	*Phytophthora erythroseptica*	12
Root rot	*Rhizoctonia solani, Fusarium* spp.	1
Rubbery rot	*Geotrichum candidum*	3
Scab, common	*Streptomyces* spp.	6
Scab, powdery	*Spongospora subterranea*	4
Silver scurf	*Helminthosporium solani*	4
Tuber internal necrosis	Potato Mop Top Virus (PMTV)	1
Tuber internal necrosis	Tobacco rattle virus (TRV)	1
Physiological disorders		4

Table 6. Summary of diseases diagnosed on **shelterbelt trees** and **woody ornamentals** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Ash (*Fraxinus* sp.)	Anthracnose	*Gloeosporium aridum*	2
	Canker/ twig blight	*Phoma* sp.	1
	Verticillium wilt	*Verticillium* sp.	1
	Herbicide injury		1
	Miscellaneous injuries	Hail injury	1
Basswood (*Tilia americana*)	Canker	*Nectria* sp.	1
Birch (*Betula* sp.)	Canker	*Cytospora* sp.	1
Crabapple	Apple scab	*Venturia inaequalis*	1
	Frogeye leaf spot	*Botryosphaeria obtusa*	1
	Silverleaf	*Chondrostereum purpureum*	1
	Environmental injury		2
	Nutrient deficiency		1
Elm, American (*Ulmus americana*)	Anthracnose	*Gloeosporium ulmicola*	2
	Botryosphaeria canker	*Botryosphaeria* sp.	2
	Coniothyrium canker	*Coniothyrium* sp.	1
	Cytospora canker	*Cytospora* sp.	2
	Dothiorella wilt	*Dothiorella* sp.	1
	Dutch elm disease	*Ophiostoma ulmi*	81
	Verticillium wilt	*Verticillium albo-atrum*	1
	Environmental injury		1
	Herbicide injury		1
Elm, Discovery (*Ulmus davidiana*)	Canker	*Botryodiplodia* sp.	1
Elm, Siberian (*Ulmus pumila*)	Botryosphaeria canker	*Botryosphaeria* sp.	1
	Cytospora canker	*Cytospora* sp.	1
Juniper	Twig blight	*Phomopsis* sp.	1
Larch (*Larix* sp.)	Environmental injury		1
Lilac (*Syringa vulgaris*)	Herbicide injury		1
Lilac, Japanese tree (*Syringa reticulata*)	Canker	Unidentified	1
	Verticillium wilt	*Verticillium albo-atrum*	1
	Herbicide injury		1
Maple, Manitoba (*Acer negundo*)	Herbicide injury		1
Maple, Silver (*Acer saccharinum*)	Environmental injury		1

Table 6 (contd.)

Mountain ash	Iron chlorosis	Nutrient deficiency	1
(*Sorbus* sp.)	Leaf spot	*Phyllosticta* sp.	1
	Environmental stress		1
Oak	Anthracnose	*Discula* sp.	2
(*Quercus*	Canker	*Botryosphaeria* sp.	1
macrocarpa)	Canker	Unidentified	1
	Canker	*Phoma* sp.	1
	Environmental injury		1
Pine, Scots	Needle cast	*Cyclaneusma minus*	1
(*Pinus sylvestris*)	Winter injury	Environmental stress	2
Poplar	Herbicide injury		1
(*Populus* spp.)	Environmental injury		1
Rose	Rust	*Phragmidium* sp.	1
Spruce (*Picea* spp.)	Canker	Unidentified	2
	Canker	*Cytospora* sp.	3
	Needle blight	*Lirula* sp.	1
	Needle cast	*Rhizosphaera kalkhoffii*	1
	Stigmina needle blight	*Stigmina lautii*	10
	Twig blight	*Sphaeropsis* sp.	1
	Twig canker	*Phoma* sp.	1
	Environmental injury		17
	Herbicide injury		1
Willow	Willow scab and black canker	*Venturia saliciperda, Glomerella miyabeana*	1

Table 7. Summary of diseases diagnosed on **oilseed crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Aster yellows	*Candidatus* Phytoplasma asteris	1
	Blackleg	*Leptosphaeria maculans*	56
	Black spot	*Alternaria brassicae*	4
	Downy mildew	*Peronospora parasitica*	2
	Root rot	*Fusarium* sp., *Pythium* sp.	10
	Root rot	*Rhizoctonia solani*	11
	Stem rot	*Sclerotinia sclerotiorum*	5
	Wilt	*Verticillium longisporum*	1
	Nutrient deficiency	Sulphur deficiency	2
	Nutrient deficiency	Undetermined	4
	Physiological disorders	Undetermined	3
	Environmental injury		15
	Herbicide injury		25
Flax	Aster yellows	*Candidatus* Phytoplasmas asteris	1
	Boll blight	*Alternaria linicola*	1
	Fusarium wilt	*Fusarium oxysporum*	3
	Pasmo	*Septoria linicola*	4
	Root rot	*Fusarium oxysporum, Rhizoctonia solani*	2
	Stem rot	*Sclerotinia sclerotiorum*	1
	Environmental injury		1
	Herbicide injury		4
Sunflower	Leaf spot	*Alternaria* sp.	1
	Root rot	*Fusarium* spp.	3
	Rust	*Puccinia helianthi*	2
	Stem canker	*Phomopsis helianthi*	2
	Nutrient deficiency		1
	Herbicide injury		4

Table 8. Summary of diseases diagnosed on **fruit crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Apple scab	*Venturia inaequalis*	1
	Fireblight	*Erwinia amylovora*	4
	Leaf spot	*Phyllosticta* sp.	1
	Twig canker	*Botryosphaeria obtusa*	1
	Environmental injury		1
	Nutrient deficiency		1
Currant, red	Downy mildew	*Plasmopara ribicola*	1
Grape	Flower blight	*Botrytis cinerea*	1
	Herbicide injury		1
Pear	Iron chlorosis	Nutrient deficiency	1
Raspberry	Anthracnose	*Elsinoë veneta*	1
	Bacterial blight	*Pseudomonas syringae*	1
	Root rot	*Pythium* sp., *Fusarium* spp., *Cylindrocarpon destructans*	1
	Iron chlorosis	Nutrient deficiency	2
Saskatoon berry	Rust	*Gymnosporangium clavipes*	1
Strawberry	Anthracnose	*Colletotrichum acutatum*	1
	Fruit rot	*Botrytis cinerea*	1
	Root rot	*Rhizoctonia* sp., *Fusarium* spp.	1
	Winter injury	Environmental injury	1

Table 9. Summary of diseases diagnosed on **forage legume crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Brown root rot	*Phoma sclerotioides*	11
	Spring black stem/ leaf spot	*Phoma medicaginis*	1
	Stemphylium leaf spot	*Stemphylium* sp.	1
	Root rot	*Fusarium* spp.	1
	Environmental injury		1

Table 10. Summary of diseases diagnosed on forage grasses and lawn grasses submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Timothy	Environmental injury		1
Turfgrass	Anthracnose	*Colletotrichum graminicola*	1
	Leaf spot	*Bipolaris* sp.	1
	Red thread	*Laetisaria fuciformis*	1

Table 11. Summary of diseases diagnosed on **special field crops** submitted to the MAFRD Crop Diagnostic Centre in 2014.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Corn	Common smut	*Ustilago zeae*	1
	Goss's wilt	*Clavibacter michiganensis* subsp. *nebraskensis*	2
	Holcus spot	*Pseudomonas syringae*	2
	Root rot	*Fusarium* sp.	2
	Yellow leaf blight	*Phyllosticta maydis*	1
	Environmental injury		6
	Herbicide injury		1
	Nutrient deficiency		2
Faba bean	Chocolate spot	*Botrytis* sp.	1
	Root rot	*Fusarium* spp.	1
Field bean	Anthracnose	*Colletotrichum lindemuthianum*	1
	Brown spot	*Pseudomonas syringae* pv. *syringae*	2
	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	2
	Halo blight	*Pseudomonas syringae* pv. *phaseolicola*	1
	Stem breakage	Physiological disorder	1
	Herbicide injury		1
Field pea	Anthracnose	*Colletotrichum pisi*	4
	Bacterial blight	*Pseudomonas syringae* pv. *pisi*	1
	Leaf spot	*Leptosphaerulina* sp.	1
	Leaf spot	*Mycosphaerella pinodes*	1
	Root rot	*Fusarium* spp., *Pythium* sp.	7
	Root rot	*Rhizoctonia solani*	1
Hemp	Brown blight	*Alternaria alternata*	1
	Flower blight	*Fusarium graminearum, F. sporotrichioides*	1
	Root rot	*Fusarium oxysporum, Pythium* sp.	1
	Herbicide injury		1
Quinoa	Leaf and stem spot	*Pleospora chenopodii*	1
Soybean	Alternaria leaf spot	*Alternaria alternata*	3
	Anthracnose	*Colletotrichum* sp.	4
	Bacterial blight	*Pseudomonas* sp.	4
	Brown spot	*Septoria glycines*	16
	Downy mildew	*Peronospora manshurica*	9
	Leaf spot	*Phyllosticta sojicola*	5
	Root rot	*Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*	23
	Root rot	*Phytophthora sojae*	14
	Stem blight	*Phomopsis longicolla*	6
	Stem blight	*Phomopsis* sp.	9
	Environmental injury		9
	Herbicide injury		13
	Nutrient deficiency		6

CROPS: Commercial Crops **-** Diagnostic Laboratory Report
LOCATION: Ontario

NAMES AND AGENCY:
M. Melzer and X. Shan
Pest Diagnostic Clinic, Laboratory Services Division, University of Guelph, 95 Stone Road W, Guelph ON N1H 8J7
Telephone: (519) 823-1268; **Facsimile:** (519) 767-6240; **Email:** xshan@uoguelph.ca
Web page: www.guelphlabservices.com

TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE PEST DIAGNOSTIC CLINIC, UNIVERSITY OF GUELPH IN 2014

ABSTRACT: Diseases and their causal agents diagnosed on plant samples received by the Pest Diagnostic Clinic, University of Guelph in 2014 are summarized in this report. Samples included greenhouse vegetables, annual and perennial ornamental plants, field crops, berry crops, tree fruit, turfgrass and trees.

METHODS: The Pest Diagnostic Clinic of the University of Guelph provides plant pest diagnostic services to growers, agri-businesses, provincial and federal governments and homeowners across Canada. Services include disease diagnosis, plant parasitic nematode identification and enumeration, pathogen detection from soil and water, and insect and plant identification. The following data are for samples received by the laboratory for disease diagnosis in 2014. Diagnoses were accomplished using microscopic examination, culturing on artificial media, biochemical identification of bacteria using BIOLOG®, enzyme-linked immunosorbent assay (ELISA), polymerase chain reaction (PCR) based techniques including DNA multiscan, PCR and RT-PCR and DNA sequencing.

RESULTS AND COMMENTS: In 2014, from January 1 to December 22, the Pest Diagnostic Clinic received samples representing plants in over 100 genera for disease diagnoses. Results are presented in Tables 1 -6 below. For various reasons, the frequency of samples submitted to the laboratory does not reflect the prevalence of diseases of various crops. Problems caused by plant parasitic nematodes, insects and abiotic factors are not listed. Most diseases identified in 2014 are commonly diagnosed.

Table 1. Summary of plant diseases diagnosed on **vegetable** samples (including **greenhouse vegetables**) submitted to the University of Guelph Pest Diagnostic Clinic in 2014.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Broccoli (*Brassica oleracea* var. *botrytis*)	Bacterial head rot	*Pseudomonas viridiflava*	1
Cabbage (*Brassica oleracea* var. *capitata*)	Grey mold	*Botrytis cinerea*	3
	Leaf spot	*Alternaria* sp.	2
	Rot	*Fusarium* sp.	1
Cantaloupe (*Cucumis melo*)	Anthracnose	*Colletotrichum* sp.	1
Caribbean pumpkin (*Cucurbita moschata*)	Anthracnose	*Colletotrichum* sp.	1
Carrot (*Daucus carota*)	Dry rot	*Fusarium* sp.	3
	Root dieback	*Pythium* sp.	1
	Root dieback	*Pythium aphanidermatum*	1
	Root dieback	*Pythium dissotocum*	2
	Root dieback	*Pythium ultimum*	1
	Violet root rot	*Rhizoctonia* sp.	1
Celery (*Apium graveolens*)	Bacterial leaf spot	*Pseudomonas syringae*	1

(Table 1 contd.)			
Celery (*Apium graveolens*)	Leaf curl	*Colletotrichum acutatum*	4
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium ultimum*	1
Cucumber (*Cucumis sativus*)	Angular leaf spot	*Pseudomonas syringae*	1
	Anthracnose	*Colletotrichum* sp.	1
	Crown and root rot	*Pythium aphanidermatum*	4
	Crown and root rot	*Pythium irregulare*	3
	Crown and root rot	*Pythium ultimum*	1
	Cucumber Green Mottle Mosaic Virus	Cucumber Green Mottle Mosaic Virus (CGMMV)	10
	Gummy stem blight	*Didymella bryoniae*	4
	Melon Necrotic Spot Virus	Melon Necrotic Spot Virus (MNSV)	2
	Root rot	*Fusarium* sp.	1
	Root rot	*Fusarium oxysporum*	4
	Root rot	*Pythium* sp.	6
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium dissotocum*	1
	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	1
	Tomato Ringspot Virus	Tomato Ringspot Virus (ToRSV)	1
Eggplant (*Solanum melongena*)	Anthracnose	*Colletotrichum* sp.	1
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Pythium ultimum*	1
	Wilt	*Verticillium dahliae*	1
Garlic (*Allium sativum*)	Anthracnose	*Colletotrichum* sp.	1
	Aster yellows	*Candidatus* Phytoplasma sp.	5
	Botrytis rot	*Botrytis* sp.	1
	Crown and root rot	*Pythium ultimum*	1
	Leaf blight	*Stemphylium* sp.	2
	Plate rot	*Fusarium* sp.	2
	Plate rot	*Fusarium oxysporum*	18
	Plate rot	*Fusarium solani*	14
	Potyvirus	Potyvirus	10
	Root rot	*Pythium* sp.	5
	Root rot	*Pythium dissotocum*	4
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Pythium ultimum*	4
	Crown and root rot	*Rhizoctonia solani*	2
	Skin blotch	*Embellisia allii*	2
Lettuce (*Lactuca sativa*)	Grey mold	*Botrytis cinerea*	2
	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium ultimum*	1
	Crown rot	*Rhizoctonia solani*	2
	Root rot	*Fusarium* sp.	4
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium dissotocum*	2
	Root rot	*Pythium irregulare*	3
	Root rot	*Pythium sylvaticum*	2

(Table 1 contd.)			
Lettuce (*Lactuca sativa*)	Root rot	*Pythium ultimum*	5
	Verticillium wilt	*Verticillium dahliae*	2
Melon (*Cucumis* sp.)	Anthracnose	*Colletotrichum* sp.	1
Onion (*Allium cepa*)	Bacterial soft rot	*Pseudomonas fluorescens*	2
	Bacterial soft rot	*Pseudomonas marginalis*	1
	Leaf blight	*Stemphylium* sp.	2
	Rot	*Pythium intermedium*	2
Parsley (*Petroselinum crispum*)	Root rot	*Pythium* sp.	1
Parsnip (*Pastinaca sativa*)	Leaf spot	*Alternaria* sp.	1
	Root dieback	*Pythium aphanidermatum*	1
	Root dieback	*Pythium irregulare*	1
	Root dieback	*Pythium sylvaticum*	1
	Root dieback	*Pythium ultimum*	1
Pea (*Pisum sativum*)	Anthracnose	*Colletotrichum* sp.	2
	Crown and root rot	*Fusarium solani*	3
	Crown and root rot	*Fusarium oxysporum*	3
	Crown and root rot	*Pythium* sp.	2
	Crown and root rot	*Pythium ultimum*	1
	Crown and root rot	*Rhizoctonia solani*	2
	Root rot	*Thielaviopsis basicola*	1
Pepper (*Capsicum* sp.)	Alfalfa Mosaic Virus	Alfalfa Mosaic Virus (AMV)	3
	Bacterial leaf spot	*Pseudomonas syringae pv. syringae*	1
	Phytophthora blight	*Phytophthora capsici*	1
	Crown and root rot	*Fusarium oxysporum*	3
	Crown and root rot	*Phytophthora capsici*	2
	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium ultimum*	1
	Root rot	*Phytophthora capsici*	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	3
	Root rot	*Rhizoctonia solani*	1
	Stem rot	*Fusarium solani*	1
	White mold	*Sclerotinia sclerotiorum*	2
	Verticillium wilt	*Verticillium dahliae*	2
Potato (*Solanum tuberosum*)	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	1
	Black dot	*Colletotrichum coccodes.*	1
	Black scurf	*Rhizoctonia solani*	2
	Common scab	*Streptomyces scabies*	1
	Dry rot	*Fusarium* sp.	3
	Late blight	*Phytophthora infestans*	3
	Leak	*Pythium ultimum*	1
	Verticillium wilt	*Verticillium dahliae*	1
Pumpkin (*Cucurbita pepo*)	Anthracnose	*Colletotrichum* sp.	1
Rutabaga (*Brassica napus*)	Club root	*Plasmodiophora brassicae*	2
	Root rot	*Pythium aphanidermatum*	1
Squash (*Cucurbita argyrosperma*)	Angular leaf spot	*Pseudomonas syringae* pv. *lachrymans*	2
	Anthracnose	*Colletotrichum* sp.	1
Tomato (*Lycopersicon esculentum*)	Anthracnose	*Colletotrichum coccodes*	3

(Table 1 contd.) Tomato (*Lycopersicon esculentum*)	Bacterial leaf spot	*Pseudomonas syringae*	3
	Bacterial leaf spot	*Xanthomonas campestris*	1
	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	2
	Bacterial speck	*Pseudomonas syringae* pv. *tomato*	2
	Blue mold	*Penicillium* sp.	1
	Buckeye rot	*Phytophthora capsici*	2
	Crown and root rot	*Fusarium oxysporum*	6
	Crown and root rot	*Phytophthora capsici*	4
	Crown and root rot	*Pythium aphanidermatum*	1
	Crown and root rot	*Pythium dissotocum*	1
	Early blight	*Alternaria* sp.	1
	Fruit rot	*Phytophthora capsici*	3
	Fruit spot	*Cladosporium* sp.	1
	Gray mold	*Botrytis cinerea*	1
	Late blight	*Phytophthora infestans*	2
	Leaf mold	*Fulvia fulva*	1
	Pepino Mosaic Virus	Pepino Mosaic Virus (PepMV)	5
	Pospiviroid	Pospiviroid	3
	Powdery mildew	*Oidiopsis* sp.	2
	Powdery mildew	*Oidium* sp.	2
	Root rot	*Fusarium oxysporum*	8
	Root rot	*Pythium* sp.	5
	Root rot	*Pythium aphanidermatum*	2
	Root rot	*Pythium dissotocum*	4
	Root rot	*Pythium irregulare*	2
	Root rot	*Pythium ultimum*	2
Tomato (*Lycopersicon esculentum*)	Sour rot	*Geotrichum* sp.	2
	Stem rot	*Phytophthora capsici*	1
	Tomato bacterial canker	*Clavibacter michiganesis* subsp. *michiganesis*	18
	Tomato Chlorotic Dwarf Viroid	Tomato Chlorotic Dwarf Viroid (TCDVd)	1
	White mold	*Sclerotinia sclerotiorum*	1
	Wilt	*Fusarium oxysporum*	1
	Verticillium wilt	*Verticillium dahliae*	2
Turnip (*Brassica rapa* subsp. *rapa*)	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	1
	Rot	*Sclerotinia sclerotiorum*	1
Watermelon (*Citrullus lanatus*)	Crown and root rot	*Fusarium solani*	1
Wild leek (*Allium tricoccum*)	Leaf spot	*Septoria* sp.	1

Table 2. Summary of plant diseases diagnosed on **fruit** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2014.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Apple (*Malus* sp.)	Apple Mosaic Virus	Apple Mosaic Virus (ApMV)	1
	Bacterial blister bark	*Pseudomonas syringae*	3
	Bitter rot	*Colletotrichum fioriniae*	4
	Black rot	*Botryosphaeria obtusa*	4
	Canker	*Botryosphaeria* sp.	3
	Canker	*Cytospora* sp.	1
	Canker	*Nectria* sp.	2
	Canker	*Neofabraea* sp.	1
	Canker	*Phomopsis* sp.	3
	Canker	*Valsa* sp.	1
	Fire blight	*Erwinia amylovora*	5
	Fruit rot	*Phytophthora* sp.	1
	Leaf spot	*Colletotrichum* sp.	1
	Leaf spot	*Phoma* sp.	2
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium sylvaticum*	1
	Twig blight	*Nectria cinnabarina*	1
Blueberry (*Vaccinium sp.*)	Mummy fruit	*Monolinia vaccinii-corymbosi*	1
	Blueberry stunt	*Candidatus* Phytoplasma sp.	17
	Twig blight	*Pestalotiopsis* sp.	1
	Gummy stem blight	*Didymella bryoniae*	1
Cranberry (*Vaccinium* sp.)	Root rot	*Pythium* sp.	3
Grape (*Vitis* sp.)	Crown gall	*Agrobacterium vitis*	7
	Grapevine Leafroll-associated Virus	Grapevine Leafroll-associated Virus (GLRaV)	45
	Grapevine Red Blotch-associated Virus	Grapevine Red Blotch-associated Virus (GRBaV)	38
	Root rot	*Pythium dissotocum*	2
Plum (*Prunus domestica*)	Anthracnose	*Colletotrichum* sp.	1
	Bacterial spot	*Pseudomonas syringae*	2
	Bacterial spot	*Xanthomonas campestris*	1
	Rot	*Fusarium* sp.	2
Raspberry (*Rubus* sp.)	Potyvirus	Potyvirus	1
	Root rot	*Phytophthora cryptogea*	1
	Root rot	*Pythium dissotocum*	1
Strawberry (*Fragaria* sp.)	Anthracnose	*Colletotrichum* sp.	9
	Charcoal rot	*Macrophomina phaseolina*	1
	Crown and root rot	*Fusarium oxysporum*	3
	Crown and root rot	*Fusarium solani*	3
	Crown and root rot	*Gnomonia* sp.	3
	Crown and root rot	*Phytophthora cactorum*	1
	Crown and root rot	*Pythium* sp.	3
	Crown and root rot	*Rhizoctonia* sp.	6
	Leaf blight	*Phomopsis obscurans*	1
	Leaf scorch	*Marssonina fragariae*	2
	Leaf spot	*Mycosphaerella fragariae*	1
	Phytoplasmas	Phytoplasmas	2
	Root rot	*Cylindrocarpon* sp.	1

(Table 2 contd.)			
Strawberry (*Fragaria* sp.)	Root rot	*Pythium ultimum*	1
	Strawberry Mild Yellow Edge Virus	Strawberry Mild Yellow Edge Virus (SMYEV)	3
	Strawberry Mottle Virus	Strawberry Mottle Virus (SMoV)	8
	Strawberry Vein Banding Virus	Strawberry Vein Banding Virus (SVBV)	6
	Crown and root rot	*Fusarium solani*	1
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium ultimum*	1

Table 3. Summary of plant diseases diagnosed on **herbaceous ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2014.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Alstroemeria (*Alstroemeria* sp.)	Root rot	*Phytophthora cryptogea*	1
	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1
Begonia (*Begonia* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Pythium dissotocum*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	2
Bentgrass (*Agrostis* sp.)	Anthracnose	*Colletotrichum graminicola*	2
	Blight	*Curvularia* sp.	2
	Leaf spot	*Bipolaris* sp.	1
	Root rot	*Pythium* sp.	2
	Take-all patch	*Gaeumannomyces graminis*	2
Bird-of-paradise (*Strelitzia reginae*)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Phytophthora nicotianae*	1
	Root rot	*Pythium* sp.	1
Boxwood (*Buxus* sp.)	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Rhizoctonia solani*	1
	Leaf blight	*Volutella buxi*	92
	Leaf spot	*Macrophoma* sp.	6
	Root rot	*Thielaviopsis basicola*	9
	Stem canker	*Colletotrichum* sp.	1
Calibrachoa (*Calibrachoa* sp.)	Root rot	*Pythium* sp.	1
	Root rot	*Thielaviopsis basicola*	1
Chrysanthemum (*Chrysanthemum* sp.)	Grey mold	*Botrytis cinerea*	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium polymastrum*	2
	Root rot	*Pythium sylvaticum*	2
	Root rot	*Pythium ultimum*	2
	Root rot	*Rhizoctonia solani*	2
	Verticillium wilt	*Verticillium dahliae*	2
Clematis (*Clematis* sp.)	Clematis wilt	*Phoma clematidina*	6
Coleus (*Solenostemon* sp.)	Downy mildew	*Peronospora* sp.	1

(Table 3 contd.)			
Coral bead (*Nertera granadensis*)	Grey mold	*Botrytis* sp.	1
	Verticillium wilt	*Verticillium albo-atrum*	1
Cordyline (*Cordyline* sp.)	acterial blight	*Pseudomonas syringae* pv. *syringae*	1
	Crown and root rot	*Fusarium oxysporum*	1
Croton (Croton sp.)	Anthracnose	*Colletotrichum* sp.	1
Cyclamen (*Cyclamen* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Dieffenbachia (*Dieffenbachia* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Leaf spot	*Myrothecium* sp.	2
	Root rot	*Phytophthora nicotianae*	1
Dipladenia (*Dipladenia* sp.)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Phytophthora nicotianae*	2
	Root rot	*Pythium dissotocum*	1
	Root rot	*Rhizoctonia solani*	1
Dracaena (*Dracaena marginata*)	Bacterial soft rot	*Pectobacterium chrysanthemi*	2
Easter cactus (*Rhipsalidopsis schlumbergera*)	Stem rot	*Fusarium oxysporum*	1
Easter lily (*Lilium longiflorum*)	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	2
Echinacea (*Echinacea* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Root rot	*Pythium dissotocum*	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
Euphorbia (*Euphorbia* sp.)	Crown and root rot	*Phytophthora nicotianae*	1
	Crown and root rot	*Pythium ultimum*	1
	Crown and root rot	*Rhizoctonia solani*	1
	Root rot	*Fusarium* sp.	1
Freesia (*Freesia* sp.)	Grey mold	*Botrytis* sp.	1
	Potyvirus	Potyvirus	1
Fuchsia (*Fuchsia* sp.)	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	2
Gerbera (*Gerbera* sp.)	Crown and root rot	*Phytophthora* sp.	2
	Crown and root rot	*Pythium dissotocum*	2
	Crown and root rot	*Pythium irregulare*	1
Gloxinia (*Sinningia speciosa*)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Grass (Gramineae)	Anthracnose	*Colletotrichum graminicola*	1
	Anthracnose	*Microdochium bolleyi*	5
	Blight	*Curvularia* sp.	3
	Crown and root rot	*Pythium* sp.	4
	Leptosphaeria	*Leptosphaeria* sp.	2
	Take-all	*Gaeumannomyces graminis*	2
Heather (*Calluna vulgaris*)	Shoot blight	*Pestalotiopsis* sp.	1
Hibiscus (*Hibiscus* sp.)	Leaf spot	*Pseudomonas syringae*	1
Hibiscus (*Hibiscus* sp.)	Botrytis blight	*Botrytis cinerea*	1
Honeysuckle (*Lonicera* sp.)	Leaf blight	*Insolibasidium deformans*	2
Hosta (*Hosta* sp.)	Hosta Virus X	Hosta Virus X (HVX)	1
Hydrangea (*Hydrangea* sp.)	Bacterial leaf spot	*Pseudomonas syringae*	1
	Bacterial leaf spot	*Xanthomonas campestris*	1
	Blight	*Botrytis cinerea*	1
	Crown and root rot	*Fusarium* sp.	2

(Table 3 contd.)			
Hydrangea (*Hydrangea* sp.)	Crown and root rot	*Pythium* sp.	3
	Crown and root rot	*Pythium dissotocum*	3
	Root rot	*Pythium* sp.	1
	Root rot	*Thielaviopsis basicola*	1
	Stem blight	*Ascochyta* sp.	1
Impatiens (*Impatiens walleriana*)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Kalanchoe (*Kalanchoe* sp.)	Crown and root rot	*Pythium dissotocum*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Leaf spot	*Cercospora* sp.	1
	Leaf spot	*Stemphylium* sp.	1
	Root rot	*Thielaviopsis basicola*	2
	Stem canker	*Corynespora cassiicola*	1
Lavender (*Lavandula* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Fusarium solani*	1
	Grey mold	*Botrytis* sp.	2
	Leaf spot	*Septoria* sp.	1
Lenten rose (*Helleborus* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Phytophthora cactorum*	4
	Crown and root rot	*Pythium dissotocum*	4
Lilac (*Syringa vulgaris*)	Bacterial blight	*Pseudomonas syringae*	1
	Witches' broom	*Candidatus* Phytoplasma fraxini	2
Lisianthus (*Eustoma grandiflorum*)	Crown rot	*Myrothecium* sp.	4
	Grey mold	*Botrytis cinerea*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Root rot	*Pythium irregulare*	3
	Stem rot	*Fusarium* sp.	2
Miscanthus sp.	Anthracnose	*Colletotrichum graminicola*	1
Money Tree (*Pachira aquatica*)	Root rot	*Fusarium solani*	1
Moth orchid (*Phalaenopsis* sp.)	Crown and root rot	*Rhizoctonia solani*	2
	Sheath and root rot	*Fusarium solani*	2
Orchid (Orchidaceae)	Anthracnose	*Colletotrichum* sp.	1
Orchid (Orchidaceae)	Fusarium rot	*Fusarium solani*	3
	Root rot	*Rhizoctonia solani*	2
Pachysandra (*Pachysandra* sp.)	Root rot	*Phytophthora nicotianae*	1
	Verticillium wilt	*Verticillium albo-atrum*	1
Persian violet (*Exacum* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Petunia (*Petunia* sp.)	Crown and root rot	*Pythium* sp.	1

(Table 3 cont.)			
Petunia (*Petunia* sp.)	Grey mold	*Botrytis cinerea*	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	163
	Fusarium wilt	*Fusarium oxysporum*	1
Phlox (*Phlox subulata*)	Botrytis blight	*Botrytis cinerea*	2
	Crown and root rot	*Pythium dissotocum*	
	Root rot	*Thielaviopsis basicola*	3
Poinsettia (*Euphorbia pulcherrima*)	Blight	*Botrytis cinerea*	2
	Root rot	*Pythium irregulare*	1
Pothos (*Epipremnum aureum*)	Root rot	*Pythium* sp.	1
Rhododendron (*Rhododendron* sp.)	Dieback	*Phytophthora citricola*	1
Rose (*Rosa* sp.)	Blight	*Botrytis cinerea*	3
	Crown and root rot	*Fusarium sp.*	1
	Crown and root rot	*Pythium dissotocum*	1
	Downy mildew	*Peronospora* sp.	2
	Powdery mildew	*Oidium* sp.	1
	Rust	*Phragmidium* sp.	2
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium dissotocum*	1
Rudbeckia (*Rudbeckia* sp.)	Downy mildew	*Plasmopara* sp.	1
	Leaf spot	*Xanthomonas campestris*	1
Salvia (*Salvia nemorosa*)	Root rot	*Pythium dissotocum*	2
	Root rot	*Thielaviopsis basicola*	2
Snap dragon (*Antirrhinum* sp.)	Powdery mildew	*Oidium* sp.	1
	Root rot	*Pythium* sp.	1
Zinnia (*Zinnia* sp.)	Botrytis blight	*Botrytis cinerea*	1
Zanzibar gem (*Zamioculcas* sp.)	Root rot	*Phytophthora nicotianae*	1

Table 4. Summary of plant diseases diagnosed on **woody ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2014.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
American chestnut (*Castanea dentata*)	Chestnut blight	*Cryphonectria parasitica*	1
American elm (*Ulmus americana*)	Canker	*Botryosphaeria* sp.	1
	Canker	*Phomopsis* sp.	1
American sycamore (*Platanus occidentalis*)	Powdery mildew	*Oidium* sp.	1
Amur maackia (*Maackia amurensis*)	Canker	*Nectria* sp.	1
Balsam fir (*Abies balsamea*)	Needlecast	*Rhizosphaera pini*	1
	Root rot	*Cylindrocarpon* sp.	2
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Phytophthora cactorum*	2
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium irregulare*	2
	Root rot	*Pythium ultimum*	2
Bur oak (*Quercus macrocarpa*)	Canker	*Cytospora* sp.	1
Callery pear (*Pyrus calleryana*)	Bacterial blight	*Pseudomonas syringae*	1
Cedar (*Thuja* sp.)	Leaf blight	*Phyllosticta thujae*	1
	Tip blight	*Pestalotiopsis* sp.	2
Colorado blue spruce (*Picea pungens*)	Dieback	*Phomopsis* sp.	1
	Needlecast	*Rhizosphaera kalkhoffii*	5
	Needlecast	*Setomelanomma holmii*	1
	Needlecast	*Stigmina* sp.	2
	Tip blight	*Sphaeropsis sapinea*	1
Dogwood (*Cornus* sp.)	Leaf spot	*Septoria* sp.	2
	Spot anthracnose	*Elsinoe corni*	1
Eastern white cedar (*Thuja occidentalis*)	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium ultimum*	1
	Twig dieback	*Pestalotiopsis* sp.	1
Elderberry (*Sambucus* sp.)	Tomato Ringspot Virus	Tomato Ringspot Virus (ToRSV)	3
Fir (*Abies* sp.)	Needlecast	*Rhizosphaera pini*	1
Forsythia (*Forsythia* sp.)	Bacterial blight	*Pseudomonas syringae*	1
Juniper (*Juniperus* sp.)	Blight	*Alternaria* sp.	1
	Juniper blight	*Kabatina juniperi*	1
	Needlecast	*Lophodermium* sp.	1
London planetree (*Platanus acerifolia*)	Powdery mildew	*Oidium* sp.	1
Maple (*Acer* sp.)	Leaf spot	*Phyllosticta* sp.	1
Metasequoia sp.	Tip blight	*Pestalotiopsis* sp.	1

(Table 4 cont.) Norway Spruce (*Picea abies*)	Needlecast	*Rhizosphaera kalkhoffii*	1
Pea shrub (*Caragana* sp.)	Dieback	*Phomopsis* sp.	1
Prunus (*Prunus* sp).	Canker	*Phomopsis* sp.	3
	Crown and root rot	*Phytophthora* sp.	1
	Root rot	*Fusarium solani*	3
	Root rot	*Pythium sylvaticum*	2
	Root rot	*Pythium ultimum*	2
Redbud (*Cercis* sp.)	Canker	*Fusarium* sp.	1
	Root rot	*Pythium sylvaticum*	1
Red maple (*Acer rubrum*)	Anthracnose	*Aureobasidium* sp.	2
Red pine (*Pinus resinosa*)	Blight	*Phomopsis* sp.	1
	Dieback	*Botryosphaeria* sp.	1
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium ultimum*	1
	Shoot blight	*Pestalotiopsis* sp.	1
Roundleaf dogwood (*Cornus rugosa*)	Root rot	*Phytophthora cactorum*	1
	Root rot	*Phytophthora citricola*	2
	Root rot	*Pythium dissotocum*	2
	Root rot	*Thielaviopsis basicola*	1
Siberian elm (*Ulmus pumila*)	Canker and dieback	*Botryosphaeria* sp.	1
Spruce (*Picea* sp.)	Crown and root rot	*Phytophthora* sp.	1
	Crown and root rot	*Pythium dissotocum*	1
	Needlecast	*Rhizosphaera kalkhoffii*	1
	Needlecast	*Setomelanomma holmii*	1
	Needlecast	*Stigmina* sp.	4
Staghorn sumac (*Rhus typhina*)	Leaf spot	*Septoria* sp.	1
Sugar maple (*Acer saccharum*)	Verticillium wilt	*Verticillium dahliae*	1
Tilia sp.	Leaf spot	*Cercospora* sp.	1
Tulip tree (*Liriodendron* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Dieback	*Phomopsis* sp.	1
White pine (*Pinus strobus*)	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	2
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium ultimum*	1
White spruce (*Picea glauca*)	Needle cast	*Rhizosphaera kalkhoffii*	1
Willow (*Salix* sp.)	Black canker	*Colletotrichum* sp.	3
Wollemia (*Wollemia nobilis*)	Tip blight	*Pestalotiopsis* sp.	1

Table 5. Summary of plant diseases diagnosed on **field crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2014.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Adzuki bean (*Vigna angularis*)	Brown spot	*Pseudomonas syringae* pv. *syringae*	7
	Leaf blight	*Pantoea agglomerans*	7
	Stem rot	*Fusarium* sp.	7
Alfalfa (*Medicago sativa*)	Crown and root rot	*Fusarium* sp.	1
Barley (*Hordeum vulgare*)	Spot blotch	*Bipolaris* sp.	2
Bean (*Phaseolus vulgaris*)	Bacterial blight	*Pantoea agglomerans*	1
	Brown spot	*Pseudomonas syringae* pv. *syringae*	3
	Common bacterial blight	*Xanthomonas campestris*	1
	Leaf spot	*Phoma exigua*	1
	Stem rot	*Fusarium* sp.	1
Corn (*Zea mays*)	Anthracnose leaf blight	*Colletotrichum graminicola*	2
Oat (*Avena sativa*)	Leaf blotch	*Septoria avenae*	3
Soybean (*Glycine max*)	Anthracnose	*Colletotrichum* sp.	1
	Blight	*Pseudomonas syringae*	1
	Brown spot	*Septoria glycines*	1
	Crown and root rot	*Fusarium oxysporum*	3
	Crown and root rot	*Fusarium solani*	3
	Crown and root rot	*Pythium* sp.	2
	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	2
	Root rot	*Phytophthora* sp.	2
	Root rot	*Pythium* sp.	2
	Root rot	*Pythium sylvaticum*	1
Sugar beet (*Beta vulgaris*)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Fusarium solani*	1
	Crown and root rot	*Pythium* sp.	1
Tobacco (*Nicotiana* sp.)	Crown and root rot	*Phytophthora nicotiana*	1
Wheat (*Triticum* sp.)	Root rot	*Fusarium oxysporum*	3
	Root rot	*Fusarium solani*	3
	Take-all patch	*Gauemannomyces graminis*	3

Table 6. Summary of plant diseases diagnosed on **herb and special crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2014.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Fenugreek (*Trigonella foenum-graecum*)	Leaf spot	*Cercopora* sp.	1
Ginseng (*Panax* sp.)	Root rot	*Cylindrocarpon destructans*	5
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	2
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium irregulare*	1
Hazelnut (*Corylus* sp.)	Bacterial blight	*Xanthomonas arboricola*	2
	Canker	*Botryosphaeria* sp.	1
	Powdery mildew	*Phyllactinia guttata*	1
Hop (*Humulus lupulus*)	Carlavirus	Carlavirus	4
	Downy mildew	*Pseudoperonospora humuli*	1
	Hop Latent Virus	Hop Latent Virus (HpLV)	5
Sea buckthorn (*Hippophae rhamnoides)*	Fruit spot	*Cladosporium* sp.	1
Stevia (*Stevia* sp.)	Crown and root rot	*Fusarium* sp.	1
	Crown and root rot	*Pythium ultimum*	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1
Vernonia (*Centrapalus pauciflorus*)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Pythium* sp.	1

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

NAMES AND AGENCY:
D. Van Dyk, A. Abd-Elmagid, and M.R. McDonald
Muck Crops Research Station, University of Guelph, 1125 Woodchoppers Lane, Kingston ON L7B 0E9
Telephone: (905) 775-3783; **Facsimile:** (905) 775-4546; **E-mail:** vandykd@uoguelph.ca
www.uoguelph.ca/muckcrop/

TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE MUCK CROPS RESEARCH STATION DIAGNOSTIC LABORATORY IN 2014

ABSTRACT: As part of the integrated pest management program provided by the Muck Crops Research Station, diagnostics service is provided to vegetable growers around Holland/Bradford Marsh, Ontario. In 2014, 232 samples were submitted to the diagnostic laboratory for identification and possible control recommendations. Samples included plants with infectious diseases, physiological disorders and insect feeding damage, insects and weeds.

INTRODUCTION AND METHODS: As part of the integrated pest management (IPM) program, the plant disease diagnostic laboratory of the Muck Crops Research Station (MCRS), provides diagnosis and control recommendations for diseases of vegetable crops to growers in the Bradford/Holland Marsh, and surrounding area of Ontario. 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. 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 observations and culturing onto growth media.

RESULTS AND COMMENTS: Weather conditions in the 2014 growing season were conducive for the development of many fungal diseases including those caused by *Sclerotinia* spp*., Peronospora destructor, Sclerotium cepivorum, Pythium* spp*.*, *and Rhizoctonia* spp. There was above average rainfall in April, in June and in September along with average temperatures from April to September and below average temperatures in July. This weather created ideal conditions for both soil-borne and airborne fungal pathogens. In particular carrot had high incidences of infection by *Pythium* spp*.* and *Rhizoctonia* spp. along with *Sclerotinia sclerotiorum.* Onions were affected by *Sclerotium cepivorum* and *Peronospora destructor*. From 8 April to 1 December, 2014, the diagnostic laboratory of the MCRS received 229 samples for diagnosis. Of these, 80% were infectious diseases (183 in total) and 20% physiological disorders (46 in total). These samples were associated with the following crops: onion (48.7%), carrot (27.6%), celery (9.5%), lettuce (2.6%), brassicas (2.1%) and other crops (9.5%). Along with plant disease samples, a total of 17 samples of insects or insect damage were assessed and 8 weed samples identified. A summary of diseases diagnosed and causal agents on crop samples submitted to the MCRS diagnostic laboratory in 2014 is presented in Table 1.

Table 1: Summary of diseases diagnosed on plants submitted to the Muck Crops Research Station Diagnostic Laboratory in 2014.

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bean	Anthracnose	*Colletotrichum lindemuthianum*	1
	White mould	*Sclerotinia sclerotiorum*	1
Beet	Alternaria leaf spot	*Alternaria brassicae*	1
	Cercospora leaf spot	*Cercospora beticola*	1
Baby bok choy	Chemical injury	Herbicide drift	1
Cabbage	Black rot	*Xanthomonas campestris* pv. *campestris*	1
	Nutrient deficiency	Phosphorous deficiency	1

(Table 1 cont.)

Carrot	Aster yellows	*Candidatus* Phytoplasma asteris	4
	Carrot cyst nematode	*Heterodera carotae*	2
	Cavity spot	*Pythium* spp.	3
	Crater rot	*Rhizoctonia carotae*	2
	Crown gall	*Agrobacterium tumefaciens*	3
	Crown rot	*Rhizoctonia solani*	1
	Damping off	*Pythium* spp. and/or *Rhizoctonia* spp.	4
	Fusarium rot	*Fusarium* spp.	3
	Growth crack (split)	Fluctuating moisture level	1
	Leaf blight	*Alternaria dauci* and *Cercospora carotae*	14
	Pythium root dieback	*Pythium spp.*	10
	Sclerotinia rot	*Sclerotinia sclerotiorum*	7
	Soft rot	*Erwinia carotovora*	2
	Chemical injury	Herbicide damage	3
	Chemical injury	Fumigant damage	1
	Environmental injury	Heat canker	4
Celeriac	Bacterial leaf spot	*Pseudomonas syringae*	1
	Early blight	*Cercospora apii*	1
	Chemical injury	Herbicide damage	1
Celery	Aster yellows	*Candidatus* Phytoplasma asteris	3
	Bacterial leaf blight	*Pseudomonas cichorii*	2
	Celery leaf curl	*Colletotrichum* spp.	3
	Early blight	*Cercospora apii*	3
	Fusarium yellows	*Fusarium oxysporum f.sp. apii*	1
	Late blight	*Septoria apiicola*	2
	Pink rot	*Sclerotinia sclerotiorum*	2
	Soft rot	*Erwinia carotovora*	1
	Physiological disorder	Transplant shock	3
	Chemical injury	Herbicide damage	2
Cucumber (greenhouse)	Fusarium root and stem rot	*Fusarium oxysporum*	1
Cucumber (field)	Angular leaf spot	*Pseudomonas syringae*	1
Garlic	Fusarium rot	*Fusarium oxysporum f.sp. cepae*	1
	Stem and bulb nematode	*Ditylenchus dipsaci*	1
Lettuce	Downy mildew	*Bremia lactucae*	2
	Lettuce drop	*Sclerotinia sclerotiorum* and *S. minor*	2
	Grey mould	*Botrytis cinerea*	1
	Powdery mildew	*Erysiphe cichoracearum*	1
Lupin	Ascochyta leaf spot	*Ascochyta* spp.	1
Napa cabbage	Nutrient deficiency	Calcium deficiency	1
Onion	Bacterial rot/soft rot	*Erwinia carotovora*	3
	Botrytis leaf blight	*Botrytis squamosa*	13
	Damping off	*Pythium* spp. and/or *Rhizoctonia* spp.	1
	Downy mildew	*Peronospora destructor*	16
	Pink root	*Phoma terrestris*	2
	Purple blotch	*Alternaria porri*	13
	Smut	*Urocystis cepulae*	8
	Stemphylium leaf blight	*Stemphylium vesicarium*	16
	White rot	*Sclerotium cepivorum*	14
	Chemical injury	Herbicide damage	6
	Environmental injury	Pelting rain injury	9
	Environmental injury	Hail damage	3
	Tip burn	Heat stress	3
	Wilting	Excessive moisture	6

Table 1 (contd)			
Pak choy	Environmental injury	High salts	1
Potato	Early blight	*Alternaria solani*	2
	Late Blight	*Phytophthora infestans*	1
Spinach	Damping off	*Pythium* spp. and/or *Rhizoctonia* spp.	1
Tomato	Bacterial leaf spot	*Xanthomonas campestris* pv. *vesicatoria*	2
	Early blight	*Alternaria solani*	2
	Late blight	*Phytophthora infestans*	1
Water spinach	Physiological disorder	Oedema	1

DISEASED SAMPLES	**185**
ABIOTIC AND OTHER DISORDERS	**47**
TOTAL SUBMISSIONS	**232**

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CULTURES : Cultures commerciales reçues en 2014 au Laboratoire de diagnostic en phytoprotection
RÉGION : Québec

NOMS ET ORGANISME :
G. Gilbert, J. Caron, N. Shallow, A.-M. Breton et K. Dumont.
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, poste 2708; **Télécopieur :** 418 646-6806
Courriel : gerard.gilbert@mapaq.gouv.qc.ca **Site internet** : http://www.agrireseau.qc.ca/lab/

TITRE : MALADIES DIAGNOSTIQUÉES SUR LES ÉCHANTILLONS DE CULTURES COMMERCIALES EN 2014 AU LABORATOIRE DE DIAGNOSTIC EN PHYTOPROTECTION DU MAPAQ

RÉSUMÉ : Du 1er janvier au 31 décembre 2014, 1741 maladies ont été identifiées parmi 2481 échantillons traités par la section de phytopathologie du laboratoire. La proportion des maladies chez les plantes maraîchères représentait 37% de toutes les maladies identifiées, les petits fruits 39%; le soutien particulier du MAPAQ pour lutter contre le dépérissement des fraisières explique cette situation. Les maladies d'origine parasitaire représentaient 1560 diagnostics soit 89% de toutes les maladies identifiées, similaire à 2013 mais supérieure à la moyenne des cinq dernières (77%). Parmi ces diagnostics, 843 sont attribuables aux champignons, 186 aux bactéries, 460 aux virus, 62 aux nématodes et 9 aux phytoplasmes. Les stress culturaux (213 diagnostics) causaient 71% des problèmes non parasitaires.

MÉTHODES : Le Laboratoire de diagnostic en phytoprotection du Ministère de l'Agriculture et de l'Alimentation du Québec (MAPAQ) offre 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 provenant des conseillers agricoles des secteurs publics et privés, 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 proviennent des publications scientifiques; voici les principaux : les nématodes sont extraits par l'entonnoir de Baermann et les genres sont identifiés par microscopie; les champignons sont isolés sur les milieux de culture artificiels, identifiés par microscopie ou par techniques de biologie moléculaire et le pouvoir pathogène de quelques genres est vérifié; les bactéries sont aussi isolées sur des géloses artificielles puis identifiées par les tests biochimiques classiques, Biolog^{R}, ELISA ou PCR; les phytoplasmes sont détectés par PCR et les virus par les tests sérologiques ELISA ou PCR. Le séquençage d'ADN est fréquemment utilisé pour appuyer l'identification des champignons et des bactéries. Deux références sont principalement consultées pour les noms des maladies et des microorganismes : « *Noms des maladies des plantes au Canada* », 4e édition (2003) et « *Maladies des grandes cultures au Canada* », 4ième édition (2004).

RÉSULTATS ET DISCUSSIONS : 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. Les maladies des légumes entreposés listées au tableau 2 incluent les légumes de courtes et de longues durées d'entreposage. Au tableau 11, les plantes ornementales d'extérieur (pépinière, aménagement paysager) et d'intérieur (serres) sont essentiellement des espèces herbacées annuelles ou vivaces.

Le nombre de maladies rapporté ne correspondent pas au nombre d'échantillons réellement reçus et traités parce que plusieurs maladies peuvent être identifiées sur un échantillon. De plus, ces totaux ne tiennent pas compte des causes indéterminées, des diagnostics insuffisants ni des résultats négatifs provenant des demandes de détection. Lorsque non précisés, les stress culturaux regroupent les désordres minéraux, les pH de sol inadéquats, les sols compactés ou salins, les phytotoxicités causées par le mauvais usage des pesticides, l'excès ou le manque d'irrigation et les blessures mécaniques. Les stress climatiques pour leur part concernent les insolations, le gel hivernal, le froid et l'excès de chaleur, les polluants atmosphériques,

l'intumescence (œdème), l'asphyxie racinaire par l'excès de pluie; les orages violents, les vents forts et la grêle blessant les feuilles.

Les fusarioses racinaires étaient les infections fongiques qui affectaient la plus grande diversité d'espèces cultivées. Les alliums présentent encore la plus grande diversité parmi les infections bactériennes; les pommes de terre et les tomates par contre montraient la fréquence la plus importante. *Pectobacterium betavasculorum* est une nouvelle espèce bactérienne causant une pourriture molle sur courgettes. Les virus associés au dépérissement des fraisiers, principalement SMoV (Virus de la marbrure du fraisier - Strawberry mottle virus) et SMYEV (Virus de la jaunisse du fraisier - Strawberry mild yellow edge virus), ont été les plus importants avec PepMV (Virus de la mosaïque du pépino - Pepino mosaic virus) des tomates de serres. *Ditylenchus dipsaci* chez l'ail causaient la plupart des maladies à nématodes rencontrées. Citons *Cymadothea* sp. chez le trèfle, une maladie fongique identifiée pour la première fois au laboratoire.

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Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail	*Botrytis cinerea* / *Botrytis* spp.	Pourriture du col	16
	Colletotrichum circinans	Anthracnose	3
	Ditylenchus dipsaci	Maladie vermiculaire de l'oignon	32
	Embellisia allii	Tache et pourriture du bulbe	10
	Fusarium proliferatum / *F. solani* / *Fusarium* sp.	Pourriture des bulbes	40
	Pratylenchus sp.	Lésions racinaires	1
	Pseudomonas fluorescens	Pourriture des bulbes	1
	Pseudomonas syringae	Anomalie de coloration foliaire	1
	Pythium sylvaticum	Pourridié pythien	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Rhizoctonia solani	Rhizoctone	1
	Gel hivernal		1
Artichaut	Carence de calcium	Brûlure des bractées	1
Asperge	*Fusarium oxysporum*	Pourriture fusarienne	1
Aubergine	*Sclerotinia sclerotiorum*	Sclérotiniose	1
	Verticillium sp.	Verticilliose	1
Betterave / poirée	Fumagine	Tache	1
	Fusarium oxysporum	Tache au collet	1
	Pseudomonas syringae	Tache foliaire	1
	Carence de Ca		1
Brocoli	*Alternaria alternata* / *A. brassicicola* / *A. brassicae*	Tache alternarienne / tache noire	3
	Pseudomonas viridiflava	Tache annulaire	1
Carotte / panais	*Cylindrocarpon* sp.	Chancre d'entrepôt	1
	Geotrichum candidum	Pourriture caoutchouc	2
	Meloidogyne sp.	Nodosité des racines	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	2
	Phytotoxicité glyphosate		1
Chou / chou de Bruxelles	*Alternaria brassicicola*	Tache noire	2
	Fusarium oxysporum	Fusariose	1
	Xanthomonas campestris pv. *campestris*	Nervation noire	2
	pH élevé		1
	Gel automnal		1
Chou chinois	*Pseudocercosporella* sp.	Tache foliaire	1
	Rhizoctonia solani	Tache foliaire	1
	Phytotoxicité fomésafène		1
Chou-fleur	*Alternaria brassicicola*	Alternariose	1
	Cladosporium sp.	Tache sur capitule	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pythium sp.	Pourridié pythien	1
	Stress de température		2

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CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Citrouille	*Erwinia tracheiphila*	Flétrissement bactérien	1
	Cladosporium sp.	Tache foliaire	1
	Colletotrichum sp.	Anthracnose	1
	Fusarium oxysporum	Pourriture des fruits	3
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phoma cucurbitacearum	Pourriture noire	3
	Potyvirus		1
	Pythium irregulare		1
	Gel automn	Pourriture du fruit	1
Concombre	*Alternaria alternata / A. radicina*	Alternariose	4
	Cladosporium sp.	Gale	1
	Colletotrichum orbiculare	Anthracnose	2
	Fusarium equiseti / F. solani / F. tricinctum	Pourriture du fruit et du collet	5
	Phytophthora capsici	Pourriture du fruit et du collet	2
	Pseudoperonospora cubensis	Mildiou	1
	Pythium ultimum	Pourridié pythien	1
Courge	*Alternaria alternata*	Alternariose	1
	Cucumber Mosaic Virus (CMV)		1
	Erwinia tracheiphila	Flétrissement bactérien	2
	Fusarium oxysporum / F. solani	Brûlure foliaire, chancre au collet	4
	Oidium sp.	Blanc	1
	Phoma cucurbitacearum	Pourriture noire	1
	Phytophthora capsici	Pourridié phytophthoréen	2
	Potyvirus	Mosaïque	1
	Pseudomonas syringae pv. *lacrymans*	Tache angulaire	1
	Carence de K		1
	Phytotoxicité quizalofop p-éthyle		1
Courgette	*Erwinia tracheiphila*	Flétrissement bactérien	1
	Fusarium sporotrichioides	Pourriture du collet et de la tige	1
	Oidium sp.	Blanc	1
	Pectobacterium betavasculorum	Pourriture molle bactérienne	1
	Plectosporium tabacinum	Tache plectosporienne	1
	Pseudomonas syringae pv. *lacrymans*	Tache angulaire	3
	Phytotoxicité quizalofop p-éthyle		1
Épinard	*Pythium* sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1
Gourgane / haricot	Broad Bean Wilt Virus (BBWV)		1
	Bipolaris sorokiniana	Tache foliaire	1
	Cucumber Mosaic Virus (CMV)		1
	Colletotrichum sp.	Anthracnose	2
	Fusarium graminearum / Fusarium sp.	Fusariose	3
	Pythium sp.	Pourridié pythien	4

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Gourgane / haricot	*Rhizoctonia solani*	Rhizoctone	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Septoria sp.	Septoriose	2
	Thielaviopsis basicola	Pourriture noire des racines	1
	Phytotoxicité bentazone		4
	Phytotoxicité cuivre		1
Laitue (frisée, pommée, romaine)	*Meloidogyne* sp.	Nodosité des racines	2
	Pseudomonas syringae	Tache foliaire	1
Maïs sucré	*Fusarium oxysporum*	Pourriture fusarienne des racines	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Rhizoctonia sp.	Rhizoctone commun	1
	Désordre physiologique	Tache sur l'épi	1
Melon / pastèque / cantaloup	*Oidium* sp.	Blanc	1
	Xanthomonas campestris	Tache de feuilles, fruits et tiges	1
	Désordre physiologique	Tache bactérienne	1
	Stress de température		1
Oignon / échalote / poireau / ciboulette	*Colletotrichum circinans*	Anthracnose	1
	Enterobacter cloacae	Pourriture de bulbes et feuillage	4
	F. oxysporum / Fusarium spp.	Fusariose du plateau	14
	Pantoea agglomerans	Pourriture des feuilles	5
	Pectobacterium carotovorum	Pourriture molle bactérienne	3
	Pseudomonas fluorescens	Pourriture molle bactérienne	1
	Pseudomonas marginalis	Pourriture molle bactérienne	1
	Pseudomonas viridiflava	Pourriture molle bactérienne	1
	Pythium coloratum / Pythium sp.	Pourridié pythien	2
	Stemphylium botryosum	Moisissure noire des feuilles	1
Okra	*Pseudomonas syringae*	Moucheture bactérienne	1
Piment / poivron	*Botrytis cinerea*	Moisissure grise	1
	Fusarium oxysporum	Pourridié fusarien	1
	Phytophthora capsici	Pourriture de fruits, de collets et de racines	7
	Pseudomonas syringae	Moucheture bactérienne	3
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Xanthomonas campestris	Tache bactérienne	2
	Salinité élevée du sol		1
Pois vert	*Aphanomyces euteiches*	Nécrose racinaire	1
	Fusarium sp.	Pourridié fusarien	2
	Rhizoctonia solani	Rhizoctone commun	1
Pomme de terre	*Alternaria alternata*	Alternariose	1
	Botrytis cinerea	Moisissure grise	1
	Colletotrichum coccodes	Dartrose	22
	Dickeya chrysanthemi	Jambe noire	1

Tableau 1. Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Pomme de terre	*Fusarium acuminatum* / *F. oxysporum* / *Fusarium* spp.	Pourriture fusarienne	20
	Pectobacterium carotovorum	Pourriture molle bactérienne	15
	Phytophthora infestans	Mildiou	2
	Pseudomonas marginalis	Pourriture molle bactérienne	5
	Potato Mop Top Virus (PMTV)	Stries brunes dans le tubercule	1
	Potato Virus X (PVX)	Malformation foliaire	1
	Pythium ultimum / *Pythium* sp.	Pourriture aqueuse	2
	Rhizoctonia solani	Rhizoctonie	2
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Streptomyces sp.	Gale bactérienne	1
	Verticillium albo-atrum / *V. dahliae*	Verticilliose	18
	Asphyxie racinaire		2
	Blessure mécanique		5
	Désordre physiologique		3
	Œdème foliaire		1
	Peau d'éléphant		1
	Phytotoxicité chlorpropham		4
	Polluant atmosphérique		1
Radis commun / daïkon	*Pseudomonas syringae*	Anomalie de coloration foliaire	1
		Pourridié pythien	1
	Pythium sp.	Rhizoctone	1
	Rhizoctonia solani		2
	Phytotoxicité pesticides		
Rabiole	*Aphanomyces* sp.	Anomalie de coloration racinaire et malformation	1
Tomate	*Clavibacter michiganensis* ssp. *michiganensis*	Chancre bactérien	4
	Colletotrichum coccodes	Anthracnose racinaire	1
	Fusarium oxysporum / *Fusarium* spp.	Pourridié fusarien	4
	Oidium lycopersici	Blanc	1
	Phytophthora infestans	Mildiou	1
	Plectosporium tabacinum	Brunissement du collet et de la tige	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium sp.	Pourridié pythien	1
	Tobacco Mosaic Virus (TMV) / Tomato Mosaic Virus (ToMV)	Anomalie de coloration foliaire	1
	Tomato Spotted Wilt Virus (TSWV)	Anomalie de coloration foliaire	1
	Carence d'éléments minéraux majeurs		2
	Phytotoxicité glyphosate		1
Total			**424**

Tableau 2. Sommaire des maladies diagnostiquées parmi les **légumes d'entrepôt** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail	*Botrytis* spp.	Pourriture de bulbes	6
	Ditylenchus dipsaci	Pourriture de bulbes	12
	Embellisia allii	Pourriture de gousses	1
	Fusarium oxysporum / *F. proliferatum*	Pourriture de bulbes	5
	Penicillium sp.	Pourriture de bulbes	1
Oignon	*Botrytis* sp.	Moisissure grise	1
	Fusarium oxysporum	Fusariose du plateau	1
	Levures	Pourriture molle du bulbe	1
	Pantoea agglomerans	Pourriture molle du bulbe	1
	Penicillium sp.	Tache et pourriture du bulbe	4
	Gel automnal		1
	Maturité insuffisante		1
Pomme de terre	*Alternaria* sp.	Alternariose	6
	Colletotrichum coccodes	Dartrose	6
	Cylindrocarpon destructans	Chancre des racines	1
	Fusarium spp.	Fusariose	10
	Geotrichum sp.	Pourriture caoutchouc	1
	Helminthosporium solani	Tache argentée	2
	Pectobacterium carotovorum	Pourriture molle bactérienne	3
	Potato Mop Top Virus (PMTV)	Anneaux bruns dans le tubercule	2
	Phytophthora infestans	Mildiou	1
	Pseudomonas marginalis	Pourriture molle bactérienne	4
	Pythium sp.	Pourriture aqueuse	1
	Rhizoctonia solani	Rhizoctonie	3
	Spongospora subterranea	Gale poudreuse	1
	Streptomyces sp.	Gale bactérienne	1
	Peau d'éléphant		1
	Cœur creux		1
	Désordre physiologique		1
	Tache de rouille		1
Total			**81**

Tableau 3. Sommaire des maladies diagnostiquées parmi les **plantes maraîchères de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Concombre	*Corynespora cassiicola*	Tache foliaire	1
	Carences d'éléments minéraux majeurs		1
Laitue	*Botrytis cinerea*	Moisissure grise	1
	Meloidogyne sp.	Nodosité racinaire	2
	Pseudomonas marginalis	Pourriture	1
	Pythium dissotocum / *Pythium* spp.	Pourridié pythien	5
Poivron	*Pectobacterium carotovorum*	Pourriture molle bactérienne	1
	Pythium sp.	Pourridié pythien	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
Tomate	*Acremonium strictum*	Chancre sec	6
	Botrytis cinerea	Moisissure grise	5
	Clavibacter michiganensis ssp. *michiganensis*	Chancre bactérien	13
	Colletotrichum coccodes	Anthracnose sur racines	5
	Fusarium oxysporum / *F. proliferatum* / *Fusarium striatum* / *Fusarium* spp.	Fusariose	27
	Oidium neolycopersici	Blanc	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Penicillium sp.	Tache foliaire, chancre de tige	2
	Pepino Mosaic Virus (PepMV)	Mosaïque foliaire	29
	Phytophthora infestans	Mildiou	1
	Plectosporium tabacinum	Chancre	9
	Pythium spp.	Pourridié pythien	3
	Pseudomonas syringae	Moucheture bactérienne	5
	Pythium sp.	Pourridié pythien	5
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Tobacco Mosaic Virus (TMV)	Mosaïque	1
	Tomato Mosaic Virus (ToMV)	Malformation foliaire	1
	Tomato Spotted Wilt Virus (TSWV)	Anomalie de coloration foliaire	4
	Verticillium dahliae	Verticilliose	6
	Carences minérales (B, Fe, Mn, N, K)		1
	Désordre physiologique		5
	Excès de chaleur		1
	Phytotoxicité pesticide		1
	Tache d'eau		1
Total			**148**

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Amélanchier	*Discula* sp.	Anthracnose	1
	Entomosporium mespili	Entomosporiose	1
	Sphaeropsis malorum	Pourriture noire	1
	Gel hivernal		1
	Phytotoxicité glyphosate		1
	Phytotoxicité soufre		1
	Salinité du sol élevée		1
Argousier	*Aureobasidium* sp. / levures	Pourriture de fruits	2
	Colletotrichum sp.	Anthracnose	1
Bleuetier en corymbe	*Alternaria* sp. / *Cladosporium* sp.	Pourriture de fruits	2
	Blueberry ScorchVirus (BlScV)	Anomalie de coloration foliaire	1
	Colletotrichum acutatum	Anthracnose	2
	Exobasidium vaccinii	Rouge	1
	Fusicoccum putrefaciens	Chancre	4
	Gloeosporium sp.	Tache foliaire	1
	Helicotylenchus sp.	Faible vigueur	1
	Phomopsis sp.	Brûlure phomopsienne	1
	Phytophthora cinnamomi	Pourridié phytophthoréen	1
	Phytoplasmes	Malformation, nanisme	7
	Pseudomonas syringae	Coulure bactérienne	2
	Pucciniastrum goeppertianum	Rouille balai de sorcières	2
	Carence de Ca	Tache et malformation foliaire	1
	Gel hivernal		7
	pH inadéquat		2
	Phytotoxicités glyphosate / paraquat / clopyralid		4
	Salinité élevée du sol		4
Bleuetier nain	*Gliocladium* sp.	Dépérissement	1
	Oidium sp.	Blanc	1
	Stress de manque d'eau		1
Camerisier	*Botrytis cinerea*	Moisissure grise	1
	Fusarium sp.	Anomalie de coloration racinaire	3
	Oidium sp.	Blanc	2
	Pythium sylvaticum / *Pythium* spp.	Pourridié pythien	4
	Rhizoctonia solani	Rhizoctone	2
	Phytotoxicité glyphosate		1
Canneberge	*Allanthophomopsis cytispora*	Pourriture noire	1
	Botrytis cinerea	Moisissure grise	1
	Cladosporium sp.	Pourriture des baies	1
	Coleophoma empetri	Pourriture des baies	2
	Colletotrichum gloeosporioides	Anthracnose	1
	Phomopsis vaccinii	Brûlure phomopsienne	1
	Phyllosticta vaccinii	Dépérissement	3
	Physalospora vaccinii	Pourriture tachetée	1
	Protoventuria myrtilli	Tache foliaire	1
	Phytotoxicité *dichlobenil*		1

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Cassissier / groseillier	*Colletotrichum gloeosporioides*	Anthracnose	1
	Septoria ribis	Tache septorienne	1
Fraisier	*Botrytis cinerea*	Moisissure grise	3
	Hainesia lythri	Pourriture de fruits	1
	Marssonina sp.	Tache pourpre	2
	Myxomycètes	Tache de feuilles et de fruits	1
	Phytophthora cactorum	Pourriture du fruit et du collet	2
	Phytophthora spp.	Pourriture des racines et des collets	5
	Pratylenchus sp.	Lésions des racines	7
	Pythium spp. / *Rhizoctonia* spp. / *Cylindrocarpon* spp. / *Fusarium* spp. / Thielaviopsis spp.	Pourriture noire des racines	75
	Ramularia brunnea	Tache commune	1
	Strawberry Crinkle Virus (SCrV)		4
	Strawberry Mottle Virus (SMoV)		214
	Strawberry Mild Yellow Edge Virus (SMYEV)		150
	Sphaerotheca macularis	Blanc	4
	Strawberry Vein Banding Virus (SVBV)		18
	Verticillium albo atrum	Verticilliose	1
	Verticillium dahliae	Verticilliose	13
	Xanthomonas fragariae	Tache angulaire	1
	Zythia fragariae	Brûlure foliaire	1
	Déséquilibre minéral		8
	Gel printanier		1
	Gel hivernal		2
	Œdème		1
	pH inadéquat		6
	Phytotoxicité atrazine / mésotrione / terbacil		4
	Phytotoxicité glyphosate		4
	Salinité élevée du sol		3
Framboisier rouge / noir	*Agrobacterium tumefaciens*	Tumeur du collet	7
	Arthuriomyces peckianus	Rouille orangée	1
	Botrytis cinerea	Moisissure grise	2
	Erwinia amylovora	Brûlure bactérienne	3
	Penicillium sp.	Pourriture du fruit	1
	Phomopsis sp.	Brûlure de la tige	1
	Phytophthora spp.	Pourridié phytophthoréen	1
	Pseudomonas syringae	Coulure bactérienne	1
	Fusarium spp. / *Pythium* spp. / *Rhizoctonia* spp.	Pourriture noire des racines	2
	Pucciniastrum americanum	Rouille jaune tardive	1
	Rhizoctonia solani	Rhizoctone	2
	Tomato Ringspot Virus (ToRSV)	Marbrure	2
	Déséquilibre minéral		1
	Gel hivernal		3
	Phytotoxicités glyphosate / dichlobenil		3

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Framboisier rouge / noir	Salinité du sol élevée		1
	Stress de manque d'eau		1
Sureau	Tomato Spotted Wilt Virus (TSWV)	Aucun symptôme	1
	Phytotoxicité pesticide		1
Vigne	*Alternaria* sp.	Pourriture des baies	1
	Aureobasidium sp.	Pourriture des baies	1
	Botryosphaeria sp.	Chancre	1
	Botrytis cinerea	Moisissure grise	1
	Cladosporium spp.	Coulure, pourriture des baies	1
	Cylindrocarpon spp.	Carie du bois	1
	Fusarium sp.	Pourriture du bois	1
	Levures	Pourriture des baies	1
	Phaeoacremonium sp.	Esca	2
	Phoma glomerata	Tache foliaire / anomalie de coloration de tige	5
	Phomopsis viticola	Excoriose	1
	Phytoplasmes	Jaunisse de l'aster	1
	Pseudomonas syringae	Coulure, brûlures de florules	1
	Pseudopezicula sp.	Rougeot	1
	Blessures par la grêle		1
	Excès de chaleur		1
	Carences d'éléments minéraux majeurs		1
	Gel hivernal		1
	Manque d'eau		1
	Phytotoxicité glyphosate		4
	Phytotoxicité atrazine/ imazéthapyr		3
Total			**682**

Tableau 5. Sommaire des maladies diagnostiquées parmi les **céréales et cultures associées** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Avoine	Carence de Mn	Tache grise	1
	Phytotoxicité metholachlor / glyphosate / glufosinate		3
Blé / épeautre	*Bipolaris* sp.	Tache helminthosporienne	1
	Fusarium avenaceum, F. graminearum	Fusariose	4
	Puccinia sp.	Rouille	1
	Pythium sp.	Piétin brun	3
	Sclerotinia borealis	Moisissure nivéale	1
	Stagonospora nodorum	Moucheture	1
	Phytotoxicités atrazine / métolachlore / metribuzine / pendimetalin / propazyne		5
Orge	*Alternaria* sp. / *Cladosporium* sp.	Tache foliaire	2
	Bipolaris sorokiniana	Tache helminthosporienne	2
	Dreschlera spp.	Rayure réticulée	2
	Fusarium spp.	Piétin fusarien	3
	Pythium attrantheridium / *Pythium* sp.	Piétin brun	3
	pH du sol inadéquat		2
	Phytotoxicité mésotrione		1
	Carence d'éléments majeurs		2
Quino*a*	*Peronospora* sp.	Mildiou	1
	Phytotoxicité pesticide		1
	Salinité du sol élevée		1
Sarrazin	*Paratylenchus* sp.	Faible croissance	1
	Carence d'éléments minéraux majeurs		1
Total			**42**

Tableau 6. Sommaire des maladies diagnostiquées parmi les **grandes cultures** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Canola	Blessure par la grêle	Tache foliaire	1
	pH acide	Anomalie de coloration foliaire	1
Maïs grain / maïs ensilage	*Alternaria alternata*	Tache foliaire	1
	Bipolaris sp.	Tache foliaire	1
	Cladosporium sp.	Moisissure noire	1
	Colletotrichum graminicola	Anthracnose	1
	Fusarium oxysporum / *Fusarium* spp.	Piétin fusarien	10
	Pratylenchus sp.	Lésions racinaires	1
	Pythium attrantheridium / *P. dissotocum* / *P. heterothallicum* / *P. irregulare* / *Pythium* spp.	Pourridié pythien	7
	Rhizoctonia solani	Faible croissance	1
	Asphyxie racinaire / sol inadéquat		4
	Carence de Mg		1
	Phytotoxicité urée		1
	Phytotoxicité glyphosate / métolachlor		2
	Salinité élevée du sol		2
Soya	*Alternaria alternata*	Tache alternarienne	1
	Ascochyta sp.	Ascochytose	1
	Colletotrichum sp.	Anthracnose	6
	Corynespora cassiicola	Pourriture des racines	2
	Fusarium graminearum / *F. oxysporum* / *F. solani* / *F. sporotrichioides* / *Fusarium* spp.	Fusariose	10
	Phomopsis sp.	Brûlure phomopsienne	1
	Phytophthora sojae / *Phytophthora* spp.	Pourridié phytophthoréen	7
	Pseudomonas syringae	Moucheture bactérienne	3
	Phytoplasme	Anomalie de coloration foliaire	1
	Potyvirus	Pourridié pythien	6
	Pythium sylvaticum / *Pythium* spp.	Rhizoctone commun	1
	Rhizoctonia solani	Sclérotiniose	1
	Sclerotinia sclerotiorum	Tache septorienne	2
	Septoria glycines		1
	Asphyxie racinaire		3
	Carence d'éléments minéraux majeurs		12
	Phytotoxicité herbicides diverses		1
	Tige verte		
Total			**94**

Tableau 7. Sommaire des maladies diagnostiquées parmi les **plantes fourragères** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Luzerne	*Leptosphaerulina* sp.	Tache lepto	1
	Pseudopeziza sp.	Tache commune Tache foliaire	1
	Cymadothea sp.	(suie)	1
	Fusarium avenaceum	Pourridie fusarien	1
	Microsphaera trifolii	Blanc	1
	Sol inadéquat		2
Total			**7**

Tableau 8. Sommaire des maladies diagnostiquées parmi les **arbres et arbustes fruitiers** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Cerisier	*Alternaria alternata*	Brûlure foliaire	1
	Blumeriella jaapii (Phloeosporella padi)	Tache foliaire, criblure	5
	Cytospora sp.	Chancre cytosporien	1
	Irpex lacteus	Carie blanche spongieuse	1
	Podosphaera sp.	Blanc	1
	Pseudomonas syringae	Brûlure foliaire, dépérissement	3
	Wilsonomyces carpophilus	Criblure	1
	Gel hivernal		4
	Phytotoxicité glyphosate / 2,4-D		2
	Stress de manque d'eau		1
Poirier	*Erwinia amylovora*	Brûlure bactérienne	2
	Botrytis cinerea	Moisissure grise	1
	Phomopsis sp.	Chancre phomopsien	1
	Venturia pirina	Tavelure	1
	Gel hivernal		2
Pommier	*Coniothyrium* sp.	Chancre sur tige	1
	Erwinia amylovora	Feu bactérien	32
	Phomopsis mali	Brûlure phomopsienne	2
	Phytophthora sp.	Pourriture du collet	1
	Pseudomonas syringae	Chancre bactérien	1
	Sphaeropsis malorum	Pourriture noire	3
	Spilocaea pomi	Tavelure	15
	Carence de Ca / Mg		2
	Excès de chaleur		1
	Phytotoxicité par les pesticides		2
	Gel hivernal		9
Prunier domestique	Gel hivernal		1
Total			**97**

Tableau 9. Sommaire des maladies diagnostiquées parmi les **graminées à gazon** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Agrostis tenuis	*Colletotrichum graminicola*	Anthracnose	1
	Curvularia sp.	Anomalie de coloration foliaire	1
	Gaeumannomyces graminis	Piétin échaudage	4
	Pythium sp.	Piétin brun	1
	Rhizoctonia sp.	Rhizoctone brun	1
Poa annua / *P. pratensis*	*Curvularia* sp.	Tache foliaire	1
	Pythium sp.	Piétin brun	1
Total			**10**

Tableau 10. Sommaire des maladies diagnostiquées parmi les **arbres** et **arbustes ornementaux** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Abies balsamea	*Fusarium oxysporum*	Chancre au collet	1
	Phytophthora megasperma	Pourridié phytophthoréen	2
	Phytotoxicité glyphosate / simazine / 2,4-D		2
Abies fraseri	Phytotoxicité glyphosate / 2,4-D		1
Buxus sempervirens	*Fusarium* sp.	Dépérissement	1
	Phoma sp.	Dépérissement	1
	Volutella sp.	Tache et brûlure foliaire	1
Hydrangea spp.	*Phoma* sp.	Pourriture foliaire	1
	Xanthomonas campestris	Tache bactérienne	1
	Froid		1
Malus sp.	*Erwinia amylovora*	Brûlure bactérienne	5
Physocarpus sp.	*Pseudomonas syringae*	Tache foliaire	1
Prunus virginiana	*Erwinia amylovora*	Brûlure bactérienne	1
Rhododendron sp.	Phytotoxicité glyphosate		1
Rosa sp.	*Marssonina rosae*	Tache noire	1
Syringa vulgaris	*Pseudomonas syringae*	Brûlure bactérienne	8
Total			**29**

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales herbacées** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Amaranthus spp.	*Pythium* sp.	Pourridié pythien	1
Antirrhirinum sp.	*Pythium* sp.	Pourridié pythien	1
	Thielaviopsis basicola	Pourriture noire des racines	1
Asarum canadense	*Thielaviopsis basicola*	Pourriture noire	1
Asclepias sp.	*Alternaria* sp.	Tache foliaire	1
	Cercospora sp.	Cercosporose	1
	Cladosporium sp.		1
Astilbe sp.	*Rhizoctonia solani*	Rhizoctone	1
	Tomato Necrosis Virus (TNV)	Tache foliaire	1
Begonia spp.	Impatiens Necrotic Spot Virus (INSV)	Anomalie de coloration	2
	Tobacco Rattle Virus (TRV)	Tache foliaire	1
	Tomato Spotted Wilt Virus (TSWV)	Malformation foliaire	2
Buddleia davidii	*Peronospora* sp.	Mildiou	1
Brunnera sp.	*Pythium* sp.	Pourridié pythien	1
	Thielaviopsis basicola	Pourriture noire des racines	1
	Désordre génétique	Anomalie de coloration foliaire	1
Calibrachoa sp.	*Botrytis cinerea*	Moisissure grise	1
	Fusarium sp.	Fusariose racinaire	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium sp.	Pourridié pythien	1
Canna sp.	*Acidovorax avenae*	Tache foliaire	1
	Fusarium sp.	Pourridié fusarien	1
	Xanthomonas campestris	Tache foliaire	1
	Phytotoxicité pesticide		1
Cimicifuga sp.	*Fusarium* sp.	Pourriture du collet	1
	Pseudomonas marginalis	Brûlure foliaire	1
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1
	Meloidogyne sp.	Nodosité racinaire	1
Convolvulus sp.	*Pseudomonas syringae*	Moucheture bactérienne	1
Cosmos sp.	*Entyloma* sp.	Charbon	1
Crassula sp.	Impatiens Necrotic Spot Virus (INSV)	Tache foliaire	1
Cyclamen sp.	*Fusarium oxysporum*	Pourridié fusarien	1
Cyrtomium sp.	Excès de lumière		1

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales herbacées** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Dahlia sp.	*Cylindrocarpon* sp.	Pourriture des racines	2
	Fusarium sp.	Pourridié fusarien	3
	Rhizoctonia solani	Rhizoctone	1
Deschampsia cespitosa	*Puccinia* sp.	Rouille	1
Dianthus sp.	*Fusarium oxysporum*	Fusariose	2
	Pythium sp.	Pourridié pythien	1
	Salinité du sol élevée		1
Echinacea purpurea	*Pythium irregulare* / *Pythium* sp.	Pourridié pythien	2
	Dérèglement génétique		1
Gaillardia sp.	Impatiens Necrotic Spot Virus (INSV)	Tache foliaire	1
Gerbera sp.	*Pythium* sp.	Pourridié pythien	1
Gladiolus sp.	*Alternaria* sp.	Tache foliaire	1
	Fusarium oxysporum	Pourriture du collet et des feuilles	1
Hemerocallis sp.	Froid	Anomalie de coloration foliaire	1
Hibiscus sp.	Fumagine	Anomalie de coloration foliaire	1
	Pseudomonas syringae	Tache foliaire	1
	Phytotoxicité pesticide		2
Hosta sp.	*Colletotrichum* sp.	Anthracnose	1
	Phytotoxicité régulateur de croissance	Malformation foliaire	3
Impatiens, New Guinea	*Phoma* sp.	Tache foliaire	1
	Désordre physiologique		1
Mandevilla sp.	Carence d'éléments minéraux majeurs		1
	Désordre génétique		1
	Œdème		2
Matteuccia struthiopteris	*Pseudomonas cichorii*	Tache foliaire	1
Musa sp.	*Acidovorax avenae*	Tache et brûlure foliaires	1
Orthosiphon sp.	Tobacco Rattle Virus (TRV)	Anomalie de coloration foliaire	1
Osteospermum sp.	Impatiens Necrotic Spot Virus (INSV)	Anomalie de coloration foliaire	1
	Tomato Spotted Wilt Virus (TSWV)	Anomalie de coloration foliaire	1
Palmier	Carence de K	Tache foliaire	1
Passiflora sp.	Cucumber Mosaic Virus (CMV)	Flétrissement, dépérissement	1
Pelargonium sp	*Fusarium solani*	Pourridié fusarien	2
	Rhizoctonia solani	Pourridié pythien	1
	Tomato Spotted Wilt Virus (TSWV)		1

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales herbacées** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Pennisetum sp.	*Fusarium* sp.	Pourridié fusarien	1
	Pythium sp.	Pourridié pythien	1
Phyllanthus retusus	Désordre physiologique	Anomalie de coloration foliaire	1
Paeonia sp.	*Fusarium* sp.	Pourridié fusarien	1
	Xanthomonas campestris	Tache bactérienne	1
Petunia sp.	*Plectosporium* sp.	Pourriture de tige	1
	Pseudomonas fluorescens	Tache foliaire	1
Phlox paniculata	*Pythium intermedium*	Pourridié pythien	1
	Thielaviopsis basicola	Pourriture noire des racines	1
Phlox subulata	*Fusarium* sp.	Pourridié fusarien	1
Racomitrium sp.	Algues	Anomalie de coloration foliaire	1
	Fusarium sp.	Brûlure foliaire	1
Saintpaulia ionantha	*Fusarium oxysporum*	Pourridié fusarien	1
Salvia sp.	Xanthomonas c*ampestris*	Tache bactérienne	1
Scaevola sp.	*Pythium irregulare*	Pourridié pythien	1
	Tomato Spotted Wilt Virus (TSWV)	Brûlure et malformation foliaires	3
Stemmadenia sp.	Oedème		1
Solanum jasminoides	Broad Bean Wilt Virus (BBWV)	Anomalie de coloration	1
Veronica sp.	*Botrytis cinerea*	Moisissure grise	1
	Peronospora grisea	Mildiou	1
Verbena sp.	*Fusarium* sp.	Pourridié fusarien	1
	Carence de Mg		1
Zinnia sp..	Botrytis cinerea	Moisissure grise	1
Total			**106**

Tableau 12. Sommaire des maladies diagnostiquées parmi les **plantes aromatiques et médicinales** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2014.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Basilic	*Peronospora belbahrii*	Mildiou	1
	Carence d'éléments minéraux majeurs		2
	Froid		1
	Polluants atmosphériques		1
Chanvre médicinal	*Botrytis cinerea*	Moisissure grise	1
	Oidium sp.	Blanc	1
	Pythium myriotylum	Pourridié pythien	1
Coriandre	*Sclerotinia sclerotiorum*	Sclérotiniose	1
Ginseng	*Phoma* sp.	Tache et brûlure foliaires	1
	Tobacco Rattle Virus (TRV)	Tache et brûlure foliaires	1
Guimauve	*Puccinia* sp.	Rouille	1
Lavande	*Botrytis cinerea*	Moisissure grise	1
Persil	*Septoria petroselini*	Septoriose	3
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium sp.	Dépérissement	1
Safran	*Fusarium* sp.	Anomalie de coloration du corme	1
	Rhizoctonia solani	Anomalie de coloration du corme	1
Thym	*Botrytis cinerea*	Moisissure grise	1
Total			**21**
GRAND TOTAL			**1741**

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 T4L1W1
Telephone: (403) 782-8100; **Facsimile:** (403) 782-6120; **E-mail:** noryne.rauhala@agr.gc.ca or kelly.turkington@agr.gc.ca

TITLE / TITRE: 2014 BARLEY DISEASE SURVEY IN CENTRAL ALBERTA

ABSTRACT: In 2014, 20 randomly selected commercial barley crops in central Alberta were surveyed for their disease levels. Foliar diseases and common root rot were light to moderate, similar to those found in previous years.

INTRODUCTION AND METHODS: A survey to document diseases of barley was conducted in 20 fields in Central Alberta from August 2-6, 2014. 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 field edge, with visual assessment made of 10 penultimate leaves at each of 5 locations that were at least 25 m apart. Foliar diseases were rated for percentage leaf area diseased (PLAD) for scald, netted net blotch and other leaf spots. Common root rot (CRR) was assessed on 5 sub-crown internodes at each of 5 sites using a 0-4 scale where 0=none, 1=trace and 4=severe. Other diseases, if present, were rated as the percentage incidence of infected plants. 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: Survey results are presented in Table 1. Growing conditions in Central Alberta in 2014 were favourable for crops, with normal temperature and precipitation in May, June, July, and August. Disease development was light to moderate, similar to that recorded in past years, throughout the region (Rauhala and Turkington 2014).

Scald (*Rhynchosporium secalis*) severity (PLAD) ranged from 0.1 to 11 % in 11 fields, was 20-43% in 3 fields and 62% in one field; the remaining crops had no scald. Netted net blotch (*Pyrenophora teres* f. *teres*) was found in 8 of the 20 surveyed fields and ranged in severity from 0.1% to 5% in 6 fields, with 12% and 21% in the other two fields. 'Other' leaf spots, diagnosed as spotted net blotch (*P. teres* f. *maculata*) or spot blotch (*Cochliobolus sativus*), were found in every field surveyed. The severity of these ranged from 1% to 13%. Al*ternaria* spp. were also isolated from sub-samples of the leaf tissues exhibiting 'other' leaf spot symptoms.

Common root rot (*Cochliobolus sativus* and *Fusarium* spp.) occurred in all of surveyed fields, at similar levels to those in past years (Rauhala and Turkington 2014).

No stripe rust (*Puccinia striiformis)* was observed in any of the 20 commercial barley fields surveyed.

REFERENCE:
Rauhala, N.E, and Turkington, T.K. 2014. 2013 barley disease survey in central Alberta. Can. Plant Dis. Surv. 89:53. (www.phytopath.ca/publication/cpds)

Table 1. Disease incidence and severity in 20 commercial barley fields in Central Alberta, 2014.

Disease (severity rating scale)	**% of fields affected**	**Average severity**	**Severity range**
Scald (PLAD*)	75	9	0 - 62
Netted Net Blotch (PLAD*)	40	2	0 -21
'Other' Leaf Spots (PLAD*)	100	5	1 - 13
Combined Leaf Spots (PLAD*)	**100**	**16**	**1 -73**
Common Root Rot (0 – 4)	100	2	1 - 4

* PLAD = percent leaf area diseased

CROP / CULTURE : Barley
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
F. Dokken-Bouchard[1], D. Stephens[1], B. Aryal[2], C. Peluola[2], T. Sliva[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.bouchard@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 2014

ABSTRACT: In 2014, fusarium head blight (FHB) incidence and severity were assessed in 30, mainly 2-row, barley crops in Saskatchewan. FHB occurred in 30% of the surveyed crops at a mean provincial severity (FHB Index) of 0.12%.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity in Saskatchewan in 2014 were assessed in 30 barley crops (28 2-row; 2 6-row). Field location and results 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 proportion of infected spikes per crop and the proportion of infected spikelets in each spike were recorded. A FHB disease severity rating, also referred to as the FHB Index, was determined for each crop surveyed: FHB severity (%) = [% of spikes affected x mean % of kernels infected] / 100. Mean FHB severity values were calculated for each soil 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 confirm the presence of *Fusarium* species on infected kernels. Cultures were grown on potato dextrose agar (PDA) or half strength PDA to observe colony morphology. Carnation leaf agar was used to aid in promoting *Fusarium* sporulation. In surveys in previous years, a maximum of 20 symptomatic kernels per sample was used to represent infected samples and confirm FHB and the *Fusarium* spp. involved. In 2014 a maximum of 8 kernels per sample was used for this purpose.

RESULTS AND COMMENTS: Approximately 0.8 million ha (2.0 million acres) of barley were seeded in Saskatchewan in 2014. The average yield of 2.88 metric tonnes per ha (54.2 bu/acre) in 2014 was lower than the record-breaking barley yields in 2013 but slightly higher than the 10-year average of 2.85 metric tonnes per ha (53.7 bu/acre) (Saskatchewan Ministry of Agriculture 2014).

In 2014, FHB occurred in 30% of the barley crops surveyed, 9 of 2-row and one of 6-row barley (Table 1). The provincial mean FHB severity for 2-row barley of 0.13% was considerably lower than in 2012 (3.0%) or 2013 (1.7%). In 6-row barley, the provincial mean severity (0.07%) was also substantially lower compared to the previous two years (3.4-3.7%); however the survey sample size (2 crops) in 2014 was very small compared with 2013 (Dokken-Bouchard et al. 2014). Similar to previous years, severity of FHB in barley was highest in Soil Zone 3 (Table 1).

Of the 30 barley spike samples collected, 9 showed putative FHB symptoms and a total of 28 isolations was made from these to confirm the presence of *Fusarium* spp. and their identity (Table 2). The most frequently isolated causal pathogen, *F. poae*, occurred in 5 (17%) of the surveyed crops, and accounted for 39% of all *Fusarium* isolations.

Fusarium graminearum was detected in 4 (13%) of the barley crops from which survey samples were collected, which was double the prevalence in 2013 (Dokken-Bouchard et al. 2014). This species accounted for 21% of isolations, also notably higher than found in previous years (e.g. 5% in 2013).

Secondary moulds were isolated from most of the samples and other barley pathogens infrequently found included *Cochliobolus* and *Septoria* spp.

Based on the survey results, FHB caused nil to minimal damage in Saskatchewan barley crops in 2014.

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.

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Table 1. Prevalence and severity of fusarium head blight (FHB) in barley crops grouped by soil zone in Saskatchewan, 2014.

Soil Zones	Two-Row Barley		Six-Row Barley	
	Prevalence[1] (No. of crops affected)	**Mean FHB Severity[2] (range)**	**Prevalence[1] (No. of crops affected)**	**Mean FHB Severity[2] (range)**
Zone 1 Brown	0% (2)	0% (-)	100% (1)	0.15% (-)
Zone 2 Dark Brown	9% (11)	0.05% (0-0.5%)	-	-
Zone 3 Black/Grey	47% (15)	0.2% (0-0.8%)	0% (1)	0% (-)
Overall Total/Mean	29% (28)	0.13%	50% (2)	0.07%

[1] Prevalence (%) = Number of crops affected / total crops surveyed
[2] FHB severity (FHB Index) = [% of spikes affected x mean proportion (%) of kernels infected] / 100.

Table 2. Fusarium species in FHB-affected barley crops in Saskatchewan in 2014.

	F. acuminatum	*F. avenaceum*	*F. equiseti*	*F. graminearum*	*F. poae*	*F. sporotrichioides*	Other *Fusarium* sp.
Prevalence[1]	3%	7%	3%	13%	17%	7%	3%

[1]Prevalence (%) = Number of crops with particular *Fusarium* sp. detected / total crops surveyed

CROP / CULTURE: Barley
LOCATION / REGION: Saskatchewan

NAMES AND AGENCY / NOMS ET ETABLISSEMENT:
J. Liu, V.A. Tran and H.R. Kutcher
Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
Telephone: (306) 966-8661; **Facsimile:** (306) 966-5015; **Email:** randy.kutcher@usask.ca

TITLE / TITRE: LEAF SPOT DISEASES OF BARLEY IN SASKATCHEWAN IN 2014

ABSTRACT: In Saskatchewan leaf spot severity was assessed in 32 barley crops in 2014. Disease severity ranged from very slight to severe, and the causal agents were determined to be *Cochliobolus sativus* (Ito & Kuribayashi) Drechs. ex Dastur (spot blotch), *Pyrenophora teres* Drechsler (net blotch) and *Septoria passerinii* Sacc. (speckled leaf blotch).

INTRODUCTION AND METHODS: Leaf spot diseases of barley were surveyed throughout Saskatchewan during August, 2014, when most crops were at the late milk to soft dough stages of growth. For each of the 32 crops sampled, ten or more leaves were collected, placed in paper envelopes and dried. These leaves were rated for disease severity during September in the laboratory using a six-category scale adapted from Tekauz et al. (2012): (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%). The causal pathogens affecting leaves were identified by surface sterilizing 10 pieces of infected leaf tissue, each from a different leaf, and placing these on wet filter paper for one week to promote sporulation. Pathogen identification (and thus of the diseases present) was based on spore shape, size and colour.

RESULTS AND COMMENTS: Mean monthly temperature and total precipitation at Saskatoon, North Battleford, Melfort, Yorkton, Regina, Swift Current and Kindersley, SK in 2014, and the 30-year (1981-2010) mean at each location are presented in Table 1. In 2014, temperatures were similar among locations, but overall much cooler than the long-term normal in May and June. Total monthly precipitation varied among locations. In general, all regions received near normal precipitation in May, but significantly above normal levels in June and variable levels dependent on location in July and August (Table 1).

Three fungal pathogens were identified, based on isolations from infected barley leaf tissue. *Cochliobolus sativus* was observed in 84% of crops surveyed and isolated from 61% of the leaf pieces collected (Table 2). The prevalence of *Pyrenophora teres* also was high (71%), but it was isolated from only 24% of leaf pieces, while *Septoria passerinii* was observed in 52% of crops and isolated from 18% of leaf pieces. Compared to 2013 and 2012, the 2014 survey results showed an increased proportion of crops affected by *P. teres* and *S. passerinii*, but little change for *C. sativus* (Liu et al. 2014).

Leaf spot severity in the majority of crops surveyed (59%) was observed to be very slight or slight, which indicated that on average there was <15% damage to the flag leaves examined (Table 3). However, 41% of crops were considered moderately or severely damaged. Recently, well-timed fungicide applications to barley crops with moderate to severe levels of disease have been found to preserve yield by 12-15% (Turkington et al. 2015).

ACKNOWLEDGEMENTS:
We thank the Saskatchewan Crop Insurance Corporation staff for collecting the barley samples for this survey.

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Table 1. Average monthly temperature and total precipitation at Saskatoon, North Battleford, Melfort, Yorkton, Regina, Swift Current and Kindersley, SK in 2014, and the 30-year† (1981-2010) average at each location

Weather	Month	Saskatoon		North Battleford		Melfort		Yorkton		Regina		Swift current		Kindersley	
		2014	Long term	2014	Long term	2014	Long term	2014	Long term	2014	Long term	2014	Long term	2014	Long term
Average	May	10.1	12.1	9.7	11	10	10.7	10.5	10.4	10.8	11.3	11.2	10.9	10.4	11
Temperature	June	14.1	16.8	14.3	15.5	14	15.9	14.5	15.5	14.3	16.2	13.5	15.3	14	15.5
(°C)	July	18.3	19.6	17.5	17.6	17.5	17.5	18.1	17.9	18.5	18.9	18.1	18.2	18.3	18.1
	August	17.9	18.6	17.1	16.9	17.6	16.8	17.8	17.1	18.3	18.1	17.9	17.6	17.8	17.3
Total	May	61.1	42.9	31.8	32.8	24.3	42.9	45.5	51.3	37.2	51.4	21.7	51.2	24.8	40.3
precipitation	June	94.8	62.8	114	65	167	54.3	235	80.1	175	70.9	114	77.1	116	67
(mm)	July	44.5	67.1	0	74.1	38.8	76.7	21.5	78.2	19.9	66.9	14.9	60.1	63.4	55.8
	August	18.5	48.6	0	57.9	57.9	52.4	86.8	62.2	135	44.8	99.1	47.4	82	43.9

†Long term (30-yr) Environment Canada weather data taken at: Saskatoon Water TP, North Battleford A, Melfort CDA,
Yorkton A, Regina INT'L A, Swift Current A, Kindersley A (http://www.weather.gc.ca)

Table 2. Pathogen prevalence and pathogen incidence from infected barley leaf tissue in Saskatchewan in 2014.

Pathogen	Prevalence (% crops)	Incidence† (%)
Cochliobolus sativus	84	61
Pyrenophora teres	71	24
Septoria passerinii	52	18

†Incidence = proportion of leaf tissue pieces from which each pathogen was isolated; indicative of the relative amount of foliar damage observed.

Table 3. Leaf spot disease severity in 32 barley crops in Saskatchewan in 2014.

Disease severity	Number of crops	Prevalence† (%)
Nil (0%)	0	0
Very slight (1-5%)	8	25
Slight (6-15%)	11	34
Moderate (16-40%)	5	16
Severe (41-100%)	8	25
Total	**32**	

†Prevalence = number of crops in each disease severity category expressed as a proportion of the total number of crops surveyed

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
M. Beyene, M. Banik and X. Wang
Cereal Research Centre, Agriculture and Agri-Food Canada, 101 Route 100, Morden MB R6M 1V5
Telephone: (204) 822-7533; **Facsimile:** (204) 822-7507; **E-mail:** xiben.wang@agr.gc.ca

TITLE / TITRE: FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA – 2014

ABSTRACT: Thirty-two barley fields in Manitoba were surveyed for fusarium head blight (FHB) in 2014 to assess disease severity and the causal *Fusarium* species. FHB severity in the surveyed fields was light with a mean FHB index of 0.4%. *Fusarium poae* was the dominant species isolated from developing kernels, followed by *F. graminearum, F. sporotrichioides and F. avenaceum.*

INTRODUCTION AND METHODS: Barley crops in Manitoba were monitored for the presence of fusarium head blight (FHB) from Aug 1 to 8 when crops were at the early- to soft- dough (ZGS 79-83) stages of growth. A total of 32 (23 2-row, 9 6-row) crops were selected at random along the survey routes, depending on the crop frequency. The area sampled was bounded by Highways #26, 16 and 45 to the north, #14 and 3 to the south, #12 to the east and #83 to the west. FHB incidence (the percentage of spikes showing typical FHB symptoms) was assessed in each crop by sampling 80-120 spikes at three locations and averaging the scores. The mean 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 and putatively infected kernels, or those of normal appearance to make up the remainder, were removed from five spikes per location. The kernels were surface sterilized in 0.3% NaOCl (commercial Javex) for 3 min., air-dried, and plated onto potato dextrose agar in Petri plates (10 kernels per plate) to quantify and identify the species of *Fusarium* spp. present, based on culture morphology as described in standard taxonomic keys.

RESULTS AND COMMENTS: In spring 2014, flooding was widespread in south-central and south-western regions of Manitoba and resulted in considerable land not being seeded, or if seeded, subsequently abandoned due to poor emergence. However, moderate crops were harvested in many districts, mainly due to subsequent dry and warm conditions from mid-July to late-September.

Barley was grown on 128,700 ha (321,800 acres) in 2014, a reduction of 30% compared to 2013 (MASC 2014). Two-row 'Conlon' was the most widely planted cultivar and occupied 29.4% of the barley acreage. Plantings of 'CDC Austenson' increased from 7.0% in 2013 to 14.2% in 2014. 'Newdale' was the third most popular cultivar, occupying 10.2% of the barley area. These three cultivars made up more than half of the barley seeded in Manitoba in 2014 (Yield Manitoba 2014).

Putative symptoms of FHB were observed in 31 of the 32 crops surveyed. The mean incidence of FHB in 2-row barley was 5.1% (range 0 - 14%) and SPI was 4.3 % (range 0 - 15%). In 6-row crops, the incidence was 3.3% (range 0 - 8%) and SPI 4.7% (range 3 - 10%). The resulting mean Fusarium Head Blight Index (FHB-I) [%incidence X %SPI / 100] for 2-row barley was 0.41% (range 0 - 3%), and that for 6-row barley 0.31% (range 1 – 5%).

The somewhat lower FHB-I in 6-row than in 2-row barley calculated for 2014 was similar to that reported for 2009, 2010 and 2013 (Tekauz et al, 2010, 2011; Banitk et al. 2014). Since 2-row cultivars are generally rated as more resistant to FHB than 6-row cultivars (Seed Manitoba 2015), the 2014 results may be due to the lower number (28%) of 6-row barley crops surveyed. Opposite, and more typical results, were obtained in 2011 and 2012 (Tekauz et al. 2012 and 2013).

The mean FHB-I for all barley was 0.38%. This figure was lower than that reported for 2012 and 2013 (Tekauz et al. 2013a) and would have caused minimal yield loss. In 2014, the environmental conditions were favourable for *Fusarium* inoculum development and infection in the early-maturing winter wheat crop. However, a period of warm and dry weather occurred when barley was at anthesis. This, combined

with the widespread application of foliar fungicides in barley likely contributed to the reduced FHB severity and resulting minimal yield and quality losses experienced in 2014.

Fusarium colonies developed from kernels collected in the 31 affected crops at a mean level of 55%. The individual *Fusarium* species identified on kernels are listed in Table 1. As found in 2011 (Tekauz 2012), *F. poae* was most common in 2014; it was detected in most crops and made up 84% of the total *Fusarium* flora. This was in contrast to 2010 and 2009, when *F. graminearum* either dominated or was at similar levels as *F. poae* (Tekauz et al. 2011, 2010). Although both *F. graminearum* and *F. sporotrichioides* were detected in 75% and 62% of barley crops, respectively, they represented only a low proportion (20% and 15%, respectively) of the total *Fusarium* flora. *Fusarium avenaceum* was found in only 3 fields and at a very low level (0.3% infected kernels).

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Table 1. *Fusarium* spp. isolated from FHB-affected barley kernels in Manitoba in 2014.

***Fusarium* spp.**	**Percent of crops**	**Percent of kernels**
F. avenaceum	0.1	0.3
F. graminearum	75	20.3
F. poae	84	63.7
F. sporotrichioides	62	14.9

CROP / CULTURE: Barley
LOCATION / RÉGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
X. Wang, M. Beyene and M. Banik
Agriculture and Agri-Food Canada, Cereal Research Centre, 101 Route 100, Morden MB R6M 1Y5
Telephone: (204) 822-7533; **Facsimile: (**204) 822-7507; **E-mail:** xiben.wang@agr.gc.ca

TITLE / TITRE: BARLEY LEAF SPOT DISEASES IN 2014 IN MANITOBA

ABSTRACT: A survey of barley crops in Manitoba in early August 2014 showed that *Pyrenophora teres* (net blotch) and *Cochliobolus sativus* (spot blotch) were the commonest leaf spot pathogens. Disease severity was somewhat higher than reported in earlier years but typical of recent years.

INTRODUCTION AND METHODS: In 2014, leaf spot diseases of barley in Manitoba were assessed by surveying the crops (23 two-row, 9 six-row) in 32 farm fields from August 1-8, when most crops were at the early-dough stage of growth (ZGS 79-83). Crops were sampled at regular intervals along the survey routes, depending on availability. The area sampled was bounded by Highways # 227, 16 and 45 to the north, the Manitoba/North Dakota border to the south, Hwy #12 to the east and Hwy #21 to the west. Disease incidence and severity were recorded by averaging their level on 10-20 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 (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, 10 surface-sterilized pieces of putatively infected leaf tissue were placed on filter paper in moist chambers for 3-5 days to promote sporulation and identify the causal agent(s) and disease(s).

RESULTS AND COMMENTS: In spring 2014, flooding was widespread in south-central and south-western regions of Manitoba and resulted in considerable land not being seeded, or if seeded, subsequently abandoned due to poor emergence. However, reasonable crops were harvested in many districts, due mainly to subsequent dry and warm conditions from mid-July to late-September.

Barley was grown on 128,720 ha (321,800 acres) in Manitoba in 2014, a reduction of 30% compared to 2013 (MASC 2015). Two-row 'Conlon' was the most widely planted cultivar and occupied 29.4% of the barley area. Plantings of cultivar 'CDC Austenson' increased from 7.0% in 2013 to 14.2% in 2014. 'Newdale' was the third most popular cultivar, occupying 10.2% of the barley area.

Pyrenophora teres (causal agent of net blotch) and *Cochliobolus sativus* (spot blotch) were the principal pathogens isolated from infected leaf tissue, and caused most of the foliar damage observed (Table 1). This is typical for barley in Manitoba in most years (Tekauz et al. 2011, 2010).

Based on damage in both the upper and lower leaf canopies, leaf spots were observed in most of the 32 barley crops surveyed. Disease levels in the upper canopy were trace, very slight or slight in 52% of crops, moderate in 37% and severe in 9%. Respective severity categories in the lower canopy were estimated as 18%, 21% and 34%, with 21% having only senescent foliage. These severity levels are somewhat higher than those reported is some earlier years (Tekauz et al. 2011), but typical of levels found more recently.

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Table 1. Incidence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2014

Pathogen	**Incidence (% of fields)**	**Frequency (% of isolations*)**
Pyrenophora teres	73	52
Cochliobolus sativus	54	48

*indicative of the relative damage caused

CROP / CULTURE: Barley

LOCATION / RÉGION: Central and 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 BARLEY IN CENTRAL AND EASTERN ONTARIO IN 2014

ABSTRACT: Twenty-nine barley crops in central and eastern Ontario were surveyed for diseases in 2014. Of 14 diseases observed, spot blotch, take-all and fusarium head blight (FHB) were found in all fields, with severe infection levels occurring in 3, 4 and 3 crops, respectively. *Fusarium poae* and *F. graminearum* were the predominant species causing FHB.

INTRODUCTION AND METHODS: A survey of barley diseases was made in the third week of July 2014 in central and eastern Ontario, where spring barley is grown. Twenty-nine crops were sampled when plants were at the soft-dough stage of growth. At three random sites per field foliar disease severity was determined on 10 flag and 10 penultimate leaves using a rating scale of 0 (no disease) to 9 (severely diseased). Diagnosis was based on visible symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered as trace, slight, moderate, and severe infection levels, respectively.

Severity for covered smut, ergot, leaf stripe, loose smut, and take-all was based on percent plants infected. Fusarium head blight (FHB) was rated for incidence (% infected spikes) and severity (% infected spikelets in the affected spikes) based on approximately 200 spikes at each of three random sites per field. A FHB Index [(% incidence x % severity)/100] was determined for each field; 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 50 infected spikes collected from each field. The spikes were air-dried at room temperature and threshed. Fifty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 60 sec. and plated in 9-cm diameter petri dishes on modified potato dextrose agar (10 g dextrose per litre amended with 50 ppm of streptomycin sulphate). The plates were incubated for 10-14 days at 22-25ºC and with a 14-hour photoperiod using fluorescent and long wavelength light. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: The survey included 5 two-row and 24 six-row barley crops. A total of 14 diseases or disease complexes was observed (Table 1). On foliage, spot blotch (*Cochliobolus sativus*), barley yellow dwarf virus (BYDV), septoria complex [including speckled leaf blotch (*Septoria tritici*) and leaf blotch (*Stagonospora nodorum*)] and net blotch (*Pyrenophora teres*) were the most common and were found in 29, 28, 27 and 26 crops at average severities of 3.0 , 2.0, 2.4 and 1.5, respectively. Severe infection with spot blotch was observed in three crops and with net blotch in two crops; no severe infections were recorded for BYD or for the septoria complex. Yield reductions due to these diseases were estimated to have averaged <5% in affected crops.

Other foliar diseases observed included leaf rust (*Puccinia hordei*), powdery mildew *(Erysiphe graminis*), scald (*Rhynchosporium secalis*), and stem rust (*Puccinia graminis* f. sp. *tritici* or f. sp. *secalis*). These were observed in 11, 10, 7, and 10 crops, at mean severities of 2.5, 2.2, 1.6, and 2.0, respectively. Although one crop had a severe level of leaf rust, none of these diseases would have resulted in substantive damage to the crop.

Loose smut (*Ustilago nuda*) and take-all root rot (*Gaeumannomyces graminis*) were found in 27 and 29 crops at mean incidences of 2.5% and 2.4%, respectively. Yield reductions by the two diseases were estimated at 5% in affected crops. Covered smut (*U. hordei*), ergot (*Claviceps purpurea*), and leaf stripe (*Pyrenophora graminea*) were observed in 26, 28, and 26 crops at incidence levels of 0.6%, 0.8%, and

0.9%, respectively. These three diseases likely resulted in minimal crop damage.
FHB was observed in all surveyed crops at a mean FHB index of 4.3% (range 0.01% to 16.0%) (Table 1). Severe levels of FHB were observed in three crops. Overall, the disease likely did not result in significant loss of barley grain yield or quality in 2014. Six *Fusarium* species were isolated from putatively infected kernels (Table 2). *Fusarium poae* and *F. graminearum* predominated and occurred in 97 and 79% of surveyed fields and on 28.0 and 15.2% of infected kernels, respectively. *Fusarium acuminatum*, *F. avenaceum, F. equiseti*, and *F. sporotrichioides* were less common, occurring in 3-52% of fields and 0.1-4.7% of kernels.

The 14 diseases observed on barley in Ontario in 2014 were the same as those recorded for 2013 (Xue and Chen 2014). Generally, the incidence and severity of the diseases were lower in 2014 than 2013. Although FHB occurred in all fields surveyed, the disease would not have caused significant reductions in grain yield and quality. Reduced rainfall in June and lower temperatures in July compared to previous years in central and eastern Ontario were likely responsible for the decreased disease severities observed in 2014.

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Xue, A.G., and Chen, Y. 2014. Diseases of barley in central and eastern Ontario in 2013. Can. Plant Dis. Surv. 94:109-111. (www.phytopath.ca/publication/cpds)

Table1: Prevalence and severity of barley diseases in central and eastern Ontario in 2014.

	NO. CROPS	DISEASE SEVERITY IN AFFECTED CROPS*	
DISEASE	**AFFECTED (n=29)**	**MEAN**	**RANGE**
BYD	28	2.0	1.0-4.0
Leaf rust	11	2.5	1.0-7.0
Net blotch	26	1.5	1.0-6.0
Powdery mildew	10	2.2	1.0-5.0
Scald	7	1.6	1.0-3.0
Septoria complex	27	2.4	1.0-5.0
Spot blotch	29	3.0	1.0-7.0
Stem rust	10	2.0	1.0-4.0
Covered smut (%)	26	0.6	0.5-2.0
Ergot (%)	28	0.8	0.1-3.0
Leaf stripe (%)	26	0.9	0.1-3.0
Loose smut (%)	27	2.5	0.1-15.0
Take-all (%)	29	2.4	0.1-10.0
Fusarium head blight**	29		
Incidence (%)		22.9	1.0-80.0
Severity (%)		11.7	1.0-40.0
Index (%)		4.3	0.01-16.0

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

Table 2: Prevalence of *Fusarium* species isolated from fusarium damaged barley kernels in central and eastern Ontario in 2014.

***Fusarium* spp.**	**% AFFECTED CROPS**	**% KERNELS**
Total *Fusarium*	100.0	52.7
F. acuminatum	3.4	0.1
F. avenaceum	34.5	3.0
F. equiseti	24.1	1.7
F. graminearum	79.3	15.2
F. poae	96.6	28.0
F. sporotrichioides	51.7	4.7

CROP / CULTURE: Canary seed (*Phalaris canariensis*)
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENT:
P. Cholango-Martinez, A. Beniuk, P. Hucl and H.R. Kutcher
Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
Telephone: (306) 966-4951; **Facsimile:** (306) 966-5015; **E-mail:** randy.kutcher@usask.ca

TITLE / TITRE: DISEASES OF CANARYSEED IN SASKATCHEWAN

ABSTRACT: *Septoria triseti* Speg. cause of leaf mottle, and three *Fusarium* spp. on seed were the most frequently isolated pathogens from canaryseed (*Phalaris canariensis*) in Saskatchewan in 2014. Most of the 21 crops sampled from the south-east and south-west regions of the province were affected by both leaf mottle and *Fusarium* spp. at varying levels, depending on location.

INTRODUCTION AND METHODS: A survey to document the diseases affecting canaryseed crops in Saskatchewan was conducted from August 12 – 24, 2014. Twenty-one randomly-selected crops varied in maturity between BBCH growth stages 65 and 89 (full flower to maturity; Lancashire *et al*. 1991). Leaf mottle severity was assessed on the flag-1 and flag-2 leaves as the percentage of the leaf area affected (Horsfall and Barratt 1945). The average severity on the two leaves was categorized as either trace (0-10%), light (6-10%), moderate (11-40%) or severe (41-100%). Flag and penultimate leaves with leaf mottle symptoms (necrotic tissue with black pycnidia) were collected from each crop and dried in paper envelopes. Subsequently, affected tissue pieces from 10 leaves per crop were surface-sterilized in 70% ethanol for 1 min and then rinsed 3 times in sterile water. The leaf tissue pieces were then plated on water agar containing streptomycin for 3 days after which the proportion of these pieces harboring the leaf mottle pathogen, *Septoria triseti*, was determined by visual observation. To determine the occurrence and level of seed infection, 100 seeds from each crop were surface-sterilized in 70% ethanol for 1 min, rinsed 3 times in sterile water, and then vacuum dried. These seeds were plated on potato dextrose agar (PDA) and incubated with 12 h light/dark at room temperature for 6 days (Warham *et al.* 1995). Morphological keys were used to identify the species of *Fusarium* present (Gerlach and Nirenberg 1982). Prevalence of *Fusarium* spp. was determined by counting the number of crops affected by *Fusarium* spp., and incidence was calculated from the proportion of seeds infected with *Fusarium* spp.

RESULT AND CONCLUSIONS: Among the 21 crops surveyed, *S. triseti* was observed in 15 crops for a prevalence of 71%. Six crops free of leaf mottle may have been sprayed with foliar fungicides; severity levels of the others were trace (4 crops), light (1), and moderate (10). The incidence of *S. triseti* in the 210 leaf tissue pieces tested in the laboratory was 49%. Although almost 50% of canary seed crops had moderate severities of leaf mottle, yield loss associated with this level of disease has not been established in Saskatchewan. In addition to leaf mottle, aphids were observed in many canaryseed crops and some lodging was noted. Lodging was more prevalent in the southeast of the province than in the southwest, possibly due to greater precipitation in the former region.

Prevalence of *Fusarium* spp. in the 21 canaryseed crops was 95%; only one crop was *Fusarium*-free. The three species identified were *F. graminearum, F. avenaceum* and *F. equiseti*, at prevalence levels among the crops of 90%, 48% and 14%, respectively (Table 2). The incidence *F. graminearum*-infected seed among the crops was as high as 73% (Table 3). The highest incidences of *F. avenaceum* and *F. equiseti* on seed ware 8% and 7%, respectively. Other fungi observed occasionally included *Alternaria* spp. and *Bipolaris* spp.

ACKNOWLEDGEMENT: We thank X.M. Zhang for help in identifying *Fusarium* species. Funding support for this survey was courtesy of the Agriculture Development Fund of the Saskatchewan Ministry of Agriculture, the Western Grains Research Foundation, and the Canary Seed Development Commission.

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Warham E.J., Butler L.D. and Sutton, B.C. 1995. Seed Testing of Maize and Wheat: A Laboratory Guide CIMMYT/CAB International, Mexico, D.F./Wallingford

Table 1. Severity of leaf mottle in canary seed crops in Saskatchewan, 2014.

Severity level	% leaf area affected	# Crops	Severity (%)
None	0	6	29
Trace	1 – 5	4	19
Light	6 – 10	1	5
Moderate	11 – 40	10	48
Severe	41 – 100	0	0

Table 2. *Fusarium* spp. isolated from seed of canaryseed in Saskatchewan in 2014.

	% Affected Crops	% of Kernels*
Total *Fusarium* spp.	95	14
Fusarium graminearum	90	12
Fusarium avenaceum	48	2
Fusarium equiseti	14	0.4

***** Based on a total of 2,100 seeds.

Table 3. Incidence of *Fusarium* spp. and leaf mottle in 21 crops of canary seed in Saskatchewan, 2014.

Crop #	SK Crop District #	*Fusarium graminearum* (%)	*Fusarium avenaceum* (%)	*Fusarium equiseti* (%)
1	2B	2	0	0
2	2B	3	2	1
3	2B	3	0	0
4	2B	17	3	0
5	2B	5	1	0
6	2B	8	0	0
7	2B	5	1	0
8	8B	73	0	0
9	8B	2	0	0
10	4B	4	2	0
11	4B	1	0	0
12	7A	0	0	1
13	7A	5	5	0
14	7A	24	0	0
15	7A	9	6	0
16	7A	0	0	0
17	7A	34	8	0
18	7A	20	2	0
19	7A	27	5	7
20	5B	1	0	0
21	5B	1	1	0

CROPS / CULTURES: Barley, Durum, Oat, Wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
R.A.A. Morrall[1], B. Carriere[2] and B. Ernst[3]
[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

TITLE /TITRE: SEED-BORNE FUSARIUM ON CEREALS IN SASKATCHEWAN IN 2014

ABSTRACT: A summary of over 2,000 results from two seed testing laboratories showed that levels of seed infection with *Fusarium graminearum* and of all *Fusarium* spp. in harvested grain were mostly double or more of those in 2013. High levels occurred in samples from eastern, central and western crop districts. Over all districts the frequencies of samples with >10% total *Fusarium* spp. infection were 26% for barley, 47% for durum, 16% for oat and 41% for wheat.

INTRODUCTION AND METHODS: Two seed testing companies provided the results of their tests for *Fusarium* spp. in cereal seed samples from Saskatchewan using either agar plating on 200 seeds (3), or quantitative PCR on 192 seeds arranged in 24 pools of 8 seeds each. For the quantitative PCR protocol, the presence or absence of DNA of *Fusarium* spp. or of *F. graminearum* in each seed pool allows statistical calculation of a probable % infection of the seed with each entity. However the chance of obtaining false negative results varies between the plate test and PCR because of sample sizes. All tests were conducted between early September and late December, 2014 and it was assumed that in this period the majority of samples came from the 2014 crop. Tests were done on random seed samples with no attempt to select fusarium-damaged kernels. In addition to the % frequency of all species of *Fusarium* combined (total *Fusarium*) and the % frequency of *F. graminearum a* third variable calculated was the mean percentage of *F. graminearum*-free samples. The results of over 2,000 tests overall were averaged according to Saskatchewan crop districts [CDs] (6) and for the whole province.

RESULTS AND COMMENTS: The 2014 growing season in Saskatchewan was characterized by precipitation above normal at some period in most areas, especially from late July through September. Crop development was slow and harvest delayed in many areas. Fusarium head blight symptoms were evident in most cereal crops, but usually at low incidence and severity levels (1, 2) Observations and conversation with agronomists suggest that a majority of cereal crops received one or more applications of foliar fungicides to control leaf spots, fusarium head blight or both diseases.

Almost no seed samples were free of all *Fusarium* spp. As in previous years (5), the species other than *F. graminearum* commonly found were *F. avenaceum*, *F. poae*, and *F. sporotrichioides* but *F. culmorum* was only rarely detected. The numerical data on seed infection (Table 1) showed that levels of infection with *Fusarium* spp. were generally higher than in 2013 (5). A review of harvested seed surveys for the last 10 years (3,4,5,) shows that 2014, 2012 and 2010 were all years with high levels of *Fusarium* spp. seed infection. The years 2005, 2011 and 2013 had moderate infection levels while 2006, 2007, 2008 and 2009 had low infection levels

The data for 2014 (Table 1) are based on 2,018 samples, similar to the 1981 check samples reported in 2012 (4). High numbers of seed samples tested reflect an ongoing concern among Saskatchewan farmers about FHB and *F. graminearum* and a shortage of healthy cereal seed for planting. However, a better appreciation of shortages or availability than provided by mean % infection levels (Table 1) is obtainable from frequency distributions. The frequencies of different levels of % total *Fusarium* spp. in seed of four cereal species harvested in 2014 are given in Fig. 1. Over all crop districts the frequencies of samples with >10% *Fusarium* spp. infection were 26% for barley, 47% for durum, 16% for oat and 41% for wheat. The percentages of seed samples with ≤ 5% infection were 61% for barley, 32% for durum, 69% for oat and 40% for wheat.

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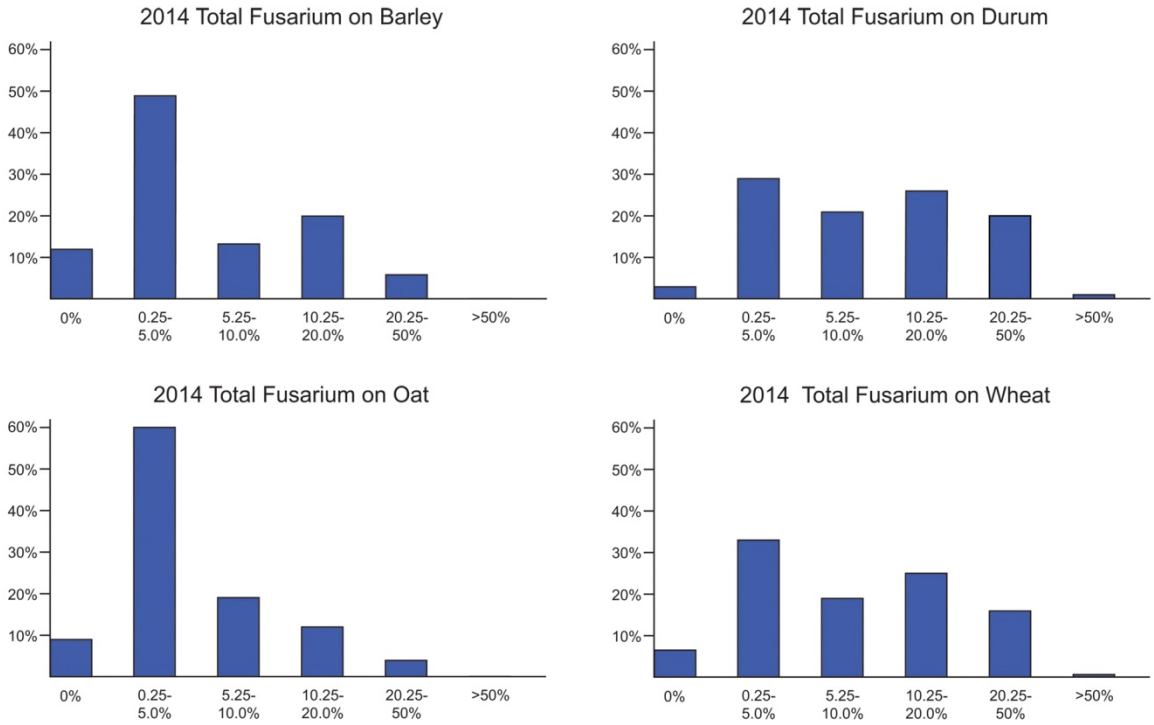

Fig. 1. Distribution of samples of harvested seed of four cereal species in six categories of % total Fusarium spp. infection (horizontal axis) in Saskatchewan in 2014 (Vertical axes =% total samples of the cereal species indicated)

Table 1. Number of cereal seed samples tested from September to the end of December 2014 and levels of infection with *Fusarium graminearum* or total *Fusarium* spp. in relation to Saskatchewan Crop Districts*

		Fusarium graminearum		**All *Fusarium* spp.****
Crop District	**No. of samples tested**	**Mean % infection**	**% samples with no infection detected**	**Mean % infection**
1A	78	13.1	6.4	19.3
1B	12	4.9	25.0	9.8
2A	188	10.4	10.1	14.7
2B	123	7.4	15.4	12.5
3AN	46	3.1	13.0	11.6
3AS	220	5.0	18.4	11.3
3BN	172	3.0	14.0	10.9
3BS	12	1.2	16.7	7.3
4A	8	1.1	62.5	10.3
4B	12	1.5	25.0	3.9
5A	36	5.3	5.6	12.1
5B	94	2.1	20.0	9.0
6A	145	5.3	18.5	15.2
6B	271	4.5	19.4	11.5
7A	171	2.8	14.2	9.7
7B	68	2.6	23.5	9.6
8A	76	2.5	25.0	6.9
8B	96	4.7	18.2	11.6
9A	114	3.1	20.7	10.0
9B	76	1.5	32.9	6.6
TOTAL	2018**	6.2%	18.0%	11.2%

*Data from Discovery Seed Labs and Prairie Diagnostic Lab Services
**Number of samples tested for total *Fusarium* from all crop districts was 1942.

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

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
T. Fetch and T. Zegeye
Cereal Research Centre, Agriculture and Agri-Food Canada, 101 Route 100, Morden MB R6M 1Y5
Telephone: (204) 578-6591; **Facsimile:** (204) 578-6524; **E-mail:** tom.fetch@agr.gc.ca

TITLE / TITRE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2014

ABSTRACT: Stem rust severity in cereal crops in western Canada was very low in 2014 and attributed to very low inoculum pressure from the USA. In wheat and barley, race QFCSC was dominant as it has been for the past decade. In oat, more variability in race structure was found and race TJS was dominant, likely influenced by its ability to attack the *Pg-a* resistance used in the southern USA.

INTRODUCTION AND METHODS: A total of 130 oat and 77 wheat and barley fields, as well as trap nurseries of barley, oat and wheat, were monitored in 2014 for stem rust to assess severity of infection by stem rust *(Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn. and *P. graminis* Pers. f. sp. *avenae* Eriks. & E. Henn.) and determine the virulence spectrum in each pathogen population. The surveys were conducted in July, August, and September. Infected stem tissue samples were collected from the sites surveyed. Urediniospores were obtained from collections and evaluated for virulence specialization on sets of host differential lines (Fetch, 2009).

RESULTS AND COMMENTS: Wet and cold soil conditions in April greatly delayed planting of cereal crops, particularly in the central prairie region. Mean temperature was below normal in April (-1 to -4C), but normal (-1 to +1°C) for the growing season. Precipitation was much above average (>200%) across Saskatchewan and western MB in April and June, and along the USA border in August. However, it was very dry (40-60% of normal) in the prairies in July. Environmental conditions for stem rust infection were generally unfavourable across the prairies in 2014. Fungicide use also reduced rust infection in 2014. Incidence and severity on susceptible lines in trap nurseries and commercial oat and barley crops were at trace levels. Stem rust infection in the USA was very light in 2014, thus there was little migration of inoculum.

All spring wheat cultivars recommended for production in western Canada 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, cultivated barley, and on wild barley (*Hordeum jubatum*) in 2014. Race determination revealed that nearly all of the samples of *P. graminis* f. sp. *tritici* in 2014 were race QFCSC, which has been dominant since 2004.

Stem rust in cultivated and wild oat was at trace levels in western Canada in 2014. All oat cultivars except ‘Stainless’ are susceptible to stem rust races TJJ and TJS (Fetch and Jin 2007). Race TJS was dominant in 2014 and attacks all commonly grown oat cultivars in Canada. This race continues to increase in frequency since its original detection in 2005 (Fetch 2009). The increasing prevalence in race TJS and of races TGN and TJN may be due to use of the *Pg-a* resistance gene in USA oat cultivars.

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

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
J.G. Menzies[1], G.S. Brar[2], D. MacLean[2], H.R. Kutcher[2], Z. Popovic[1], S. Deceuninck[1] and M. Keber[1]
[1]Cereal Research Centre, Agriculture and Agri-Food Canada, 101 Route 100, Morden MB R6M 1Y5
Telephone: 204-822-7522; **Facsimile:** 204-822-7507; **E-mail:** jim.menzies@agr.gc.ca
[2]Department of Plant Science/Crop Development Centre, University of Saskatchewan, Saskatoon SK S7N 5A8

TITLE / TITRE: **CEREAL SMUT SURVEYS, 2014**

ABSTRACT: In Manitoba in 2014, 59 spring wheat fields, 10 barley fields, and 14 oat fields were surveyed for the smut diseases caused by *Ustilago* spp. Five wheat crops were infested with *U. tritici* infected plants, at severities ranging from trace to 0.3%, one barley crop was infested with *U. nuda* infected plants at trace severity, and no oat crops had infected plants. In Saskatchewan, 24 fields of spring wheat and 28 fields of winter wheat were surveyed. Four spring wheat crops and four of winter wheat were infested with *U. tritici*-infected plants at severity levels of trace to 2.5%, and trace to 3.0%, respectively. No carboxin resistant strains of *Ustilago* were identified.

INTRODUCTION AND METHODS: Two surveys, one in Manitoba and one in Saskatchewan, were conducted during July to early August in 2014 to assess the incidence and severity of the smut diseases caused by *Ustilago hordei, U. nigra, U. nuda, U. tritici, U. avenae* and *U. kolleri*. The area surveyed in Manitoba included crop districts 1, 2, 3, 7, 8, 9 and 11 and in Saskatchewan, crop districts 2B, 3A, 3B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, and 9B. Fields were selected at random at approximately 15 - 30 km intervals, depending on the frequency of the crops in the area. In Manitoba, 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 one m^2 area at a minimum of two sites on the path. In Saskatchewan, the percentage of infected plants was estimated by assessing a 5 m row at 5 random locations in a field and counting the number of total spikes (or panicles), and of infected spikes (or panicles)). Crops with <0.05% infections were classified as trace in Saskatchewan.

An isolate of smut was collected from each field with smutted plants. This was compared with a carboxin-sensitive isolate, '72-66', of *U. nuda* from Canada, and a carboxin-resistant isolate, 'Viva', of *U. nuda* from France (Newcombe and Thomas 1991), using the teliospore germination assay of Leroux (1986) and Leroux and Berthier (1988) to determine if resistance to the fungicide carboxin may be 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 cultures were incubated at 20°C in a controlled environment chamber and examined for teliospore germination after 24 h.

RESULTS AND COMMENTS:
Manitoba: Of the 59 crops of spring wheat assessed, 41 were of awned wheat and 18 of awnless wheat. Three (7%) crops of awned wheat were infested with smut (*U. tritici*) at trace severity levels. Two (11%) crops of awnless wheat were infested with smut at severity levels of trace, and 0.3%. Six crops of 2-row barley and four of 6-row barley were assessed, with loose smut (*U. nuda*) being observed only in one 2-row barley crop at a trace level. No smut infection was observed in the 14 oat crops surveyed.

Saskatchewan: Four (17%) of the 24 crops of spring wheat sampled were infested with smut (*U. tritici*) at severity levels of trace, trace, 1.5% and 2.5%. As well, four (14%) of the 28 winter wheat crops were infested with smutted plants at severity levels of trace, 1.0%, 2.0% and 3.0%.

None of the *Ustilago* spp. strains collected in Manitoba or Saskatchewan in 2014 was able to germinate and grow on agar medium amended with carboxin.

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

NOM ET ORGANISME / NAME AND AGENCY:
S. Rioux
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

TITRE / TITLE: OBSERVATIONS DES MALADIES DES CÉRÉALES AU QUÉBEC EN 2014

RÉSUMÉ: Les taches foliaires étaient, comme à l'habitude, présentes dans toutes les régions, alors que la rouille couronnée de l'avoine a été observée dans les stations situées le long de la vallée sud du Saint-Laurent, et la rouille des feuilles et l'oïdium du blé et de l'orge ont touché principalement les régions centrales. La rouille jaune du blé s'est manifestée de nouveau en 2014. Elle a été observée dans les régions centrales (trois stations) et de l'est (une station) du Québec et a touché plus gravement le blé d'hiver que le blé de printemps. La fusariose de l'épi, quant à elle, n'a pas été un problème en 2014.

ABSTRACT: As usual, leaf spots were observed in all regions, while crown rust in oat was found primarily at test locations along the St. Lawrence Valley (south shore), and brown leaf rust and powdery mildew on barley and wheat mostly in central regions. Stripe rust occurred again on wheat in 2014. It was observed in central (three test locations) and eastern (one test location) regions, and symptoms were more severe on winter wheat. Fusarium head blight was not a problem in 2014.

MÉTHODES: Les essais d'enregistrement et de performance de céréale réalisés dans différentes régions du Québec (CÉROM 2014) ont été visités une fois durant la saison afin d'y noter les maladies foliaires présentes. Le stade de développement des céréales lors des visites variait de laiteux moyen à pâteux moyen. L'intensité des maladies identifiées sur la base des symptômes a été notée selon l'échelle de notation 0 à 9 (0 = aucun symptôme; 9 = symptômes sur plus de 50 % de la surface de la feuille étendard). Les valeurs de 0 à 4 réfèrent à une faible intensité, les valeurs de 4 à 7 à une intensité moyenne et les valeurs de 7 à 9 à une intensité élevée. Le nom des agents pathogènes normalement associés à ces maladies pour le blé de printemps, le blé d'hiver, l'orge et l'avoine, est mentionné dans le texte à titre indicatif. Pour les cultures de blé et d'orge, le nombre d'avis de dommages causés principalement par la fusariose a été fourni par la Financière agricole du Québec (FADQ) (Michel Malo, FADQ, communication personnelle).

RÉSULTATS et COMMENTAIRES: En 2014, la fonte des neiges très lente du printemps a retardé l'assèchement et le réchauffement des sols. Les semis ont ainsi débuté à partir de la deuxième semaine de mai dans toutes les régions, ce qui représente un retard de quelques jours à plus d'une semaine pour les régions du sud de la province. Pour ces régions, les conditions climatiques de juin et juillet ont néanmoins été favorables au développement des cultures, mais n'ont toutefois pas permis à ces dernières de rattraper le retard causé par les semis tardifs. Pour les régions plus à l'est, les précipitations au cours de l'été ont été moins abondantes que normalement.

Chez l'avoine, la tache ovoïde (*Stagonospora avenae*) a été observée dans toutes les régions visitées. L'intensité des symptômes a varié de moyenne à élevée sauf en Montérégie où elle était faible. La rouille couronnée (*Puccinica coronata*) a été présente dans les deux essais de la Montérégie, à Saint-Étienne-de-Lauzon (région de Québec) et à La Pocatière (Bas-Saint-Laurent). Comme par les années passées, l'essai de La Pocatière a été le plus touché avec des symptômes de forte intensité chez les lignées les plus sensibles.

La rouille jaune (*Puccinia striiformis*) qui a été observée pour la première fois au Québec en 2013 sur du blé de printemps à Saint-Augustin-de-Desmaures (région de Québec) a récidivé en 2014 dans les régions du centre du Québec, d'abord sur le blé d'hiver à Saint-Augustin-de-Desmaures et à La Pocatière, puis sur le blé de printemps à Princeville (Centre-du-Québec) et Saint-Étienne-de-Lauzon. L'intensité des symptômes de certaines lignées/cultivars de blé d'hiver était très élevée, alors que pour le blé de printemps les lignées/cultivars les plus sensibles étaient moyennement affectés. La rouille des

feuilles (*Puccinia triticina*), quant à elle, a été très peu présente en 2014. Elle a été notée seulement à Saint-Étienne-de-Lauzon et il y avait peu de symptômes. Chez le blé de printemps, comme à l'habitude, les taches foliaires (*Drechslera tritici-repentis*, *Stagonospora nodorum* et *Cochliobolus sativus*) dont l'intensité des symptômes variait de moyenne à élevée étaient présentes dans toutes les régions. L'oïdium (*Blumeria graminis* f. sp*. tritici*, syn. *Erysiphe graminis*) d'intensité faible à moyenne a été observé sur le blé de printemps à Princeville et Saint-Étienne-de-Lauzon, et sur le blé d'hiver à Saint-Augustin-de-Desmaures. La fusariose de l'épi du blé n'a pas été un problème en 2014 au Québec alors que seulement 3,2 % des producteurs assurés (39 sur 1223) ont signalé des dommages à leur culture attribuables à cette maladie.

Chez l'orge, les taches foliaires (*Drechslera teres*, *Rhynchosporium secalis* et *Cochliobolus sativus*) ont été observées dans tous les essais visités et l'intensité des symptômes a varié de moyenne à élevée. La rouille des feuilles (*Puccinia hordei*) était présente, quoique faiblement, à Saint-Augustin-de-Desmaures et à La Pocatière, alors que l'oïdium (*Blumeria graminis* f.sp*. hordei*, syn. *Erysiphe graminis*) s'est manifesté modérément à Saint-Augustin-de-Desmaures seulement. Tout comme pour le blé, la fusariose de l'épi n'a pas été un problème chez l'orge en 2014 où seulement 7 producteurs sur 622, soit seulement 1,1 % des producteurs d'orge assurés à la FADQ, ont rapporté des dommages dus à la maladie.

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CROP / CULTURE: Corn
LOCATION/ REGION: Ontario

NAMES AND AGENCIES / NOMS ET ETABLISSEMENTS:
K.K. Jindal[a], L.M. Reid[a], A.U.Tenuta[b], T. Woldemariam[a], X. Zhu[a], C. Van Herk[b] and G. Kotulak[b]
[a]Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre, Ottawa ON K1A 0C6
Telephone: (613) 759-1752; **Facsimile**: (613) 952-9295; **E-mail**: krishan.jindal@agr.gc.ca
[b]Ontario Ministry of Agriculture, Food and Rural Affairs, P.O. Box 400, Ridgetown ON N0P 2C0

TITLE / TITRE: STATUS OF CORN DISEASES IN ONTARIO, 2014 CROP SEASON

ABSTRACT: Northern corn leaf blight (NCLB) was the most common and severe leaf disease found in Ontario corn fields in 2014. It was particularly widespread in southern and western Ontario, with one third of affected crops having incidence levels of ≥50% and a severity of ≥4 (21 to >75% leaf area affected). Eyespot and common rust also were widespread and like NCLB observed at higher incidence and severity levels in southern than eastern Ontario. Grey leaf spot was localized primarily in southern Ontario where it was observed in the majority of crops. Ear and stalk rot diseases were insignificant at the time of survey. Neither Stewart's bacterial wilt nor Goss's bacterial wilt and blight were detected in Ontario in 2014.

INTRODUCTION AND METHODS: The cool, wet environmental conditions during the 2014 growing season in Ontario resulted in many corn crops being planted later than normal, maturity being delayed as a result of slow crop development, and an increase in the incidence and severity of many foliar diseases. A total of 222 corn crops were surveyed across Ontario from August 29 to September 13, 2014 to document the occurrence and severity of various corn diseases, including anthracnose leaf blight and die back (ALB) [*Colletotrichum graminicola* (Ces.) G.W. Wils], eyespot [*Aureobasidium zeae* (Narita & Hiratsuka) Dingley], grey leaf spot (GLS) [*Cercospora zeae-maydis* Tehon & E.Y. Daniels], northern corn leaf blight (NCLB) [*Exserohilum turcicum* (Pass.) K.J. Leonard and E.G. Suggs], common rust (*Puccinia sorghi* Schwein), southern rust (*P. polyspora* Underw.), common smut [*Ustilago maydis* (DC.) Corda], head smut [*Sphacelotheca reiliana* (Kuhn) G.P. Clinton], physoderma brown spot [*Physoderma maydis* (Miyabe) Miyabe], ear rot (*Fusarium* spp.), stalk rot (*Fusarium* spp., and *Colletotrichum graminicola*), and Stewart's bacterial wilt (*Pantoea stewartii* Mergaert et al.). The annual corn disease survey provides vital information on endemic pathogen populations and allows scouting for new invasive pathogens such as Goss's bacterial wilt and blight [*Clavibacter michiganensis* subsp. *Nebraskensis* (Vidaver & Mandel) Davis et al.] which has been detected in other parts of Canada (Manitoba and Alberta) and bordering U.S. Great Lakes states, including Michigan (Kelsey et al., 2015).

In addition to disease occurrence, the incidence (number of affected plants) and severity of the major leaf diseases (eyespot, GLS, NCLB and rust) were also recorded in all 222 surveyed fields. Severity of eyespot, GLS and rust was rated on a 0-5 scale (0=no symptoms, 1=<1%, 2=1-5%, 3=6-20%, 4=21-50%, 5=>50% leaf area with symptoms) and NCLB on a 0-6 scale (0=no symptoms, 1=<1%, 2=1-5%, 3=6-20%, 4=21-50%, 5=51-75%, 6=>75% leaf area with symptoms). Leaves displaying NCLB symptoms were collected for *E. turcicum* race identification and distribution patterns. Additional symptomatic plant parts were collected for subsequent laboratory analysis, especially if initially unidentifiable, or if Goss's bacterial wilt or Stewart's bacterial wilt was suspected.

RESULTS AND DISCUSSION:

Northern corn leaf blight continues to be the most common foliar corn disease in Ontario and in 2014 the disease was detected in 185 (83%) of crops (Table 1). Fifty-three of the 185 crops with NCLB had incidences ≥50% and severity ratings ≥4. These most affected crops were found in 10 counties across the province [Renfrew (3), Chatham Kent (13), Elgin (2), Essex (5), Middlesex (5), Oxford (7), Dufferin (9), Perth (4), Waterloo (4), Wellington (1)], illustrating how widespread NCLB is in Ontario and why it has become the most economically important foliar disease of corn. The disease was found in all fields sampled in southern and western Ontario, but fewer (65%) in eastern Ontario. Mean disease severity and incidence in affected crops was also considerably lower in eastern Ontario (1.4 and 14%,

respectively) and central Ontario (2.0 and 13%) compared to southern (3.4 and 46%), and western Ontario (3.9 and 55%). However, three crops in eastern Ontario had disease severities ≥4.0. In addition to favourable environmental conditions, changing agronomic practices in southern and western Ontario, including shorter crop rotations, increased growing of corn on corn, and higher residue levels due to more adoption of conservation tillage have increased disease pressure. Also, changes in pathogen population dynamics (new races) have resulted in increased susceptibility of corn hybrids to the higher NCLB levels (Wise and Mueller, 2011). Corn crops in six counties in this region (i.e. Chatham-Kent, Dufferin, Essex, Perth, Waterloo and Wellington) had mean NCLB severity ratings ≥3.5 and mean disease incidences ≥40% (Table 2). Furthermore, all seed corn fields surveyed in Chatham-Kent and Essex counties had a higher mean disease severity (4.0; range 2.5-6) and a higher mean disease incidence (62%; range 20-100%) than those recorded for commercial corn fields. The high incidence of NCLB in Ontario is of concern because yield loss from the disease erodes producer profits. The necessity to use additional disease management strategies, such as foliar fungicides, increases production costs and is an environmental risk. In future, sustainable and economic corn production will require the development of new NCLB Ht genes/inbreds and their incorporation into high yielding commercial corn hybrids.

Variability in commercial corn hybrid reactions to NCLB was evident from the 14 Ontario Corn Committee (OCC) 2014 performance trials, in which very high mean severity ratings (≥5) occurred at10 locations (Dresden, Elora, Ilderton, Orangeville, Ridgetown, Thorndale, Tilbury, Waterloo, West Loren, and Woodstock) (Table 3). These elevated disease levels indicate that the OCC trials provide a useful platform by which to screen the disease reactions of commercial and developmental hybrids to NCLB. The trial sites are planted across the province and are under variable environmental and management conditions. The same sites can be used to map the geographical distribution of physiologic races of *E. turcicum*.

It is not uncommon to find both resistant and susceptible NCLB lesion types on the same leaf, or to observe that the reactions of some hybrids to NCLB differ depending on where they are grown. This indicates the presence of different races of *E. turcicum*, as has been reported in previous years (Zhu et al. 2012, 2013). To verify this, and to map the distribution of such races in corn growing regions of Ontario, 170 leaf samples with NCLB symptoms were collected during the survey for future study.

Eyespot was more prevalent in 2014 compared to previous years. The disease was found in 174 (78%) of the sites sampled (Table 1) at a mean severity of 2.4 and at an incidence of 21% in affected crops (Table 2). Ten of the affected crops had severity levels of 5 with 30-100% of plants affected (incidence). As with NCLB, eyespot was less common in eastern Ontario (69% of crops affected) compared to southern and western Ontario (87%). However, 9 individual crops in eastern Ontario had high eyespot severity ratings of 4.0, compared to the mean eyespot severity of 2.8 in affected crops in southern Ontario. The widespread distribution of eyespot in Ontario was demonstrated by the elevated severity ratings of ≥4 in 33 corn fields situated throughout the region. A few of the hybrids included in the OCC trials planted at Dublin, Thorndale, Waterloo, and West Lorne, as well as many entries in seed company demonstration plots, exhibited moderate to high levels of resistance to eyespot.

Common rust also was one of the more common foliar diseases detected in Ontario corn in 2014. By contrast **southern rust,** which has been increasing in southern and mid-central U.S. regions, was found in only 3 fields in Chatham-Kent County. Common rust was found in 144 (65%) fields (Table 1) at a mean disease severity of 2.1 and incidence of 18% (Table 2). As for both NCLB and eyespot, the disease was less prevalent in eastern Ontario than in southern and western Ontario; however, three fields in eastern Ontario had a high disease severity rating of ≥4. Intermediate to high levels of rust were recorded in 30 fields in Southern and Western Ontario, including 8 fields (6 in Chatham-Kent and 2 in Middlesex) with high severities of ≥4. At 5 OCC sites (Elora, Ridgetown, Waterloo, West Lorne and Winchester) commercial hybrids exhibited intermediate infection levels (severity rating of 3.0), whereas at 2 sites (Ilderton and Thorndale) severe infection (severity rating of 4.0) to common rust was obvious. Some of the hybrids at these locations exhibited moderate to high resistance to common rust. In seed corn, 4 of 14 fields surveyed contained female inbreds that were moderately to highly susceptible to common rust.

Grey leaf spot was found in only 50 (23%) of the fields sampled (Table 1). GLS was not widespread in Ontario in 2014. Most affected fields (92%) were in four counties, Chatham-Kent, Elgin, Essex and Middlesex in southern Ontario. In eastern Ontario, where 102 fields were sampled, GLS was found in only as single field in Stormont, Dundas & Glengarry County. GLS severity and incidence were moderate to high, 2.5 and 25%, respectively, in 8 seed corn fields. In OCC trials at Ridgetown, Dresden, and Tilbury, some test hybrids were highly susceptible to GLS, as was the case for various hybrids in some company demonstration plots at Chatham (Chatham-Kent) and Mersea (Essex). Traditionally, GLS has not been of major concern in Ontario other than in the extreme southwest counties of Essex and Chatham-Kent, where factors such as increased corn residues, intensive corn and seed production, and favourable warm and humid conditions throughout late July and August had favoured its development. This is in stark contrast to the U.S. Midwest corn-belt where GLS is widespread throughout the region and is the most economically important foliar corn disease.

Anthracnose leaf blight and dieback was detected in 69 fields (31%). Although ALB was found across the province, its severity and incidence were low with exception of two fields in Chatham-Kent where the incidence was >45%. Mean disease severity and incidence in affected fields was 1.5 and 8%, respectively. ALB was observed in only 4 seed corn fields and 5 OCC trial sites at low to moderate severities of 1 to 3.

Other leaf spots: Brown spot was found throughout the province; however, its severity and incidence were low in the majority of fields except for several in Chatham-Kent county where symptoms on sheaths appeared severe. **Phaeosphaeria leaf spot** caused by *Phaeosphaeria maydis* (Henn.) Rane, Payak, & Renfro was found in two fields in southern Ontario. **Northern leaf spot** was not found in any of the fields surveyed in 2014.

Fungal ear and stalk diseases: **Common smut** and **Head smut** were found in only 20 (9%) of the sampled fields (Table 1). Overall, mean common smut and head smut incidence was <5% in affected fields. The diseases were observed at incidence levels of ≥10% in only 4 fields in three counties, Ottawa (1), Oxford (2), and Stormont, Dundas & Glengarry (1). Common smut and head smut were not found in crops of seed corn. **Ear rot** was found in 11 fields at a low incidence level. Ears with exposed kernels were found to have *Fusarium* spp. infection. **Stalk rot** was found in 10 fields at a very low incidence. One field with a higher stalk rot incidence of 15% was found in Chatham-Kent County. The low incidence and occurrence of ear and stalk diseases at the time of the survey suggests these diseases were less important in 2014 than in other years. However, continued cool, wet conditions into the fall, which delayed crop development and harvesting, resulted in an increase in **Gibberella ear rot** and its accompanying vomitoxin (DON) levels in 2014 compared to 2013; nonetheless, levels were significantly lower than in 2011 (Stewart and Tenuta, 2014).

Four fields in Chatham-Kent, Essex and Elgin were found to have **crazy top** which is caused by the soil pathogen *Sclerospora macrospora* Sacc. As noted previously by Zhu et al. (2013), crazy top-infected plants display multiple barren ears, longer leaves on husks, and common smut on diseased tassels.

Stewart's bacterial wilt, which historically has been the most economically important disease in Ontario seed corn production, once again was not detected in any of the seed or commercial corn fields sampled in 2014. The decline in Stewart's bacterial wilt in Ontario, as well as the U.S., has been attributed to the effective control of its vector, the corn flea beetle, through the use of neonicotinoid seed treatments (Chaky et al. 2013). Likewise, **Goss's bacterial wilt and blight** was not found in Ontario in 2014.

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Table 1. Disease occurrence in Ontario cornfields grouped by county, 2014.

County	**No. fields**	**Disease / Number of crops affected**							
		ALB	**Eyespot**	**GLS**	**NCLB**	**Rust**	**Smut**	**Ear rot**	**Stalk rot**
Durham	3	2	2	0	2	2	2	0	0
Frontenac	5	2	0	0	3	1	1	0	0
Lanark	3	0	2	0	0	1	0	0	0
Leeds & Grenville	12	1	6	0	9	7	1	0	0
Ottawa	9	0	8	0	7	5	2	2	0
Prescott & Russell	12	5	11	0	8	4	2	0	0
Renfrew	18	4	8	0	10	4	1	0	1
Stormont, Dundas & Glengarry	43	16	35	1	29	19	1	0	3
Chatham-Kent	29	12	25	28	29	27	2	4	2
Elgin	9	5	7	4	9	5	0	0	0
Essex	8	2	8	8	8	8	2	0	0
Middlesex	20	4	17	6	20	16	2	2	2
Oxford	18	5	16	0	18	15	2	2	2
Dufferin	11	3	10	2	11	11	0	0	0
Heron	7	5	6	1	7	6	1	0	0
Perth	6	1	4	0	6	4	1	1	0
Waterloo	6	1	6	0	6	6	0	0	0
Wellington	3	1	3	0	3	3	0	0	0
Central Ontario	3	2	2	0	2	2	2	0	0
Eastern Ontario	102	28	70	1	66	41	8	2	4
Southern Ontario	84	28	73	46	84	71	8	8	6
Western Ontario	33	11	29	3	33	30	2	1	0
Ontario total	**222**	**69**	**174**	**50**	**185**	**144**	**20**	**11**	**10**

ALB = Anthracnose leaf blight and dieback, **GLS** = Grey leaf spot, **NCLB** = Northern corn leaf blight, **Rust** = Common and Southern rust, **Smut** = Common smut, **Ear rot** = includes Gibberella ear rot and Fusarium ear rot, **Stalk rot** = includes Fusarium stalk rot and Pythium stalk rot

Table 2. Severity and incidence of major diseases in Ontario corn fields in 2014, grouped by county.

County	Eyespot				GLS				NCLB				Common Rust			
	Severity[1]		Incidence(%)[2]		Severity[1]		Incidence(%)[2]		Severity[1]		Incidence(%)[2]		Severity[1]		Incidence(%)[2]	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Durham	2.0	2-2	10	10-10	-	-	-	-	2.0	1-3	13	5-20	2.0	2-2	10	10-10
Frontenac	-	-	-	-	-	-	-	-	1.0	1-1	5	4-6	1.0	1-1	5	5-5
Lanark	1.0	1-1	5	5-5	-	-	-	-	-	-	-	-	1.0	1-1	5	5-5
Leeds & Grenville	1.5	1-3	14	6-35	-	-	-	-	1.3	1-3	16	2-55	1.3	1-3	10	5-20
Ottawa	2.4	1-4	18	5-40	-	-	-	-	1.4	1-2.5	10	3-40	2.4	1-4	23	5-40
Prescott & Russell	2.2	1-3	13	5-20	-	-	-	-	1.2	1-2.5	14	5-75	1.5	1-2	10	10-10
Renfrew	1.1	1-2	11	5-20	-	-	-	-	2.4	1-5	36	1-95	1.8	1-3	30	5-80
Stormont, Dundas & Glengarry	2.2	1-4	25	4-80	1.0	1-1	2	2-2	1.2	1-2.5	8	3-40	2.3	1-5	26	3-80
Chatham-Kent	2.6	1-5	28	5-80	2.4	1-4	23	5-40	3.6	2.5-6	53	10-95	2.9	1-5	30	5-70
Elgin	3.0	2-5	37	10-95	1.5	1-2	15	8-20	2.9	2-4	34	15-80	2.2	2-3	15	10-20
Essex	2.6	1-4	23	10-40	2.8	2-4	27	15-50	3.9	2-6	56	15-95	1.9	1-2.5	14	10-20
Middlesex	3.2	1-4	26	5-60	2.3	1-5	19	8-40	3.0	1-5	38	5-90	2.2	1-4	14	5-30
Oxford	2.6	1-5	24	3-80	-	-	-	-	3.4	2-5	45	5-100	1.9	1-3	16	5-40
Dufferin	2.0	1-5	14	5-40	1.0	1-1	5	5-5	4.2	1-6	58	5-90	1.6	1-3	9	5-20
Heron	2.2	1-3	10	5-20	1.0	1-1	5	5-5	2.3	1-3	14	5-30	2.2	1-3	8	5-10
Perth	2.4	1-5	12	5-30	1.0	1-1	5	-	4.5	2-6	62	10-90	2.0	1-3	8	5-10
Waterloo	1.8	1-4	13	5-40	-	-	-	-	4.9	3-6	73	30-95	1.3	1-3	9	5-30
Wellington	3.0	2-5	17	10-30	-	-	-	-	3.5	2.5-5	40	10-90	1.7	1-2	8	5-10
Central Ontario	2.0	2-2	10	10-10	-	-	-	-	2.0	1-2	13	5-20	2.0	2-2	10	10-10
Eastern Ontario	2.0	1-4	19	5-80	1.0	1-1	2	2-2	1.4	1-5	14	4-100	2.0	1-5	22	5-80
Southern Ontario	2.8	1-5	30	3-100	2.4	1-5	22	5-40	3.4	1-6	46	5-100	2.4	1-5	21	5-70
Western Ontario	2.2	1-5	13	5-40	1.0	1-1	5	5-5	3.9	1-6	55	5-100	1.7	1-3	9	5-30
All Ontario	**2.4**	**1-5**	**21**	**5-100**	**2.3**	**1-5**	**20.7**	**5-50**	**2.8**	**1-6**	**36**	**1-100**	**2.1**	**1-5**	**18**	**4-80**

[1]Disease severity in affected crop rated as percentage of leaf area with symptoms; **eyespot**, **GLS** (grey leaf spot) and **common rust** rated on a 0-5 scale (0-no symptoms, 1=<1%, 2=1-5%, 3=6-20%, 4=21-50% and 5=>50% leaf area with symptoms); **NCLB** (Northern corn leaf blight) on 0-6 scale (0=no symptoms, 1=<1%, 2=1-5%, 3=6-20%, 4=21-50%, 5=51-75% and 6=>75% leaf area with symptoms)

[2]Incidence is number of affected plants/total number of plants observed x 100

Also: 'Means' and 'range' are based on the crops in which the disease was observed.

'hypen' indicates disease not found in the fields sampled.

Table 3. Mean severity and incidence of major diseases of corn at 14 OCC trial sites in Ontario, 2014.

OCC[1] trial site	Eyespot		GLS		NCLB		Common rust	
	Severity[2]	Incidence (%)[3]	Severity[2]	Incidence (%)[3]	Severity[2]	Incidence (%)[3]	Severity[2]	Incidence (%)[3]
Dresden	3.0	20	4.0	40	5.0	100	2.0	15
Dublin	5.0	30	0.0	0	4.0	20	0.0	0
Elora	4.0	40	0.0	0	6.0	100	3.0	30
Ilderton	3.0	20	0.0	0	5.0	60	4.0	30
Lancaster	2.0	10	0.0	0	2.0	5	0.0	0
West Loren	3.0	20	2.0	20	5.0	80	3.0	20
Orangeville	3.0	20	0.0	0	5.5	50	2.0	10
Ottawa	2.0	5	0.0	0	2.5	15	2.0	55
Ridgetown	4.0	30	4.0	30	5.0	50	3.0	30
Thorndale	4.0	40	0.0	0	6.0	90	4.0	30
Tilbury	3.0	30	3.0	35	6.0	100	2.0	20
Waterloo	4.0	40	0.0	0	6.0	100	3.0	30
Winchester	2.0	25	0.0	0	1.0	5	3.0	60
Woodstock	3.0	20	0.0	0	5.0	40	2.0	10

[1]OCC- Ontario Corn Committee
[2]Disease severity in affected crop rated as percentage of leaf area with symptoms; **eyespot**, **GLS** (grey leaf spot) and **common rust** rated on a 0-5 scale (0-no symptoms, 1=<1%, 2=1-5%, 3=6-20%, 4=21-50% and 5=>50% leaf area with symptoms); **NCLB** (Northern corn leaf blight) on 0-6 scale (0=no symptoms, 1=<1%, 2=1-5%, 3=6-20%, 4=21-50%, 5=51-75% and 6=>75% leaf area with symptoms)
[3]Incidence (%) is number of affected plants/total number of plants observed x 100

CROP / CULTURE: Oat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
A.D. Beattie[1], X.M. Zhang[1], F.L. Dokken-Bouchard[2] and G.J. Scoles[1]
[1]Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
Telephone: (306) 966-2102; **Facsimile:** (306) 966-5015; **E-mail:** aaron.beattie@usask.ca [2]Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina SK S4S 0B1

TITLE / TITRE: 2014 SASKATCHEWAN OAT FUSARIUM HEAD BLIGHT SURVEY

ABSTRACT: Plants in 90 oat fields from 15 Saskatchewan Crop Districts were sampled and tested for the presence of fusarium head blight using a plate microbiological method and real-time PCR. *Fusarium avenaceum*, *F. graminearum* and *F. poae* were identified in over 90% of samples, while *F. culmorum* and *F. sporotrichioides* were detected in 31% and 0% of the samples, respectively, using real-time PCR.

INTRODUCTION AND METHODS: To identify and quantify the *Fusarium* species affecting oat crops in Saskatchewan in 2014, 90 crops from 15 Crop Districts throughout the province were sampled between August 10 and 29, when plants were at the late milk to early dough development stage. Twenty panicles were harvested at random from each field, placed in paper bags, and air-dried at room temperature. Samples were hand threshed and a portion of the seed was surface-sterilized in 3% (v/v) NaOCl for 2 minutes, rinsed with water to remove residual NaOCl and air dried. Fifty randomly selected kernels were plated on potato dextrose agar in Petri dishes (10 seeds per dish). The *Fusarium* colonies isolated were identified to species based on morphological characteristics (Gerlach and Nirenberg 1982).

The remaining seed was ground to < 40 µm fineness using a Retsch ZM 200 mill. DNA was extracted using the QIAGEN DNeasy Plant Mini Kit. Primers and TaqMan probes (6-FAM/TAMRA) specific for five *Fusarium* species (*F. avenaceum, F. culmorum*, *F. graminearum, F. poae, and F. sporotrichioides*) were designed based on available DNA sequence information (Halstensen et al. 2006; Yli-Mattila et al. 2008; Nicolaisen et al. 2009). Real-time PCR was performed with the ABI 7900HT Fast Real-Time PCR System (Applied Biosystems Inc.) to detect and quantify each *Fusarium* species.

RESULTS AND COMMENTS: The results from the microbiological method and real-time PCR are provided in Table 1. As with survey results from previous years, *F. poae* was the most common species isolated from crops by the plate method (27%), followed by *F. graminearum* (4%), *F. avenaceum* (2%)*, F. sporotrichoides* (2%)*,* and *F. equiseti* (2%). *Fusarium culmorum* was not isolated from any of the crop samples. A comparison of the two methods indicates real-time PCR was more sensitive than the plate method in detecting the various *Fusarium* species. *Fusarium poae* was detected in 100% of the samples by real-time PCR, while *F. graminearum*, *F. avenaceum*, *F. culmorum* and *F. sporotrichioides* were detected in 94%, 92%, 31% and 0% of the crop samples at the 0.001 pg/ng detection limit (Table 1). The mean quantity of *Fusarium* species in 2014 was higher than in the past three years, with some individual samples of *F. avenaceum*, *F. graminearum* and *F. poae* being notably higher (Table 2).

Except for one sample collected from Crop District 5B which had an extremely high quantity of *F. poae* (17.86 pg/ng), the quantity of *Fusarium* DNA detected by real-time PCR in 2014 ranged from 0.001 to 4.024 pg/ng, which was higher than in 2013 (0.001 to 2.545; Beattie et al. 2014), 2012 (0.001 to 3.571 pg/ng; Beattie et al. 2013), 2011 (0.01 to 0.985 pg/ng; Beattie et al. 2012) and 2009 (0.002 to 3.509 pg/ng; Yajima et al. 2011), but lower than in 2010 (0.010 to 4.793 pg/ng; Yajima et al. 2011). Means and ranges of *Fusarium* DNA quantity varied among crop districts (Tables 3-4). The highest mean quantity and the individual sample with the highest quantity of *F. avenaceum* were found in Crop District 9A (Table 3). *Fusarium. culmorum* was detected at low levels in all crop districts with the highest quantity detected being 0.446 pg/ng from crop district 6B (Table 3). The highest mean quantity and the sample containing the highest quantity of *F. graminearum* DNA were from Crop District 2B (Table 4). *Fusarium poae* levels were relatively high in all crop districts, except Crop District 4B (Table 4). Particularly high mean quantities of 1.170, 2.277 and 1.149 pg/ng were detected in Crop Districts 2A, 5B and 9B, respectively (Table 4). The

mean quantity (2.277 pg/ng) and individual sample quantity (17.86 pg/ng) detected in crop district 5B are the highest values observed since RT-PCR detection of *Fusarium* content started in 2009.

ACKNOWLEDGMENTS:
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Table 1. *Fusarium* spp.detected in Saskatchewan oat crops in 2014

	Plate Method		RT-PCR Method (% of Crops)	
Fusarium spp.	**% of Crops**	**% of Kernels[a]**	**>0.001[b]**	**>0.10[b]**
F. avenaceum	2	9	92	21
F. culmorum	0	0	31	2
F. graminearum	4	11	94	18
F. poae	27	24	100	74
F. sporotrichioides	2	5	0	0
F. equiseti	2	10	-	-

[a]Percentage of infected kernels from affected crops.
[b]*Fusarium* DNA/Extracted DNA (pg/ng).

Table 2. *Fusarium* DNA abundance in Saskatchewan oat crops in 2014 (% of crops).

Range*	***F. avenaceum***	***F. culmorum***	***F. graminearum***	***F. poae***	***F. sporotrichioides***
0.001-0.100	71	29	77	26	0
0.101-0.500	18	2	13	50	0
0.501-1.000	2	0	1	11	0
1.001-2.000	1	0	2	10	0
2.001-3.000	0	0	0	2	0
3.001-4.000	0	0	0	0	0
4.001-5.000	0	0	1	0	0
>5.000	0	0	0	1	0

**Fusarium* DNA/Extracted DNA (pg/ng).

Table 3. Quantity of *Fusarium avenaceum and F. culmorum* (pg/ng; *Fusarium* DNA/Extracted DNA) detected in Saskatchewan Crop Districts in 2014.

Crop District	No. of Crops	*F. avenaceum*			*F. culmorum*		
		Detected (%)	**Mean**	**Range**	**Detected (%)**	**Mean**	**Range**
1A	5	100	0.062	0.005-0.223	20	0.000	0.000-0.002
1B	13	100	0.070	0.002-0.385	15	0.001	0.000-0.008
2A	1	100	0.240	-	0	-	-
2B	10	100	0.162	0.007-0.479	20	0.005	0.000-0.048
3A	1	100	0.005	-	0	-	-
3B	4	100	0.145	0.010-0.496	25	0.001	0.000-0.005
4B	1	100	0.005	-	100	0.008	-
5A	8	100	0.091	0.005-0.642	63	0.012	0.000-0.059
5B	13	62	0.106	0.000-0.991	8	<0.001	0.000-0.003
6A	4	75	0.011	0.000-0.034	75	0.083	0.000-0.327
6B	18	94	0.029	0.000-0.143	56	0.031	0.000-0.446
8A	2	100	0.011	0.018-0.004	0	-	-
8B	1	100	0.280	-	0	-	-
9A	7	100	0.237	0.011-1.061	29	0.003	0.000-0.014
9B	2	86	0.228	0.015-0.442	0	-	-

Table 4. Quantity of *Fusarium graminearum and F. poae* (pg/ng; *Fusarium* DNA/Extracted DNA) detected in Saskatchewan Crop Districts in 2014.

		F. graminearum			*F. poae*		
		Detected (%)	**Mean**	**Range**	**Detected (%)**	**Mean**	**Range**
1A	5	100	0.290	0.037-0.660	100	0.583	0.337-1.137
1B	13	100	0.016	0.003-0.052	100	0.327	0.055-0.781
2A	1	100	0.010	-	100	1.170	-
2B	10	100	0.657	0.025-4.024	100	0.298	0.045-0.681
3A	1	100	0.002	-	100	0.335	-
3B	4	100	0.019	0.010-0.030	100	0.172	0.035-0.297
4B	1	100	0.006	-	100	0.047	-
5A	8	100	0.013	0.009-0.018	100	0.190	0.005-0.530
5B	13	100	0.146	0.011-1.065	100	2.277	0.051-17.86
6A	4	100	0.014	0.007-0.030	100	0.304	0.155-0.569
6B	18	94	0.016	0.000-0.035	100	0.146	0.006-0.411
8A	2	50	0.062	0.000-0.123	100	0.113	0.074-0.152
8B	1	100	0.009	-	100	0.217	-
9A	7	57	0.006	0.000-0.015	100	0.222	0.013-0.853
9B	2	100	0.005	0.003-0.007	100	1.149	1.149-1.149

CROP / CULTURE: Oat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENT:
J. Taylor, P. Cholango, M. Dyck, T.S. Grewal and H.R. Kutcher
Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
Telephone: (306) 966-4951; **Facsimile:** (306) 966-5015; **Email:** randy.kutcher@usask.ca

TITLE / TITRE: LEAF SPOT DISEASES OF OAT IN SASKATCHEWAN IN 2014

ABSTRACT: Leaf spot disease severity and the causal pathogens responsible were assessed in 33 oat crops in Saskatchewan in 2014. *Pyrenophora avenae* Ito & Kuribayashi (pyrenophora leaf blotch), *Cochliobolus sativus* Ito & Kuribayashi Drechs. ex Dast. (spot blotch) and *Stagonospora avenae* (Frank) Bissett f. sp. *avenaria* (stagonospora leaf blotch) were the common oat pathogens isolated from diseased leaves. Crown rust (*Puccinia coronata* Corda f. sp. *avenae* Eriks.) and fusarium head blight (*Fusarium* spp.) were also observed in some crops.

INTRODUCTION AND METHODS: In 2014, leaf spot diseases of oat were surveyed across Saskatchewan in mid to late August, when the crops were at the milky to soft dough stages af growth. Thirty-three crops were sampled in 2014 with disease severity assessed on 2 to 4 plants collected at each of five points approximately 20 m apart and 30 m from the field edge. Field ratings were based on disease severity on the upper (flag and penultimate leaves) and lower canopies as follows: 0 (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Approximately 10 leaves were collected from each crop, dried and stored in paper envelopes. The pathogens responsible were identified in the laboratory during October by surface sterilizing 10 pieces of infected leaf tissue, each from a different leaf, and placing them on water agar in petri plates for seven days to promote sporulation. The pathogens (and diseases they cause) were identified on the basis of spore size, shape and colour.

RESULTS AND COMMENTS: Growing conditions in most regions of Saskatchewan were wet to very wet in the spring and early summer of 2014 (Saskatchewan Ministry of Agriculture 2014). Warm weather in July and August, combined with high humidity contributed to foliar disease development. However, temperatures had been lower than normal in May and June, which led to delayed maturity of crops and a later harvest than normal. Also, warmer conditions in September and October allowed for harvesting to be completed under favourable conditions.

Leaf spots were observed in the foliar canopies of all 33 crops surveyed. Disease severity varied from trace to slight in the upper canopy. In the lower canopy, severity ranged from trace to slight in 25 crops and moderate in 8 crops. Three leaf-spot pathogens were identified based on the laboratory isolations from leaf tissue. *Pyrenophora avenae* was the most common pathogen, followed by *Cochliobolus sativus* and *Stagonospora. avenae* f.sp. *avenaria* (Table 1). The same pathogens have been identified from oat in Saskatchewan in previous years (Tekauz et al. 2012). Crown rust was observed at a 'trace' level in two crops and at a 'severe' level in another. Based on visible symptoms on panicles, fusarium head blight was recorded in 12 crops, 9 at 'trace' and 3 at 'moderate' levels.

Leaf spot diseases at trace to slight levels were expected to have limited impact on oat yields. Foliar fungicides applied to control severe crown rust in highly susceptible oat cultivars in Saskatchewan have been shown to increase yields by up to 27% (May et al. 2014).

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Table 1. Incidence and isolation frequency of leaf spot pathogens of oat in Saskatchewan in 2014

Pathogen	Incidence (% crops)	Frequency (% isolations)*
Pyrenophora avenae	91	70
Cochliobolus sativus	61	23
Stagnospora avenae	18	6

*indicative of the relative amount of foliar damage observed

CROP / CULTURE: Oat
LOCATION / RÉGION: Manitoba and eastern Saskatchewan (eastern prairie region) and Ontario, Quebec and Prince Edward Island (eastern Canada)

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:

J. G. Menzies[1], A.G. Xue[2], J. Gruenke[1], R. Dueck[1], C. Saramaga[1], Z. Popovic[1] and T. Dykstra[1]
[1]Cereal Research Centre, Agriculture and Agri-Food Canada, 101 Route 100, Morden MB R6M 1Y5
Telephone: 204-822-7522; **Facsimile:** 204-822-7507; **E-mail:** jim.menzies@agr.agr.ca
[2]Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre, K.W. Neatby Building, 960 Carling Avenue, Ottawa ON K1A 0C6

TITLE / TITRE: CROWN RUST OF OAT IN THE EASTERN PRAIRIES AND EASTERN CANADA IN 2013

ABSTRACT: In 2013, 100 cereal fields with wild oat and 18 fields of common oat in Manitoba and Saskatchewan were surveyed for the incidence and severity of *Puccinia coronata* f.sp. *avenae*. Plants with crown rust were found in 89 and 17% of the wild and common oat fields at mean severities of 15% and a trace, respectively. No virulence was detected to resistance gene *Pc94* in these Manitoba and Saskatchewan collections. No virulence was detected to the resistance genes *Pc54, Pc58, Pc59, Pc91, Pc94, Pc96, Pc97* and *Pc98* in collections from Ontario, Quebec or Prince Edward Island.

INTRODUCTION AND METHODS: Surveys for incidence and severity of oat crown rust (caused by *Puccinia coronata* Cda f. sp. *avenae* Eriks.) were conducted in Manitoba and Saskatchewan from August 7 to 28 in 2013. Incidence was considered to be the percentage of leaves infected with rust in a given field, and severity the mean percentage leaf area with pustules. Crown rust collections were obtained from: wild oat (*Avena fatua* L.) and common oat (*A. sativa* L.) in commercial farm fields and susceptible and resistant oat lines and cultivars grown in uniform rust nurseries. The nurseries were located at Brandon, Emerson, Morden and St. Isidore, MB, and at Indian Head, SK. Samples from fields in Ontario, Quebec and Prince Edward Island were collected between July 16 and August 7. For virulence studies, single-pustule isolates (spi) were established from the rust collections. Races were identified using 16 standard oat crown rust differentials (Table 1) as described by Chong et al. (2000). In addition, single *Pc*-gene lines with *Pc91, Pc94*, or *Pc96* were used as supplemental differentials. Oat lines with putative new crown rust resistance genes, *temp_pc97* and *temp_Pc98* were also included in the differential sets to determine their reactions to the single-pustule isolates established from the rust collections.

RESULTS AND COMMENTS: One hundred fields with wild oat and 18 fields of common oat were surveyed in Manitoba and Saskatchewan. Wild oat plants infected with *P. coronata* f. sp, *avenae* were found in 89 (89%) of fields, and infected common oat plants were found in 3 (17%) of the fields.

Crown rust incidence and severity were at trace levels in commercial oat crops over the entire survey area. Rust incidence and severity on wild oat were low in south-central and south-eastern Manitoba, mostly at trace levels. The highest levels of crown rust were found in south-western Manitoba; these included crops in the vicinity of Brandon. The incidence of crown rust in affected crops in Manitoba ranged from trace to 100%, and severity from trace to 60%. The mean incidence in infested crops was 17%, and the mean severity 3%.

Crown rust incidence and severities in wild oat were higher in south-eastern Saskatchewan. In the Yorkton, SK region incidence and severity level were at trace levels. In Saskatchewan, the incidence of crown rust in infested fields ranged from trace to 100% and severity from trace to 80%. The mean incidence in affected crops was 60%, and the mean severity 15%.

Single-pustule isolates from wild oat numbered 128. One hundred-and- five races were identified from these using the crown rust differentials listed in Table 1. The number of spi of each race ranged from one to five. Only a single spi was obtained for 92 of the races identified. No spi from wild oat was identified with virulence to the resistance gene *Pc94*.

Common oat collections yielded 21 spi. Eighteen races were identified from these, with the number of isolates of each race ranging from one to two. A single spi was obtained for 15 of the 18 races identified. None of the spi from common oat had virulence to the resistance genes *Pc54, Pc94*, and *Pc98*.

Collections from the uniform rust nurseries yielded 20 spi. Nineteen races were identified from these, with the number of isolates ranging from one to two. Only one spi was identified for 18 of the races, and no spi possessed virulence to resistance genes *Pc62, Pc94* and *Pc98*.

In 2013, none of the spi from the eastern prairie region was virulent to *Pc94* (Table 1). Greater than 50% of all spi possessed virulence to resistance genes *Pc38, Pc39, Pc56,* and *Pc68*. The high levels of virulence to *Pc38* and *Pc39* likely reflect the deployment of *Pc38* and *Pc39*, in combination, in the eastern prairies as well as in North Dakota and Minnesota since the 1980s.

Collections from eastern Canada resulted in 16 spi. Fifteen races were identified, with only a single spi identified for 14 of these. None of the races possessed virulence to the resistance genes *Pc54, Pc58, Pc59, Pc91, Pc94, Pc96, Pc97,* and *Pc98* (Table1). Fifty percent or more of the spi possessed virulence to the resistance genes *Pc38, Pc39, Pc48, Pc52, Pc56* and *Pc68*.

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Table 1. Frequencies (%) of virulence of *Puccinia coronata* f. sp. *avenae* isolates from the Canadian eastern prairie region and eastern Canada on 16 standard and three supplemental crown rust differential oat lines in 2013.

Oat lines and *Pc* gene present	Eastern Prairies						Eastern Canada	
	Wild Oat		Commercial Oat		Uniform Rust Nursery			
	# isolates	%	# isolates	%	# isolates	%	# isolates	%
Standard								
Pc38	124	97	20	95	19	95	14	88
Pc39	119	93	20	95	19	95	13	81
Pc40	65	51	5	24	6	30	2	13
Pc45	28	22	3	14	4	20	2	13
Pc46	69	54	10	48	5	25	6	38
Pc48	16	13	1	5	8	40	11	69
Pc50	5	4	2	10	3	15	3	19
Pc51	71	55	12	57	8	40	2	13
Pc52	12	9	1	5	7	35	8	50
Pc54	4	3	0	0	1	5	0	0
Pc56	111	87	16	76	19	95	11	69
Pc58[a]	1	1	1	5	1	5	0	0
Pc59[a]	13	10	1	5	1	5	0	0
Pc62	20	16	3	14	0	0	1	6
Pc64	41	32	2	10	4	20	1	6
Pc68	70	55	17	81	14	70	14	88
Supplemental								
Pc91	12	9	6	29	2	10	0	0
Pc94	0	0	0	0	0	0	0	0
Pc96	15	12	1	5	2	10	0	0
Putative new gene[b]								
Temp_Pc97	12	9	1	5	1	5	0	0
Temp_Pc98	7	5	0	0	0	0	0	0
Total	128		21		20		16	

[a]The *Pc58*-differential was shown to carry three linked genes, and the *Pc59*-differential three unlinked genes (Chong et al. 2008).
[b]*Temp_pc97* and *temp_Pc98,* are temporary designations for genes recently obtained from *Avena sterilis* (J. Chong, personal communication).

CROP / CULTURE: Oat
LOCATION / RÉGION: Central and 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 CENTRAL AND EASTERN ONTARIO IN 2014

ABSTRACT: In 2014, 22 oat crops in central and eastern Ontario were surveyed for the presence of diseases. Ten were identified, most at slight to moderate levels, but severe levels of crown rust in 7 crops, of barley yellow dwarf in 3 crops, and of pyrenophora leaf blotch and fusarium head blight (FHB) in one crop each. *Fusarium poae* was identified as the predominant causal species of FHB.

INTRODUCTION AND METHODS: A survey to document diseases in central and eastern Ontario oat crops was conducted in the third week of July 2014 when plants were at the soft dough stage of development. Twenty-two fields were chosen at random in the regions where most oat crops are 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 diagnosis was based on visible symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity for ergot, loose smut, and take-all was based on the percent plants infected. Fusarium head blight (FHB) was rated for incidence (% infected panicles) and severity (% infected spikelets in the affected panicles) based on assessing approximately 200 panicles at each of three random sites per field. A FHB Index [(% incidence x % severity)/100] was determined for each field; 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 50 infected panicles (heads) collected from each field. The panicles were air-dried at room temperature and subsequently threshed. Fifty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 60 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 with a 14-hour photoperiod using fluorescent and long wavelength ultraviolet tubes. The *Fusarium* species isolated were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Ten diseases were identified and all were commonly observed (Table 1). Barley yellow dwarf (BYDV), crown rust (*Puccinia coronata* f. sp. *avenae*), pyrenophora leaf blotch (*Pyrenophora avenae*) and stagonospora leaf blotch (*Stagonospora avenae* f. sp. *avenaria*) were the most important diseases, found in 22, 21, 21 and 22 crops at average severities of 3.0, 4.4, 2.1 and 2.7, respectively. Severe infection levels by stagonospora leaf blotch were not detected, but severe crown rust was recorded in seven crops, BYD in three, and pyrenophora in one crop. These diseases collectively may have resulted in yield reductions of =>5% in affected crops.

Other foliar diseases observed included halo blight (*Pseudomonas syringae* pv. *coronafaciens*) and spot blotch (*Cochliobolus sativus*). Severe levels of these diseases were not found; therefore none would have resulted in substantial damage to the crop.

Ergot (*Claviceps purpurea*) was found in 21 crops with a mean severity of 0.5. Loose smut (*Ustilago nuda*) and take-all root rot (*Gaeumannomyces graminis* var. *avenae*) were observed in all surveyed crops at mean severities of 0.5, 0.6, and 2.2%, respectively. These three diseases likely resulted in minimal damage.

Fusarium head blight occurred in all crops at a mean FHB index of 2.7% (range 0.01-36.0%) (Table 1). The disease was recorded at slight to moderate levels in the affected crops with a single exception, a crop with very severe FHB. Six *Fusarium* species were isolated from FHB-discoloured kernels (Table 2).

Fusarium poae predominated; it occurred in 91% of fields and on 21.1% of kernels. *Fusarium equiseti, F. graminearum* and *F. sporotrichioides* were less common and were found in 36-64% of fields and in 3.5-9.5% of kernels. *Fusarium acuminatum* and *F. equiseti* were least common, occurring in 5 and 32% of crops and in 0.4 and 1.8% of kernels, respectively.

The diseases observed on oat in Ontario in 2014 were the same as those recorded in 2013 (Xue and Chen 2014). The severity of crown rust was reduced compared to 2013, but BYD, pyrenophora leaf blotch, stagonospora leaf blotch and take-all severity were all higher in 2014 than 2013. The average severity of FHB in 2014 was similar to that of 2013, but although it was observed in all surveyed fields, FHB likely had no significant effect on oat grain yield or quality in 2014.

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Table 1: Prevalence and severity of oat diseases in central and eastern Ontario in 2014.

DISEASE	NO. CROPS AFFECTED (n=22)	DISEASE SEVERITY IN AFFECTED CROPS*	
		MEAN	RANGE
Barley yellow dwarf	22	3.0	1.0-6.0
Crown rust	21	4.4	2.0-7.0
Halo blight	20	1.4	1.0-3.0
Pyronophora leaf blotch	21	2.1	1.0-6.0
Spot blotch	22	1.2	1.0-2.0
Stagonospora leaf blotch	22	2.7	1.0-4.0
Ergot (%)	21	0.5	0.5-1.0
Loose smut (%)	22	0.6	0.1-2.0
Take-all (%)	22	2.2	0.5-5.0
Fusarium head blight**	22		
Incidence (%)		11.5	1.0-60.0
Severity (%)		10.1	1.0-60.0
Index (%)		2.7	0.01-36.0

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

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

Table 2. Prevalence of *Fusarium* species isolated from discolored kernels of oat in central and eastern Ontario in 2014.

***Fusarium* spp.**	**% AFFECTED FIELDS**	**% KERNELS**
Total *Fusarium*	100	40.4
F. acuminatum	5	0.4
F. avenaceum	55	9.5
F. equiseti	32	1.8
F. graminearum	36	4.2
F. poae	91	21.1
F. sporotrichioides	64	3.5

CROP / CULTURE: Spring and winter wheat
LOCATION / RÉGION Southern Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
D.A. Gaudet, M.J. Frick, K. Kundrik and E. Amundsen
Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403 1st Ave. S., Lethbridge AB T1J 4B1
Telephone: (403) 327-4561; **Facsimile:** (403) 382-3156; **E-mail:** denis.gaudet@agr.gc.ca

TITLE / TITRE: 2014 STRIPE RUST SURVEY IN SOUTHERN ALBERTA

ABSTRACT: Stripe rust incidence and severity were assessed in winter and spring wheat fields in - Southern Alberta during the 2013-2014 crop season. *Puccinia striiformis* f. sp. *tritici* was first recorded in mid-June 2014, an average of two weeks earlier than in most years. Severities up to 40% to 65% were recorded in susceptible winter wheat and spring wheat cultivars, respectively, in a corridor north and south of Highway 3, but overall impact of stripe rust on yields was low.

INTRODUCTION AND METHODS: Commercial fields of winter and spring wheat in the region extending south of Highway 1 to the USA border and from Cardston/Ft Macleod to Medicine Hat in southern Alberta were surveyed for stripe rust. The surveys were in November 2013 following seeding, in 2014 in early May and at weekly intervals from early June to mid-August until spring wheat started general ripening. The number of fields assessed on each sampling date varied from 10 to 24. Fields were traversed in a "V" pattern until 10 sites separated from each other by 25 m were evaluated for incidence and severity. The incidence of plants with striping on leaves in a square metre area along the "V" pattern, and the severity as the average percent of the total leaf surface area infected per plant were recorded. Based on average severity, crops were classified as follows: clean (0%), trace (<1%), light (1-4%), moderate (5-19%) and severe (20-100%).

RESULTS AND COMMENTS: There was no evidence of overwintering for 2013-2014 of stripe rust in Southern Alberta (Table 1), although moderate levels were reported in winter wheat plots in Olds, Alberta in early June 2014. This suggested that overwintering had occurred in the area around Olds; however, there were no reports that this particular overwintering event resulted in a subsequent spread during the growing season in Central Alberta. Stripe rust was first recorded at trace levels (<1% severity) on June 13 in a winter wheat field near Cardston and in a second field east of Lethbridge (Table 1). By June 25, stripe rust was widespread in winter wheat, occurring in 75% of the winter wheat fields in the Lethbridge region, with severity levels exceeding 10% in several fields. By mid-July, stripe rust had been observed in 70% of the winter wheat fields surveyed with 30% of fields exceeding 10% severity (Table 1). The highest severity levels in winter wheat were recorded near Coaldale, at 100% incidence and 40% severity.

Stripe rust was first observed on spring wheat in the Lethbridge region at trace levels on July 10. By early August, 64% of spring wheat fields surveyed contained stripe rust with 18% of the crops exceeding 10% severity. The highest levels were recorded in the stripe rust-susceptible spring wheat cultivar 'AC Abound' near Coaldale at 100% incidence and 65% severity. In general, elevated rust severity levels were observed in a corridor north and south of Highway 3 that extended from Cardston to Lethbridge to Bow Island with a few spring and winter wheat crops outside of the corridor exceeding trace levels (Figure 1). In Alberta, the predominant red winter wheat cultivars planted in 2013 were 'Radiant' and 'Moats', which are susceptible and moderately resistant to stripe rust, respectively. The predominant red spring wheat cultivars 'AC Harvest', 'Carberry', 'Lillian' and 'Stettler', range from resistant to highly resistant. Despite the early occurrence of stripe rust in mid-June, which was two weeks earlier than in most years, the seeding of resistant cultivars and the widespread use of fungicides likely limited the impact of stripe rust on wheat yields in Southern Alberta in 2014.

Table 1. Stripe rust severity levels recorded in winter- and spring wheat fields in Southern Alberta during the 2013-2014 crop season.

Crop (Date)	Severity Level				
	Clean **(0%)**	Trace **(<1%)**	Light **(1% to 4%)**	Moderate **(5% to 19%)**	Severe **(20% to 100%)**
Winter wheat (Nov. 2013)	11	0	0	0	0
Winter wheat (May 2014	10	0	0	0	0
Winter wheat (June 13)	10	2	0	0	0
Winter wheat (June 20)	20	4	0	0	0
Winter wheat (June 25)	5	9	3	3	0
Winter wheat (July 02)	11	7	2	0	0
Winter wheat (July 10)	5	5	4	5	4
Spring wheat (July 10)	5	3	2	0	0
Winter wheat (July 16)	4	1	0	1	1
Spring wheat (July 16)	16	1	1	0	0
Winter wheat (July 24)	3	5	1	3	5
Spring wheat (July 24)	11	7	0	4	0
Spring wheat (July 30)	10	6	5	3	0
Spring wheat (August 05)	7	6	2	6	3

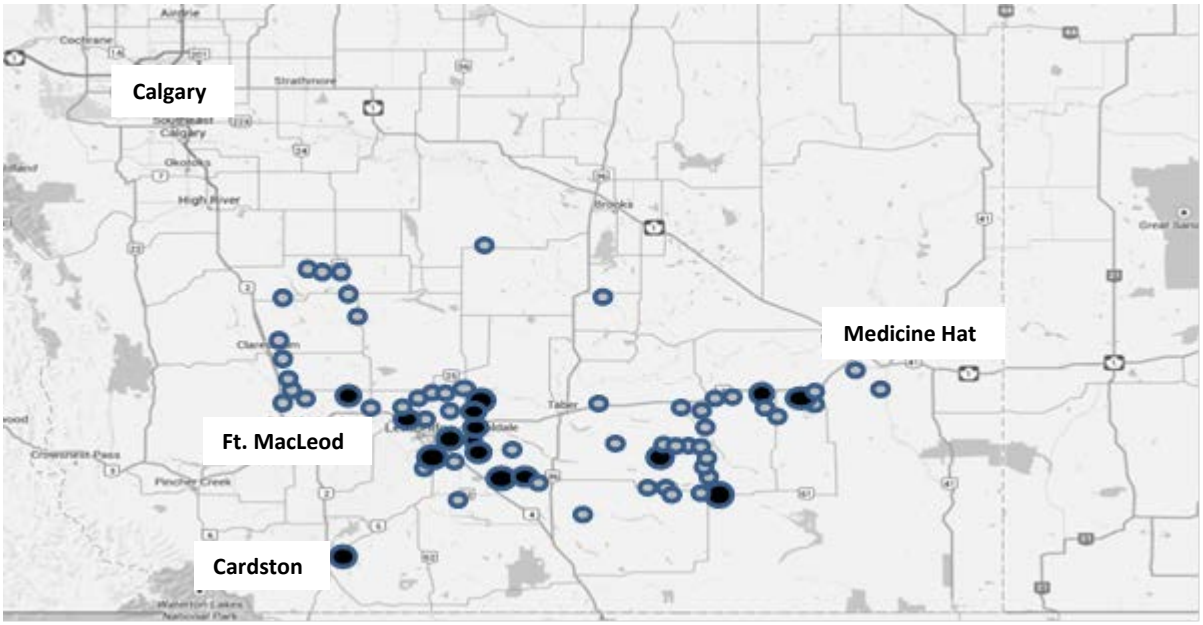

Figure 1. Occurrence of stripe rust in Southern Alberta during the 2014 crop season. Dots with light centers represent fields with average severity levels of less than 5%; dots with dark centers represent fields with average severity levels of greater than 5%.

CROP / CULTURE: Winter and spring wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
G.S. Brar, D. MacLean and H.R. Kutcher
Department of Plant Sciences/Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
Telephone: (306) 966-4951; **Facsimile:** (306) 966-5015; **Email:** randy.kutcher@usask.ca

TITLE/TITRE: STRIPE RUST SURVEY OF WINTER AND SPRING WHEAT IN SASKATCHEWAN IN 2014

ABSTRACT: Thirty-eight winter and spring wheat crops and four trap plots of differential wheat genotypes located at research establishments were surveyed for stripe rust in Saskatchewan in 2014. Stripe rust was found only in south-western Saskatchewan and was less widespread than in 2013.

INTRODUCTION AND METHODS: Thirty-eight commercial crops of winter and spring wheat, and susceptible differential wheat lines in the four trap plots in 12 crop districs of Saskatchewan were surveyed at the late milk to soft dough growth stages for stripe rust (*Puccinia striiformis* f. sp*. tritici*) between late July and late August, 2014. The crops surveyed were separated from each other by at least 20 km. The trap plots were located at Saskatoon (central SK), Prince Albert (northern SK), Scott (west-central SK) and Swift Current (southwestern SK). Each crop was traversed in a "V" pattern within which individual plants at 5 sites separated by about 40 m were evaluated for incidence and severity of stripe rust (Puchalski et al. 2012). Incidence was estimated as the proportion of infected plants exhibiting at least trace levels of stripe rust in a 5 m row of the crop. The modified Cobb scale (Peterson et al. 1948) was used to assess stripe rust severity on the flag leaves of 50 plants per crop (10 leaves per site). A six-category scale was used to assess stripe rust severity in each field: clean (no visible symptoms); trace (<3% leaf area affected); light (3-5%); moderate (>15-20%); and severe (>20%).

RESULTS AND COMMENTS: In 2014, temperatures in Saskatchewan were slightly cooler than the long-term normal. In general, precipitation in all regions was close to the long term average in most months, except June, when precipitation was much greater than the long-term average.

Stripe rust was observed in 8 (21%) of the wheat crops in 2014 and on the susceptible differentials (i.e. Avocet -*YrA* and Avocet +*YrA*) in the four trap plots. Of the 38 wheat crops surveyed: 30 (79%) were clean and two (5%) had trace levels of stripe rust (Table 1). Additionally, 2 crops were rated as light, one as moderate and 3 as severe. Stripe rust was rated as severe on Avocet -*YrA* (susceptible check) at Prince Albert and Scott and as moderate at Saskatoon and Swift Current. Stripe rust was most widespread in crop district 4B with all four crops sampled being positive for stripe rust. The three severely affected crops were in crop districts 4A, 4B and 3B-N.

Stripe rust was frequently observed and uniformly distributed across the province in 2013 (Brar et al. 2014), but was much less so in 2014. It was also light in 2014 in the USA as compared with 2013 (Anmin Wan, USDA Washington State, personal communication). This may be the reason for the low levels of stripe rust observed in Saskatchewan as the inoculum normally is blown in from the USA to the south. Stripe rust was observed in southern Alberta at moderate to severe levels in 2014 (André Laroche and Denis Gaudet, Agriculture and AgriFood Canada, Lethbridge, personal communication), which may be the reason for stripe rust mainly occurring in south-western Saskatchewan. In stripe rust-infected crops, teliospore formation was observed by late July to early August.

Stripe rust was not observed in 2014 in crop districts 5A, 9A-E, 9A-W, 8B, and 7A, which are in the northern and the eastern portions of the province. This further supports the likelihood that stripe rust inoculum from southern Alberta spreads into south-western Saskatchewan.

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Table 1. Prevalence (proportion of crops affected) and severity of stripe rust on commercial winter wheat crops in 2014 in Saskatchewan by crop district.

Crop District	Prevalence	Severity Class*				
		Clean	Trace	Light	Moderate	Severe
3A-N	0/4	4	0	0	0	0
3B-N	1/9	8	0	0	0	1
4A	1/2	1	0	0	0	1
4B	4/4	0	1	1	1	1
5A	0/2	2	0	0	0	0
6B	1/4	3	1	0	0	0
7A	0/2	2	0	0	0	0
7B	0/3	3	0	0	0	0
8B	0/1	1	0	0	0	0
9A-E	0/1	1	0	0	0	0
9A-W	0/2	2	0	0	0	0
9B	1/4	3	0	1	0	0
Total	**8/38**	**30**	**2**	**2**	**1**	**3**

*Severity classes: clean (no visible symptoms); trace (<3% leaf area affected); light (3-5%); moderate (>15-20%); severe (>20%)

CROP / CULTURE: Wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
F. Dokken-Bouchard[1], B. Aryal[2], M.R. Fernandez[3], S. Kassir[2], C. Peluola[2], T. Sliva[2], and D. Stephens[1]
[1]Saskatchewan Ministry of Agriculture, 3085 Albert Street, Regina SK S4S 0B1
Telephone: (306) 787-4671; **Facsimile:** (306) 787-0428; **E-mail:** faye.bouchard@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 2014

ABSTRACT: In 2014, Fusarium head blight (FHB) incidence and severity were assessed in 191 wheat crops in Saskatchewan. FHB occurred in 54% and 77% of the surveyed common and durum wheat crops, respectively. The provincial mean FHB severity (FHB Index) for common wheat was 0.5% and for durum wheat 1.8%.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 191 wheat crops in Saskatchewan in 2014 - 127 common wheat (Canada Western Red Spring and Canada Prairie Spring classes) and 64 durum wheat (Canada Western Amber Durum class). Field location and results 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 Saskatchewan Ministry of Agriculture staff randomly collected 50 spikes from each wheat crop at the late milk to early dough stages of growth (Lancashire et al. 1991). Spikes were analyzed for visible FHB symptoms at the Crop Protection Laboratory in Regina. The percentage of infected spikes per crop and the percentage 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 spikelets 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 (PDA) and carnation leaf agar (CA) to confirm presence of *Fusarium* species on infected kernels. PDA or half strength PDA were used to observe colony morphology; CA was used to promote sporulation. In previous years' surveys, a maximum of 20 symptomatic kernels per sample were selected to represent infected samples to confirm FHB and the *Fusarium* spp. involved. In 2014, a maximum of 8 kernels per sample were selected and cultured for this purpose.

RESULTS AND COMMENTS: Approximately 3.4 million ha (8.5 million acres) of spring wheat and 1.7 million ha (4.2 million acres) of durum wheat were seeded in Saskatchewan in 2014. Wheat production was above the 2004-2013 average of 2.40 metric tonnes per ha (36.1 bu/ac) for spring wheat) and 2.36 tonnes per ha (35.4 bu/ac) for durum wheat, but not as high as the record-breaking 2013 season. The average yields in 2014 were 3.0 metric tonnes per ha (44.7 bu/ac) for spring wheat and 2.7 metric tonnes per ha (40.0 bu/ac) for durum wheat in 2014 (Saskatchewan Ministry of Agriculture 2014).

In 2014, FHB occurred in 54% and 77% of the surveyed common and durum wheat crops, respectively (Table 1). Prevalence and severities of FHB in common and durum wheat were lowest in soil zone 1. FHB was most prevalent in soil zone 2 for both common and durum wheat. Irrigation zones were not surveyed in 2014. The highest mean severity for both common wheat and durum was in Zone 2. The sample with the highest FHB severity (23.5%) was from a durum wheat crop in soil zone 2.

Overall, the 2014 provincial mean FHB severity was similar to that of previous years for common wheat (0.5%), but had continued to increase in durum wheat to 1.8%. Mean common wheat FHB severity was

0.6% in 2011, 1.2% in 2012, and 0.5% in 2013. Durum wheat FHB severity was 0.9% in both 2012 and 2011, and 1.3% in 2013. However, the provincial mean FHB severities for common wheat and durum wheat in 2014 were still lower than in 2010 (2.0%), which was the first year since 2001 that the provincial annual mean FHB severity exceeded 1% (Dokken-Bouchard et al. 2014).

Of the 191 wheat spike samples collected, 117 had visible FHB symptoms as confirmed by culturing and pathogen identification. The most frequently isolated pathogen on samples with visible FHB symptoms was *F. graminearum* (Table 2). This species, which is considered the most aggressive FHB-causing pathogen, was detected in 46% of surveyed fields and accounted for 66% of total *Fusarium* isolations. *Fusarium graminearum* was detected in 42% of the common wheat samples and 55% of the durum wheat samples with visible symptoms, which is approximately double compared to 2013. It accounted for 69% of the total *Fusarium* isolations from common wheat and 63% from durum wheat. This level is higher than found in any previous year (Dokken-Bouchard et al. 2014).

Fusarium poae was detected in only 10% of surveyed crops and accounted for just 5% of total *Fusarium* isolations in 2014, a decrease compared to 2013, when it was detected in 31% of surveyed fields and accounted for 24% of *Fusarium* isolations. In previous years, either *F. avenaceum* or *F. poae* had been the dominant species in the province (Dokken-Bouchard et al. 2014). In 2014, *F. avenaceum* was detected in 14% of surveyed fields and accounted for 12% of total *Fusarium* isolations, similar to 2013.

Other fungal pathogens observed on wheat spikes samples collected in 2014 included *Septoria* spp. and *Cochliobolus* spp. along with various secondary moulds.

ACKNOWLEDGEMENTS:
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Table 1. Prevalence and severity of fusarium head blight (FHB) in common and durum wheat crops grouped by soil zone in Saskatchewan, 2014.

Soil Zones	Common Wheat		Durum Wheat	
	Prevalence[1] (No. of Crops Surveyed)	**Mean FHB Severity[2] (range)**	**Prevalence[1] (No. of Crops Surveyed)**	**Mean FHB Severity[1] (range)**
Zone 1 Brown	25% (16)	0.03% (0 – 0.2%)	52% (31)	0.2% (0 – 1.5%)
Zone 2 Dark Brown	75% (36)	1.2% (0 – 16.8%)	100% (33)	3.3% (0.1 – 23.5%)
Zone 3 Black/Grey	49% (75)	0.3% (0 – 6.8%)	--	--
Overall Total/Mean	54% (127)	0.5% (0 - 16.8%)	77% (64)	1.8% (0-23.5%)

[1]Prevalence = Number of crops affected / total crops surveyed
[2]FHB severity (FHB Index) = [% of spikes affected x mean proportion (%) of kernels infected] /100.

Table 2. *Fusarium* spp. in FHB-affected wheat crops in Saskatchewan in 2014.

Crop	***Fac***	***Fav***	***Fc***	***Fe***	***Fg***	***Fp***	***Fs***	**Other *Fusarium* spp.**
Durum	16*	25	2	3	55	11	3	16
Common	6	9	1	2	42	9	2	18
Wheat Total	9	14	1	3	46	10	2	17

Fac = F. acuminatum, Fav = F. avenaceum, *Fc = F. culmorum*, *Fe = F. equiseti*, *Fg = F. graminearum*, *Fp = F. poae*, *Fs = F. sporotrichioides*

*Number of crops affected / total crops surveyed (%) for all species of *Fusarium*

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

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
M.R. Fernandez[1], K. Hodge[2], A. Brown[3], P. Screpnek[3],G. Almasi[3], B. Doig[4], H.R. Kutcher[5], F.L. Dokken-Bouchard[6], and C.O. Peluola[7]
[1]Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, P.O. Box 1030, Swift Current SK S9H 3X2
Telephone: (306) 770-4459; **Facsimile:** (306) 770-4411; **E-mail:** myriam.fernandez@agr.gc.ca
[2]Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, #300-2010 12th Avenue, Regina SK S4P 0M3
[3]Saskatchewan Crop Insurance Corporation, Box 3000, 484 Prince William Drive, Melville SK S0A 2P0
[4]Saskatchewan Ministry of Agriculture, Regional Services Branch, #1192-102nd Street, North Battleford SK S9A 1E9
[5]Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
[6]Saskatchewan Ministry of Agriculture, Crops and Irrigation Branch, 3085 Albert Street, Regina SK S4S 0B1
[7]Saskatchewan Ministry of Agriculture, Crop Protection Laboratory, 346 McDonald Street, Regina SK S4N 6P6

TITLE / TITRE: **COMMON AND DURUM WHEAT GRAIN SAMPLES WITH *FUSARIUM*-DAMAGED KERNELS ACROSS SASKATCHEWAN IN 2014**

ABSTRACT: Wheat samples collected by the Saskatchewan Crop Insurance Corporation were graded for *Fusarium*-damaged kernels (FDK). Over 60% of all submitted samples had FDK. Rural municipalities (RMs) with highest % of submitted common wheat samples with FDK, and highest mean severities mostly at ≤4%, were for the most part in the Dark Brown and Black/Dark Gray soil zones. Similarly, RMs with highest % of submitted durum wheat samples with FDK were mostly in the Dark Brown and western edge of the Black/Dark Gray soil zone, with mean severities ranging from 4% to ≥10%.

INTRODUCTION AND METHODS: Common and durum wheat samples were collected in 2014 by Saskatchewan Crop Insurance Corporation (SCIC) staff from customers who submitted a claim due to yield or quality losses. SCIC insures approximately 70-75% of the seeded acres in Saskatchewan and producers are guaranteed a #2 grade for each wheat crop and class. In 2014, The average number of insured acres per customer was approximately1,272. Producers who submitted a claim for any crop type (cereal or non-cereal), represented approximately 24% of the producers insured in 2014 by SCIC. The total samples graded represent an area of approximately 6.4 million insured acres. A sample representative of the harvested grain was collected by SCIC staff and was subsequently graded by SCIC grain graders at their station in Melville, SK, according to Canadian Grain Commission standards.
The grain samples graded by SCIC to February 12, 2015 are included in this report. Common wheat samples totaled 4,789 with 91% being CWRS (Canada Western Red Spring) and the remainder CPSW (Canada Prairie Spring White) or CPSR (Canada Prairie Spring Red). Durum wheat samples numbered 3,415. The data gathered and presented here includes wheat class, the rural municipality (RM) where the grain sample originated, and the reason(s) for the downgrade. Only those samples with *Fusarium*-damaged kernels (FDK) resulting from fusarium head blight (FHB), are included in this analysis. It is assumed that producers who did not submit a claim in 2014 did not have a crop(s) with a FDK level greater than 0.5% for CWAD (Canada Western Amber Durum), or greater than 0.8% for CWRS or 1.5% for CPSW/CPSR. These levels would have resulted in a #2 grade for each of those quality classes (Canadian Grain Commission 2015), or the damage due to FHB was not apparent.

RESULTS AND COMMENTS: The tabulated results are illustrated in Figures 1 to 6. **Figure 1** shows the number of common wheat samples from each Saskatchewan RM submitted to SCIC in 2014. RMs having the highest number of submitted common wheat samples were in the north-central portions of the Dark

Brown soil zone and in the Black/Dark Gray soil zone, especially the north-east portion. Most RMs having no common wheat samples submitted ('colourless RMs' in the Figure) were in the Brown soil zone. Overall, FDK-affected common wheat samples made up 62.8% of all those submitted in 2014. The remaining samples had other categories of damage, or no damage at all. **Figure 2** shows the incidence of FDK in each RM, calculated as the proportion of total samples with any FDK, submitted from that RM. The RMs with the highest percentage of common wheat samples affected by FDK were concentrated in the Dark Brown and Black/Dark Gray soil zones, with the majority of the RMs having most or all samples with FDK being in the north-east and south-east regions. In contrast, most RMs in the Brown soil zone had no samples with FDK, and in those that did, less than half of the samples were affected.

Figure 3 shows the average percentage FDK (severity) in affected common wheat samples from each RM. There were only a few affected RMs scattered across the province with mean FDK severities of ≤1.5%, corresponding to a resulting downgrade to CWRS #3 or CPS #2. The RMs with the highest mean FDK severities were mostly in the Dark Brown and Black/Dark Gray soil zones, and in most cases the resulting downgrading was due to FDK levels as high as 4% corresponding to "feed" grade for both CWRS and CPS classes, while for others FDK was greater than 4%, indicating a downgrading to 'sample/salvage' for both wheat classes. There were very few RMs in the Brown soil zone with submitted common wheat samples that would have been downgraded to "feed" or "sample/salvage".

For durum wheat, **Figure 4** shows the number of samples submitted to SCIC from each RM in 2014. The RMs with the highest number of submitted durum wheat samples were in the west-central portion of the province in both the Brown and Dark Brown soil zones. There were fewer samples submitted from southern RMs, and there appeared to be no samples submitted from the north-west edge of the Dark Brown soil zone presumably because fewer durum wheat crops were grown in that area. The fewer number of durum wheat samples submitted from RMs in the Brown soil zone could be attributed to lower, or no, FDK levels in that region.

FDK-affected durum wheat samples comprised 68.1% of the total; the remainder had other types of damage, or no damage at all. **Figure 5** shows the incidence of FDK in each RM calculated as the proportion of samples with any FDK. The RMs with the greatest proportion of samples with any FDK are concentrated mostly within the Dark Brown soil zone and the western edge of the Black/Dark Gray soil zone, where more than half of the durum wheat samples had FDK, including some RMs where all samples submitted were infected. By contrast, most of the RMs in the Brown soil zone had a lower percentage of samples with FDK, or no samples with FDK ('colourless' RMs in Figure 5).

Figure 6 shows the mean FDK severity in durum wheat per RM in 2014. The RMs with the highest FDK severities (≥10%), corresponding to downgrading to "sample/salvage", were mostly in the Dark Brown soil zone and the western edge of the Black/Dark Gray soil zone. The RMs with the lowest mean severities, ≤2%, which corresponded to crop downgrading to CWAD #3 and #4, were all in the Brown soil zone. Approximately 40% of the RMs in this soil zone had submitted samples with mean FDK levels of up to 4% corresponding to downgrading to CWAD #5, while fewer than 20% of the RMs had submitted samples with mean FDK severities as high as 10%, but none had >10% FDK. However, for most RMs in the Brown soil zone durum wheat samples submitted to SCIC were fewer than 25.

ACKNOWLEDGEMENT:
We gratefully acknowledge the participation of Saskatchewan Crop Insurance Corporation staff for the collection and grading of common and durum wheat samples from producers across the province. We also thank Jason Patterson, Tamara Rounce, and Mark Berry of Agriculture and Agri-Food Canada, Science and Technology Branch, for technical assistance.

REFERENCE:
Canadian Grain Commission. 2015. Wheat – Chapter 4 / Official Grain Grading Guide. (http://www.grainscanada.gc.ca/oggg-gocg/04/oggg-gocg-4e-eng.htm)

Fig. 1. Number of common wheat samples, by rural municipality, evaluated for *Fusarium*-damaged kernels in Saskatchewan in 2014.

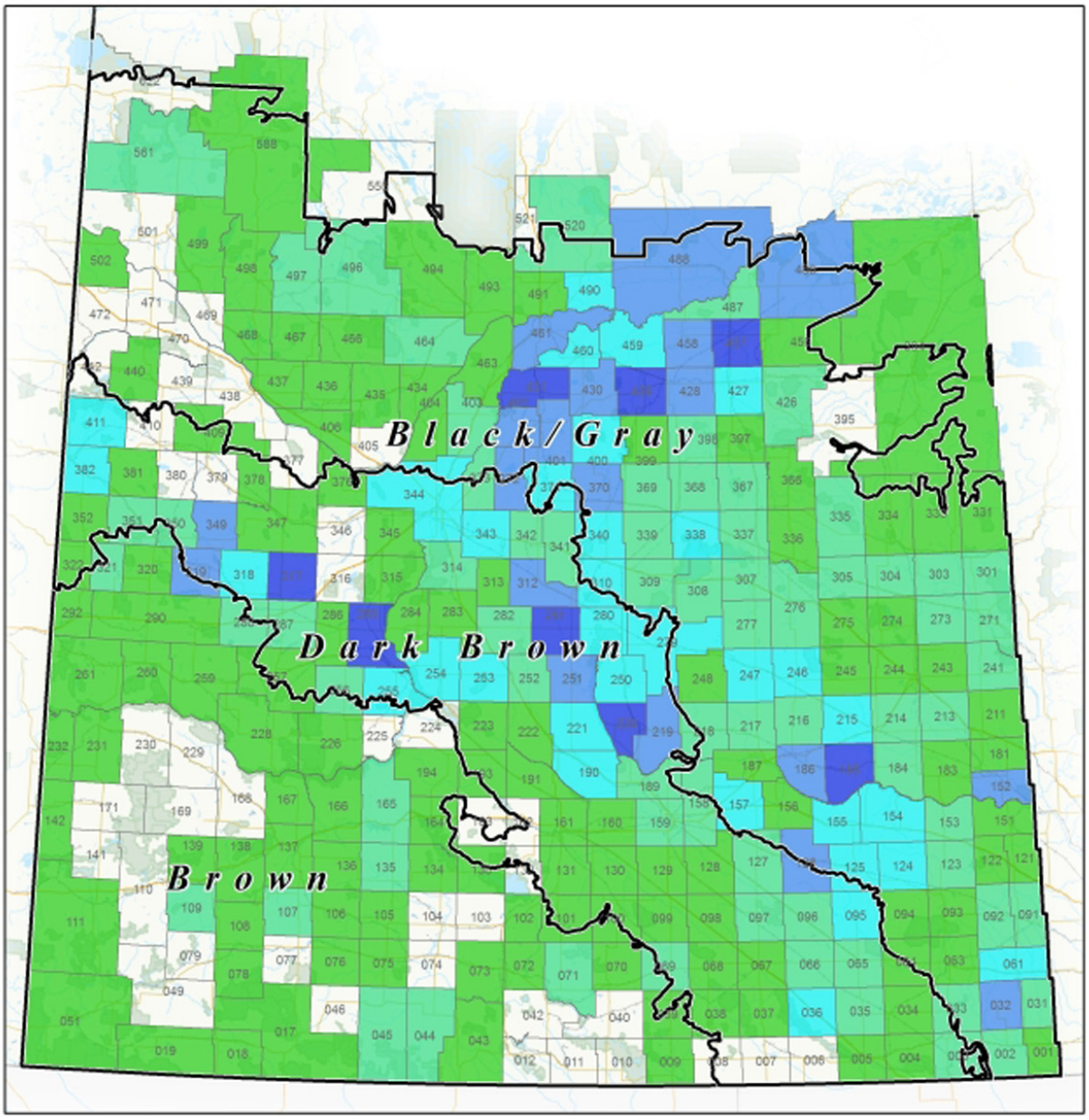

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Fig. 2. Percentage common wheat samples, by rural municipality, with *Fusarium*-damaged kernels across Saskatchewan in 2014.

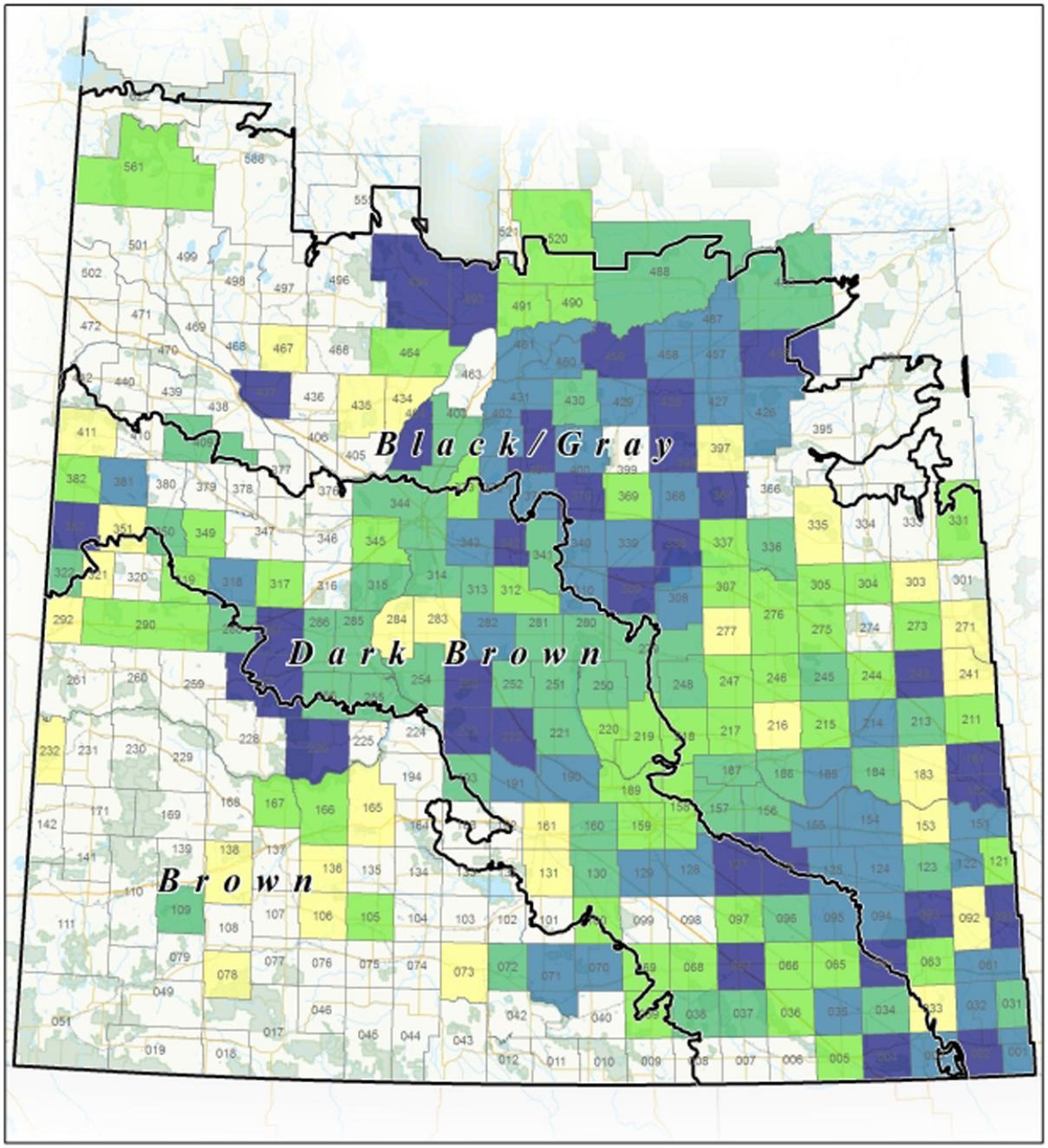

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Fig. 3. Mean severity of *Fusarium*-damaged kernels, by rural municipality, in common wheat across Saskatchewan in 2014.

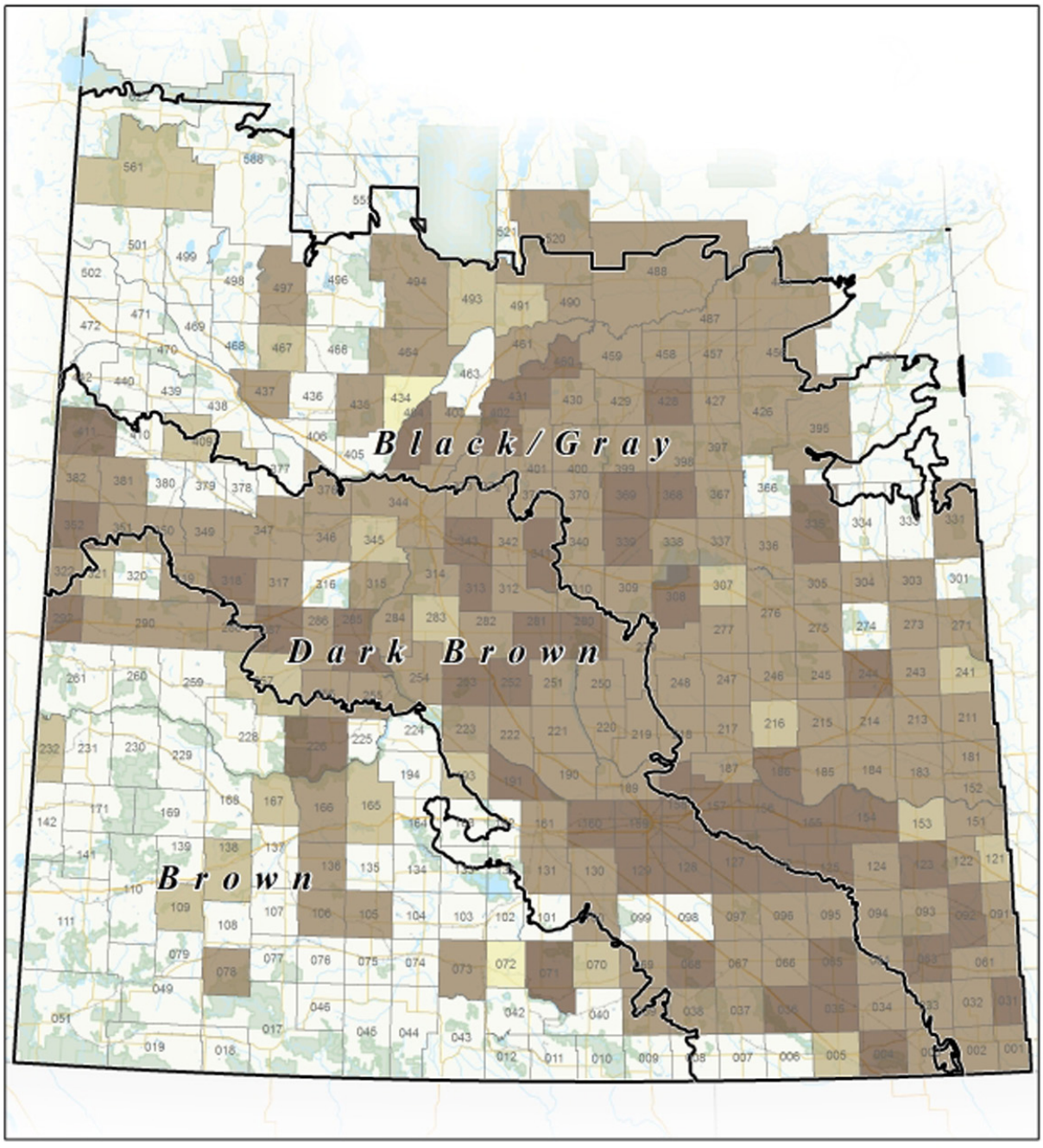


Fig. 4. Number of durum wheat samples, by rural municipality, evaluated for *Fusarium*-damaged kernels in Saskatchewan in 2014.

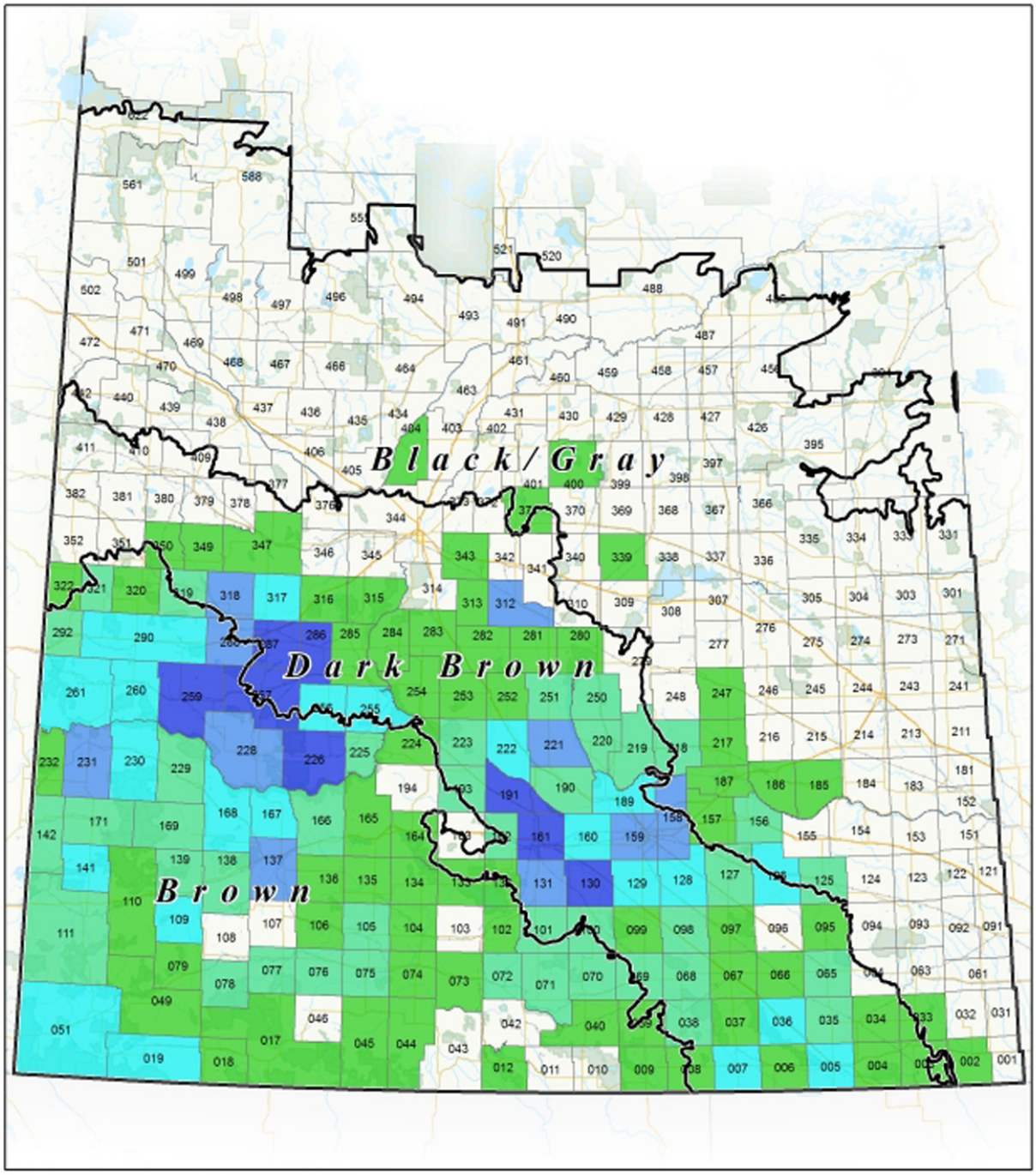


Fig. 5. Percentage durum wheat samples, by rural municipality, with *Fusarium*-damaged kernels across Saskatchewan in 2014.

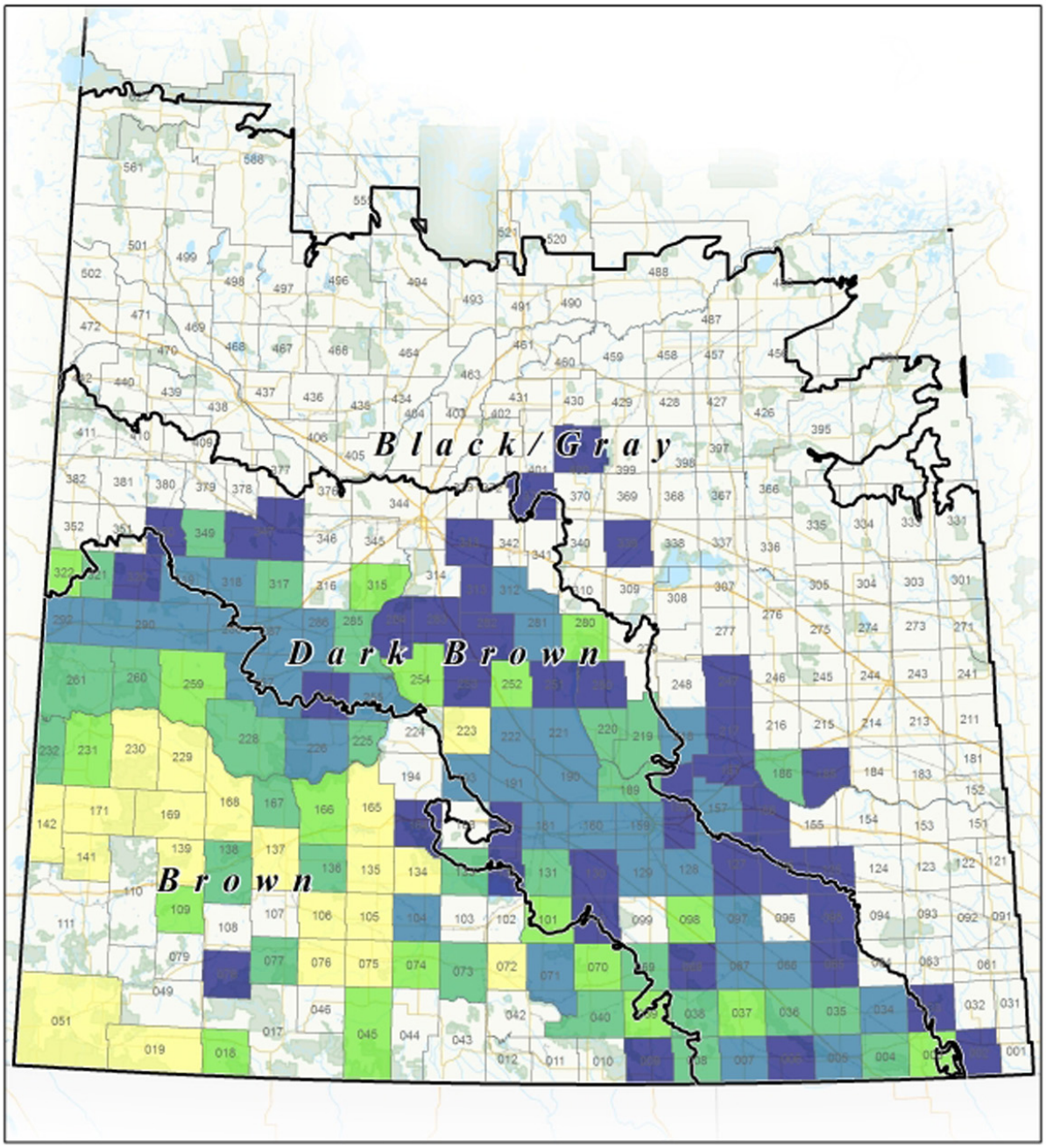
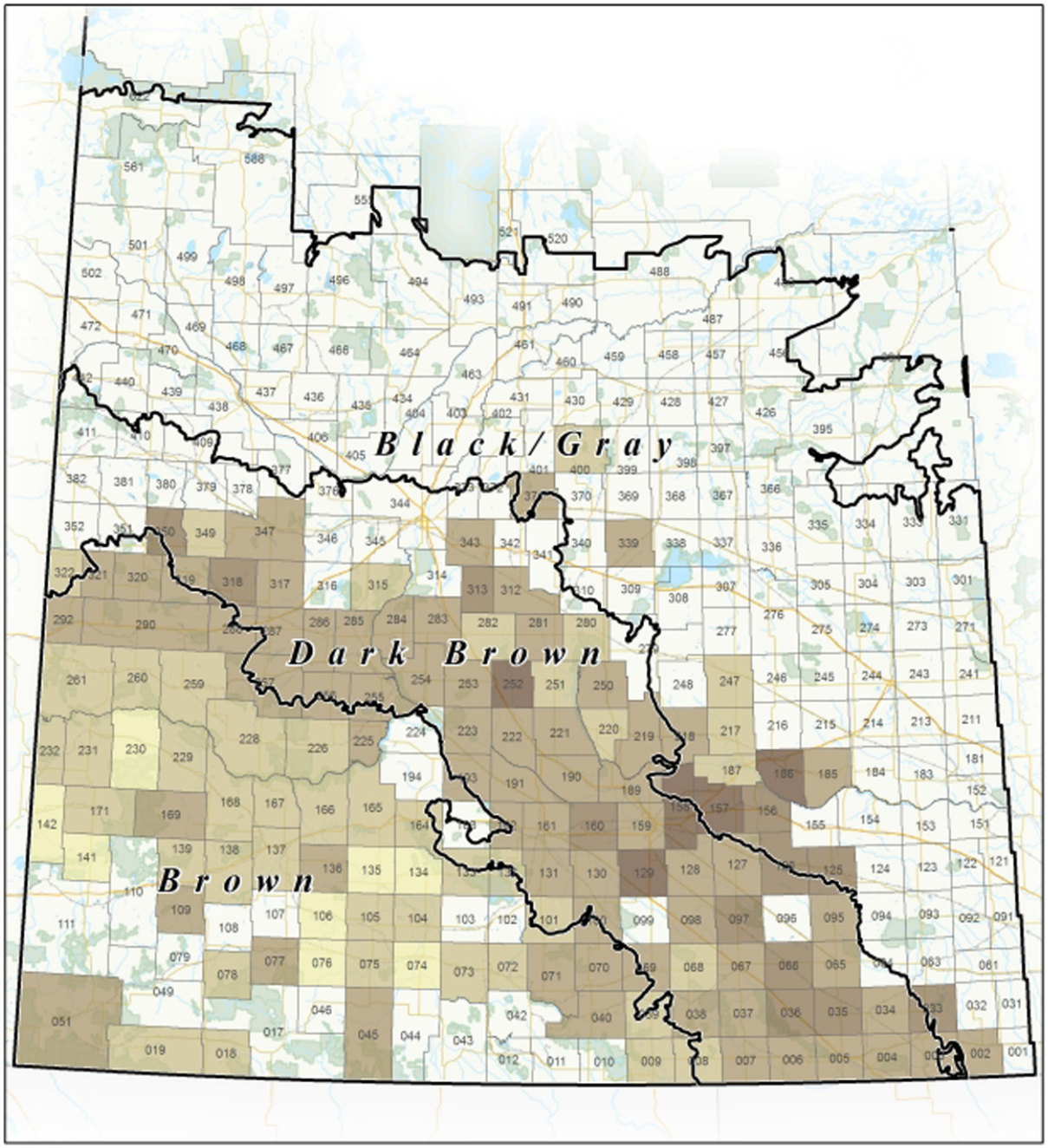


Figure 5 Percentage durum wheat samples with FDK

- 3.2% - 28.1%
- 28.2% - 53.8%
- 53.9% - 72.7%
- 72.8% - 88.9%
- 89% - 100%

Fig. 6. Mean severity of *Fusarium*-damaged kernels, by rural municipality, in durum wheat across Saskatchewan in 2014.



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

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
M.R. Fernandez[1], K. Hodge[2], W. Ellouze[1], F. Waelchli[3], A. Brown[3], F.L. Dokken-Bouchard[4], and C.O. Peluola[5]
[1]Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, P.O. Box 1030, Swift Current SK S9H 3X2
Telephone: (306) 770-4459; **Facsimile:** (306) 770-4411; **E-mail:** myriam.fernandez@agr.gc.ca
[2]Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, #300-2010 12th Ave., Regina SK S4P 0M3
[3]Saskatchewan Crop Insurance Corporation, Box 3000, 484 Prince William Drive, Melville SK S0A 2P0
[4]Saskatchewan Ministry of Agriculture, Crops and Irrigation Branch, 3085 Albert St., Regina SK S4S 0B1
[5]Saskatchewan Ministry of Agriculture, Crop Protection Laboratory, 346 McDonald Street, Regina SK S4N 6P6

TITLE / TITRE: **LEAF SPOT DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2014**

ABSTRACT: Leaf spot (LS) disease occurrence and severity were surveyed in 158 wheat crops across Saskatchewan. Disease severity and frequency of pathogen isolation were compared relative to soil zone, cultivar, fungicide use, previous crops and tillage systems. The overall LS severity was higher than in 2013, but similar to 2012, and was highest in the black/grey soil zone for common wheat and in the brown soil zone for durum wheat. *Pyrenophora tritici-repentis* was the most prevalent and widespread pathogen followed by the septoria leaf complex. *Cochliobolus sativus* was the most common in durum wheat. There were differences in LS severity and pathogen isolation frequency among tillage systems and previous crops.

INTRODUCTION AND METHODS: A survey for leaf spot (LS) diseases of common and durum wheat was conducted between the milk and dough growth stages in 2014. A total of 158 common or durum crops were sampled in 18 crop districts (CD). In each field, 50 flag leaves were collected at random and air-dried at room temperature. Percentage of leaf area affected by LS (severity) was recorded for each leaf, and mean percentage leaf areas with L S were calculated for each crop and CD. For crops with the highest LS severities and which had not been sprayed with a fungicide at any growth stage (total of 48 crops), 1 cm^2 surface-disinfested leaf pieces were plated on water agar for identification and quantification of the causal LS pathogens.

There were 43 fields sampled in soil zone (SZ) 1 (Brown), 63 in SZ2 (Dark Brown), and 52 in SZ3 (Black/Grey). Information on the agronomic practices was obtained from the producers for most fields.

Among the sampled crops, 60 were identified as durum wheat and 94 as common wheat (4 were not identified to wheat type). There were 42 different common and durum wheat cultivars sampled, the most common (grown in 5 fields or more) being the durum wheat cultivars ‘Strongfield’ (24 fields), ‘Brigade’ (13), ‘Transcend ‘and ‘CDC Verona’ (6 each), and the common wheat cutivars ‘CDC Utmost’ (14), ‘Shaw’ (10), ‘Lillian’ and ‘AC Unity’ (8 each), and ‘Carberry’ (5).

Information on whether the sampled crops had been sprayed with fungicide(s), and when, was also obtained from most producers. There were twice as many crops sprayed with fungicides (72) as nonsprayed (32). Most treated crops had been sprayed at heading/flowering (42), followed by those sprayed at the flag leaf stage (13).

Information on the crops grown (or summerfallow) in 2013 and 2012 and tillage method was also obtained from producers for most of the surveyed fields. Comparison of LS severity and fungal frequency among tillage systems and among previous crops was made for common wheat crops. Tillage system was

classified as traditional (formerly known as “conventional”), minimum, or zero, while previous crop in 2013 or 2012 was classified as a cereal, a non-cereal (oilseed or pulse), or as summerfallow. Most of the wheat crops sampled were under zero-till (106), followed by crops under minimum-till (17), with only four crops being managed traditionally. The most common previous crop was an oilseed (58), with fewer crops being preceded by a cereal (29) or a pulse (26), while the crop two years previously were a cereal (58), an oilseed (38), or a pulse (16). Summerfallow was the least common agronomic practice, with only 9 fields having been left fallow the previous year and 5 fields two years previously. For cropping sequence in the previous two years, there were more wheat crops that had been preceded by a noncereal (oilseed or pulse) in 2013 and a cereal in 2012 (47) than wheat crops that had been preceded by a noncereal in each of the previous two years (27), or a cereal in 2013 and a noncereal in 2012 (22).

RESULTS AND COMMENTS: Leaf spots were observed in all crops surveyed in 2014 (Table 1). In individual crops, percentage flag leaf area affected ranged from trace to 28%. The overall mean LS severity of 9.8% was higher than in 2013 (7.6%), but similar to 2012 (10.0%), and somewhat lower than in 2011 (11.6%) (Fernandez et al., 2012, 2013, 2014). The higher average LS severity in 2014 than in 2013 can be explained, at least in part, by wetter than normal conditions in June 2014, although it was also cooler than normal. Total precipitation in June in all soil zones was higher in 2014 than in the previous two years. It was lowest in SZ1 and highest in SZ3 (for SZ1, 2014: 114 mm, 2013: 87 mm, 2012: 106 mm; for SZ2, 2014: 125 mm, 2013: 91 mm, 2012: 88 mm; for SZ3, 2014: 157 mm, 2013: 109 mm, 2012: 104 mm). The average mean temperature was lower than in the previous two years (for SZ1, 2014: 13.8ºC, 2013: 15.6ºC, 2012: 16.2ºC; for SZ2, 2014: 14.6ºC, 2013: 16.1ºC, 2012: 16.8ºC; for SZ3, 2014: 14.1ºC; 2013: 15.5ºC, 2012: 15.6ºC). In July 2014 precipitation was generally lower than in the previous few years, while the mean temperature was somewhat higher than in 2013, but lower than in 2012. Precipitation and temperature data were based on five locations per soil zone (Environment Canada 2015).

Influence of soil zone, crop district, and fungicide on leaf spot severity

Overall, there was little difference in mean LS severity between common and durum wheat crops (10.2-9.5%). There was a difference in mean LS severity among soil zones for common and durum wheat combined, with crops in SZ1 having a greater LS severity (12.5%) than in the other soil zones, especially SZ2 (7.3% for SZ2, 10.8% for SZ3). Greater disease severity in SZ1 could be attributed, at least partly, to the higher proportion of durum wheat (71% in SZ1, 45% in SZ2, 5% in SZ3) which was the wheat species with the greatest LS levels in this soil zone (Figs. 1 and 2, Table 1). LS severity in the other soil zones was greater in common than in durum wheat. In addition, durum wheat in SZ1 had an overall greater LS severity than in the other soil zones, while LS severity in common wheat was highest in SZ3 despite the fact that 83% of crops in this soil zone had been sprayed with a fungicide, compared to 48% in SZ2, and 33% in SZ1. For durum wheat, 85% of crops in SZ2, and 65% in SZ1 had been sprayed with a fungicide. In all three soil zones, crops sprayed with a fungicide had a lower LS severity than those that had not been sprayed at any growth stage. (Reductions from spraying in LS severity were 31% to 40% for common wheat, and 41% to 54% for durum wheat). In previous years, for common and durum wheat crops combined, mean LS severity was greatest in SZ3 and lowest in SZ1 (Fernandez et al., 2012, 2013, 2014). Similarly, common wheat disease severity was greatest in SZ3 and lowest in SZ1, and for durum wheat it was greater in SZ2 than SZ1. Only the latter result for durum wheat does not agree with the observations in 2014.

When analyzed according to CD, common wheat grown in 1A/1B (south-east) and 5A/5B (east) had the greatest LS severity, while those in 3A/3B (south-west/south-central) had the lowest disease severity (Fig. 1, Table 1). For durum wheat, CDs 3A/3B, 4A/4B (south-west) and 8A/8B (north-east) had the greatest mean disease severities, while south-eastern CDs 1A/1B and 2A/2B and central CD 6A/6B had the lowest severities (Fig. 2, Table 1). Durum wheat had a greater disease severity than common wheat only in the south-west and south-central CDs (3A/3B and 4A/4B)

Influence of cultivar on leaf spot severity

For common wheat cultivars grown in five or more fields, Carberry had the greatest mean LS severity (12.0%), followed by CDC Utmost (11.0%), Lillian (9.1%), Shaw (8.2%) and Unity (7.1%). Within the durum wheat cultivars, Strongfield and CDC Verona had the greatest mean LS severity (10.9-11.3%), followed by Brigade (6.8%) and Transcend (4.1%).

Causal pathogens

As reported for previous years (Fernandez et al., 2012, 2013, 2014), for both common and durum wheat *Pyrenophora tritici-repentis* (tan spot) was the most prevalent and widespread LS pathogen (Table 1). This was followed in frequency and number of fields affected by the septoria leaf complex*,* among which *Stagonospora nodorum* and *Septoria tritici* were the most common. *Cochliobolus sativus* (spot blotch) was the least common LS pathogen based on the number of fields from which it was isolated. *Cochliobolus sativus* and *S. avenae* f.sp. *triticea* were among the least frequently isolated from affected crops. The lower presence of *C. sativus* in 2014 could be explained by lower temperatures in June 2014 than in the previous two years.

Septoria tritici was more frequently isolated from common than durum wheat (Table 1), which also concurs with observations made in previous years (Fernandez et al., 2012, 2013, 2014); however, *S. nodorum* was most frequent in durum than in common wheat. The greater presence of *C. sativus* in durum than in common wheat is also similar to observations made in previous years. Overall, in 2014 while this pathogen was isolated from 51% of common wheat crops, it was present in 91% of the durum wheat crops sampled.

For common wheat crops, *P. tritici-repentis* was most common in SZ1, while the septoria leaf complex and *C. sativus* were most common in SZ2 and SZ3 (Table 1). In most cases this is similar to observations from previous years (Fernandez et al., 2012, 2013, 2014). In durum wheat, *S. nodorum* was most common in SZ2 while *C. sativus* was most common in SZ1 (CDs 3A/3B and 7A/7B).

Influence of tillage on leaf spot severity and pathogen frequency

Overall, common wheat crops grown under zero-till had the lowest mean LS severity (Table 2), which agrees with observations from 2011 (Fernandez et al., 2012). *Pyrenophora tritici-repentis* was isolated at the highest mean frequency in fields under zero-till, and at the lowest frequency in fields under tradional-till. This is similar to observations made in 2012 (Fernandez et al., 2013). In contrast the septoria leaf complex was less frequent under zero-till than traditional-till, and *C. sativus* was least frequent under zero-till.

Influence of previous crop(s) on leaf spot severity and pathogen frequency

Common wheat crops grown after a pulse crop had the lowest mean LS severity, followed by those grown after an oilseed, summerfallow and a cereal (Table 3). The greatest mean percentage isolation of *S. nodorum* and *S. tritici* was observed after an oilseed crop which agrees with observations from 2012 and 2011 (Fernandez et al., 2012, 2013). The greatest mean percentage isolation of *C. sativus* was observed in wheat preceded by summerfallow. Based on the cropping sequence in the previous two years, it was observed that common wheat preceded by a noncereal crop in both years or a noncereal crop in 2013 and a cereal crop in 2012 had a lower LS severity (8.7%-8.9-%) than those preceded by a cereal in 2013 and a noncereal in 2012 (13.5%).

ACKNOWLEDGEMENTS:

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Fig. 1. Location of common wheat fields surveyed across SK in 2014, whether they were sprayed with a foliar fungicide, and their recorded leaf spot disease severity.

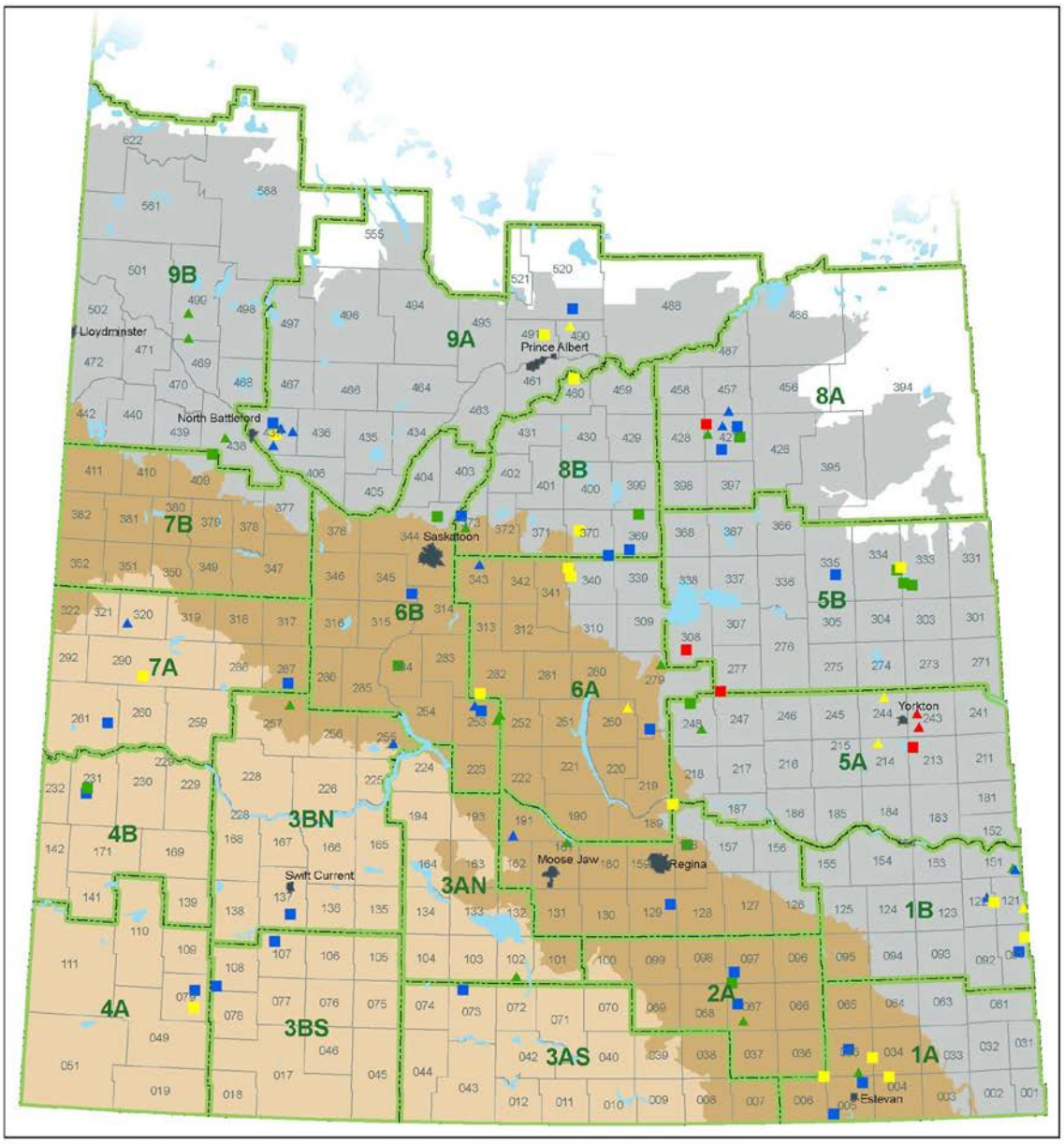

Fig. 2. Location of durum wheat fields surveyed across SK in 2014, whether they were sprayed with a foliar fungicide, and their recorded leaf spot disease severity.

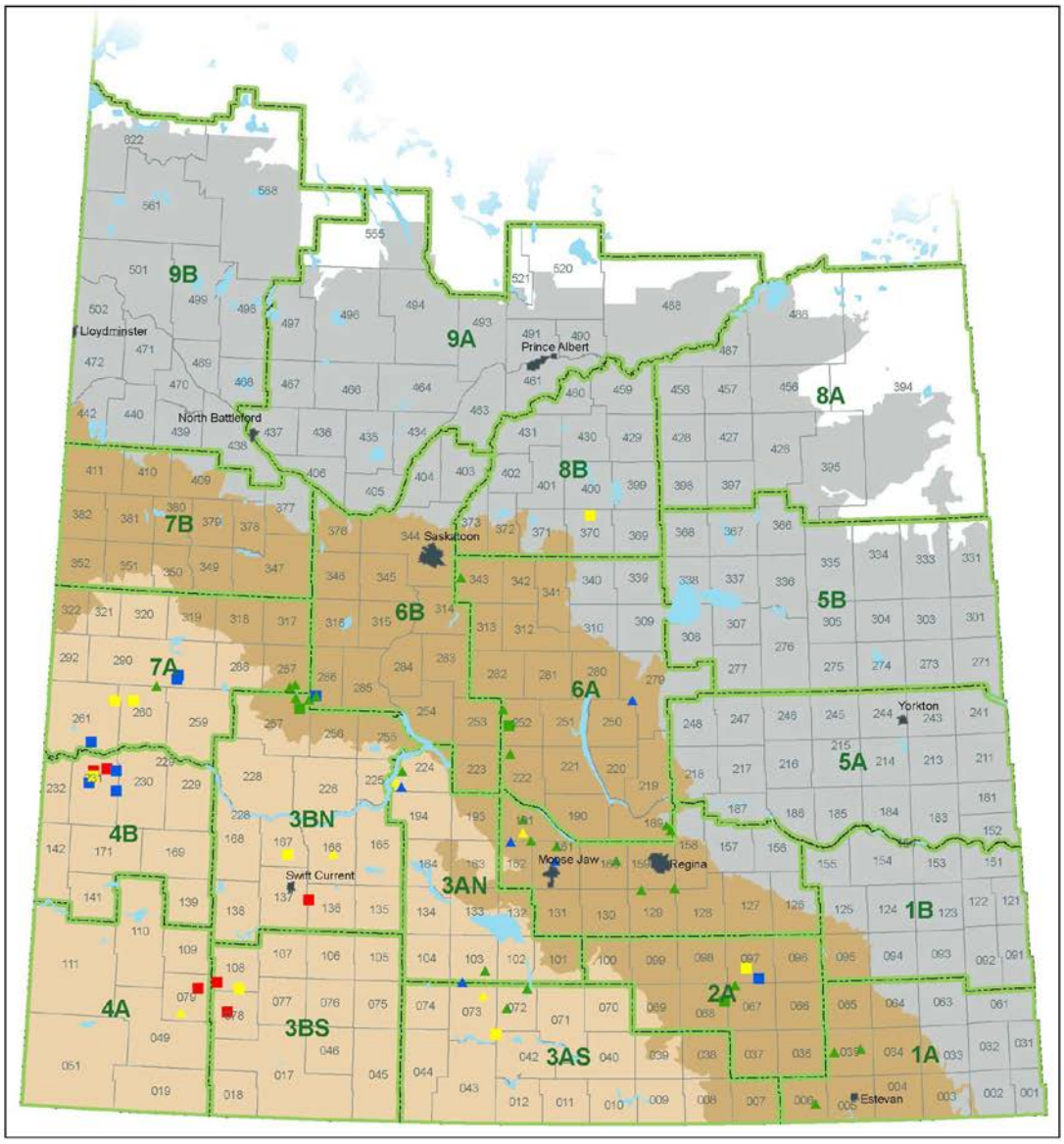

Table 1. Incidence and severity of leaf spotting diseases and percentage isolation of the most common leaf spotting pathogens in common and durum wheat crops, surveyed in Saskatchewan in 2014.

Soil Zone/Crop District	No crops[1]	Mean severity[2]	*Pyrenophora tritici-repentis*[3]	*Stagonospora nodorum*[3]	*Septoria tritici*[3]	*Stagonospora avenae* f.sp. *triticea*[3]	*Cochliobolus sativus*[3]
			%				
Soil Zone							
Common wheat:							
1 (Brown)	12	9.1	88.2/6	5.4/6	3.6/6	2.0/5	1.7 /4
2 (Dark Brown)	33	9.5	81.5/15	8.3/15	7.4/14	1.2/14	5.5/6
3 (Black/Gray)	49	11.0	80.8/16	8.8/15	6.5/14	2.2/14	5.8/9
Mean/total:	**94**	**10.2**	**82.3/37**	**7.8/36**	**6.4/34**	**1.8/33**	**4.8/19**
Durum wheat:							
1 (Brown)	29	14.2	74.6/9	10.5/9	0.1/1	2.7/4	15.1/8
2 (Dark Brown)	28	4.9	79.4/2	16.7/2	0.4/1	-	3.8/2
3 (Black/Gray)	3	6.8	-	-	-	-	-
Mean/total:	**60**	**9.5**	**75.5/11**	**11.7/11**	**0.3/2**	**2.7/4**	**12.8/10**
Crop District							
Common wheat:							
1A/1B	14	11.0	80.5/5	7.5/4	10.7/4	1.3/5	2.7/4
2A/2B	10	8.8	80.9/5	8.4/5	7.9/4	0.6/4	9.8/2
3A/3B	7	7.1	86.4/5	6.5/5	3.8/5	2.4/4	1.7/4
4A/4B	4	10.0	-	-	-	-	-
5A/5B	13	14.5	89.1/5	3.4/5	2.9/4	0.8/4	11.3/2
6A/6B	15	9.3	77.8/5	11.5/5	7.6/5	2.0/5	5.7/1
7A/7B	5	10.1	96.2/3	1.7/3	1.5/3	0.6/3	-/-
8A/8B	14	10.4	74.1/5	10.9/5	6.6/5	3.9/5	5.5/4
9A/9B	12	9.0	78.0/4	10.7/4	8.8/4	1.7/3	2.3/2
Durum wheat:							
1A/1B	3	3.7	-	-	-	-	-
2A/2B	13	6.3	79.4/2	16.7/2	0.4/1	-/-	3.8/2
3A/3B	18	11.6	63.2/3	10.9/3	0.1/1	1.4/1	25.7/3
4A/4B	8	17.9	87.3/3	11.5/3	-/-	0.9/2	0.9/2
6A/6B	9	4.5	-	-	-	-	-
7A/7B	8	8.8	73.5/3	9.2/3	-/-	7.7/1	13.9/3
8A/8B	1	14.0	-	-	-	-	-

[1] Number of crops sampled. All crops had leaf spot lesions on the flag leaves.
[2] Mean percentage flag leaf affected.
[3] Mean percentage fungal isolation/number of crops where the pathogen occurred. For each CD, the number of crops where *P. tritici-repentis* was isolated is the total number of crops plated for fungal identification and quantification.

Table 2. Incidence and severity of leaf spotting diseases and mean percentage isolation of the most common leaf spotting pathogens, by tillage method, for common wheat crops surveyed in Saskatchewan in 2014.

Previous Crop	**No crops**[1]	**Mean severity**[2]	***Pyrenophora tritici-repentis***[3]	***Stagonospora nodorum***[3]	***Septoria tritici***[3]	***Stagonospora avenae* f.sp. *triticea***[3]	***Cochliobolus sativus***[3]
			---------- % ----------				
Traditional	2	12	66/2	14/2	10/2	6/2	5/2
Minimum	9	14	75/9	11/9	8/9	1/8	7/6
Zero	16	9	85/16	8/15	5/15	2/13	3/7

[1]Number of crops sampled by tillage method category. All crops had leaf spot lesions on the flag leaves.
[2] Mean percentage flag leaf area infected estimated on leaf samples that were still green when sampled.
[3] Mean percentage fungal isolation/number of wheat crops where the pathogen occurred.

Table 3. Incidence and severity of leaf spotting diseases and mean percentage isolation of the most common leaf spotting pathogens, by previous crop, for common wheat crops surveyed in Saskatchewan in 2014.

Previous Crop	**No crops**[1]	**Mean severity**[2]	***Pyrenophora tritici-repentis***[3]	***Stagonospora nodorum***[3]	***Septoria tritici***[3]	***Stagonospora avenae* f.sp. *triticea***[3]	***Cochliobolus sativus***[3]
			---------- % ----------				
Cereal	10	13	82/10	8/10	5/9	3/9	6/6
Oilseed	11	10	78/11	12/11	8/10	1/11	4/4
Pulse	4	8	82/4	9/4	6/4	3/3	2/3
Fallow	3	12	82/3	3/3	5/3	1/3	14/2

[1]Number of crops sampled by previous crop category. All crops had leaf spot lesions on the flag leaves.
[2] Mean percentage flag leaf area infected estimated on leaf samples that were still green when sampled.
[3] Mean percentage fungal isolation/number of wheat crops where the pathogen occurred.

CROP / CULTURE: Wheat
LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
D. MacLean, G.S. Brar, J. Liu, J.T. Vera, J. Taylor and H.R Kutcher
Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
Telephone: (306) 966-4951; **Facsimile:** (306) 966-5015; **E-mail:** randy.kutcher@usask.ca

TITLE / TITRE: LEAF SPOT DISEASES OF WHEAT IN SASKATCHEWAN IN 2014

ABSTRACT: The incidence and severity of leaf spot diseases of wheat were assessed in 50 wheat crops in 14 crop districts across the province of Saskatchewan in 2014. Disease symptoms were apparent in every field surveyed, with disease severity varying greatly, from trace to light in 52% of crops and moderate to severe in 48%. *Pyrenophora tritici-repentis* was the principal causal agent isolated from diseased leaf tissue. Other leaf spot pathogens present included *Septoria tritici* and *Cochliobolus sativus*.

INTRODUCTION AND METHODS: Leaf spot diseases of wheat were assessed across 14 crop districts in Saskatchewan from early July to mid-August in 2014. When assessed, crops varied in maturity from the flag leaf to the soft dough growth stage. Disease severity ratings were taken on both the upper canopy, including the flag and penultimate leaf, and the lower canopy. The severity rating scale employed six categories, including: clean (no visible symptoms), trace (1-5%), light (6-15%), moderate (16-40%) and severe (41-100%) percentages of the flag and penultimate leaf area affected by leaf spots. This scale was originally developed by Tekauz et al. (2012). In each crop sampled a minimum of 10 leaves were collected and placed in paper bags to dry until they were analyzed to identify the pathogens present. These were determined by surface sterilizing 10 pieces of infected leaf tissue, one from each of the 10 leaves collected. The leaf tissue pieces were placed on moist filter paper in Petri dishes for 4 days to promote sporulation. The pathogens (and diseases they cause) were identified based on spore size, shape and colour, using standard taxonomic keys.

RESULTS AND COMMENTS: Growing conditions in Saskatchewan were wet to very wet in the spring and early summer of 2014 (Saskatchewan Ministry of Agriculture 2014). Warm weather in July and August, combined with high humidity contributed further to disease development. Temperatures were lower than normal in May and June, which delayed crop maturity and harvesting. However, warmer weather in September and October allowed for a successful harvest.

Pyrenophora tritici-repentis (tan spot), *Septoria tritici* (septoria leaf blotch), and *Cochliobolus sativus* (spot blotch) were the pathogens identified from the laboratory assessment of wheat leaf tissue. The frequency of isolation of each pathogen from leaf tissue samples varied among crop districts; overall the provincial mean for *P. tritici-repentis* was 56%, for *S. tritici* 29%, and for *C. sativus* 22% (Table 1).

Leaf spots were present in the canopies of all wheat crops sampled in 2014. The severity of leaf spots in the upper canopy was assessed as trace in 42% of crops, light in 10%, moderate in 32% and severe in 16% (Table 2). Previous studies in Saskatchewan have indicated up to a 20% yield increase from application of foliar fungicides to wheat crops that are susceptible moderate or severe upper canopy leaf spot damage (Kutcher et al. 2005, Kutcher et al. 2011).

REFERENCES:
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Tekauz, A., Kutcher, H.R., Gilbert, J., Beyenne, M., Stulzer, F., Ghazvini, H. and Hajipour, Z. 2012. Leaf spot diseases of Manitoba and Saskatchewan oat in 2011. Can. Plant Dis. Surv. 92:92-93. (www.phytopath.ca/publication/cpds)

Table 1. Isolation frequency (% of leaf pieces from which the pathogen was isolated) of leaf spot pathogens of wheat in Saskatchewan in 2014.

Crop District	Number of crops	*Pyrenophora tritici-repentis*	*Septoria tritici*	*Cochliobolus sativus*
2B	1	20*	0	90
3AN	4	63	33	12
3BN	7	39	45	29
4A	2	60	10	35
4B	4	67	65	8
5A	1	43	29	86
5B	4	53	8	0
6A	2	21	11	6
6B	9	60	35	21
7A	5	74	12	42
7B	3	79	10	16
8B	2	65	33	13
9A	2	42	17	6
9B	4	55	31	19
Average		**56**	**29**	**22**

*indicative of the relative amount of foliar damage observed

Table 2. Leaf spot disease severity in the upper canopy (flag and penultimate leaves) in Saskatchewan wheat crops in 2014.

Disease rating (severity)		**Number of crops (n=50)**	**Prevalence† (%)**
Clean	(0%)	0	0
Trace	(1-5%)	21	42
Light	(6-15%)	5	10
Moderate	(16-40%)	16	32
Severe	(41-100%)	8	16

†Prevalence – the number of crops in each severity category expressed as a proportion of the total number of crops surveyed

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

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
B. McCallum and E. Reimer.
Agriculture and Agri-Food Canada, Cereal Research Centre, 101 Route 100, Morden MB R6M 1Y5
Telephone: (204) 294-1837; **Facsimile:** (204) 822-7507; **E-mail:** brent.mccallum@agr.gc.ca

TITLE / TITRE: LEAF RUST AND STRIPE RUST OF WHEAT IN MANITOBA AND EASTERN SASKATCHEWAN IN 2014

ABSTRACT: Field surveys were conducted from June to September 2014 to assess the levels of wheat leaf rust and stripe rust. Wheat leaf rust was found at moderate levels in trap plots and disease nurseries later in the growing season. The epidemic started relatively late but higher levels were found in August and September. Stripe rust was found only at trace levels. Both rusts were widespread throughout Manitoba and eastern Saskatchewan.

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*) from June to September 2014.

RESULTS AND COMMENTS: The first reports of wheat leaf rust in Manitoba were in July, which is later than normal. Drought conditions in the USA mid-western states resulted in lower levels of infection in those regions and hence less inoculum arriving in Canada than in a typical year. Most commercial wheat crops in Manitoba and eastern Saskatchewan were treated with foliar fungicides which control leaf rust. In nontreated fields or plots epidemics reached moderate levels later in the season. At Indian Head, Saskatchewan, severity was relatively high on susceptible cultivars late in the season (September); as an example, 'AC Barrie' had 60% levels of leaf rust infection on flag leaves.

Stripe rust was found at only trace levels throughout the surveyed region. As with leaf rust, the drought in the USA mid-western states resulted in very low levels of stripe rust in those regions and therefore lower levels of inoculum blowing into Canada. Additionally, widespread foliar fungicide application controlled stripe rust in commercial fields.

CROP / CULTURE: Spring Wheat
LOCATION / REGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
H. Derksen and P. de Rocquigny
Crops Knowledge Centre, Manitoba Agriculture, Food and Rural Development, 65-3rd Avenue NE, Carman MB R0G 0J0
Telephone: (204) 745-5676; **Facsimile:** (204) 745-5690; **E-mail:** pamela.derocquigny@gov.mb.ca

TITLE / TITRE: FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN MANITOBA – 2014

ABSTRACT: Forty-seven spring wheat fields in Manitoba were surveyed to monitor the incidence and severity of Fusarium head blight (FHB). The mean FHB Index was 1.0%, lower than the 10-year average of 2.9%. There was little to no yield or quality loss due to FHB in spring wheat in Manitoba in 2014.

INTRODUCTION AND METHODS: Forty-seven spring wheat fields were surveyed between July 24 and August 31, 2014 across Manitoba to monitor the incidence and severity of FHB. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random. Instead, information on their location and the management practices used by producers was obtained from Farm Production Advisors with Manitoba Agriculture, Food and Rural Development (MAFRD).

Fusarium head blight in each field was assessed by non-destructive sampling of 100 plants when most crops were at growth stage ZGS 73 – 85. In each field, the percentage of infected spikes (disease incidence) and the mean spike proportion infected (SPI) were determined. The FHB Index (overall severity) was calculated as (% incidence x % SPI / 100).

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share report, red spring wheat was planted on 869,406 ha in 2014. In addition, there were 22,732 ha of pedigreed red spring wheat production insured.

'Carberry' was the predominant red spring wheat cultivar planted by Manitoba producers, occupying 35.1% of the total red spring wheat acreage. It was also the cultivar in 12 of the 47 fields sampled. 'Harvest' was the second most common cultivar grown, occupying 14.9% of the area, followed closely by 'Glenn' (12.1%). 'Harvest' and 'Glenn' were grown in 7 and 6 of the fields sampled, respectively. 'Carberry' was the predominant cultivar planted for pedigreed seed production (26.5%), followed by 'Cardale' (23.7%) and 'AAC Brandon' (22.0%). 'Cardale' was sampled in 6 surveyed fields, while 'AAC Brandon' was represented in only one field. 'Faller' was the predominant feed wheat grown in Manitoba in 2014, representing 47.0% of the 110,467 ha reported. 'Faller' was present in 6 of the 47 fields surveyed. Other cultivars represented in this survey included 'CDC Stanley', 'WR859CL', 'CDC Plentiful', 'CDC Utmost', 'AC Domain', and 'Muchmore'.

Information on fungicide use by producers indicated that 39 of the 47 fields surveyed were treated with a foliar application of either tebuconazole-, metconazole-, prothioconazole- or prothioconazole + tebuconazole-based products, for suppression of FHB.

Symptoms of FHB were observed in 35 of the 47 fields surveyed. The average % disease incidence was 5.9% (range 0 – 28.0%), SPI 16.8% (range 0 – 55.0%) and resulting average FHB Index 1.0% (range 0 – 7.4%). Table 1 further illustrates the average FHB Index in the general Central, Eastern/Interlake, Northwest and Southwest agricultural regions, and the number of fields surveyed per region.

The average 2014 FHB Index was lower than the 10-year (2003-2012) average of 2.9% (Table 2). No survey for FHB in spring wheat was done in 2013. Although favourable conditions for inoculum development and infection of the winter wheat crop existed in 2014, a transition to warmer, drier weather when spring wheat crops were at anthesis, combined with foliar fungicide application in the majority of fields surveyed, resulted in reduced FHB severity and little to no yield or quality loss in spring wheat in Manitoba in 2014.

REFERENCES:

Manitoba Agricultural Services Corporation (MASC). 2014. 2014 Variety Market Share Report.

Table 1. 2014 spring wheat FHB Index by Agricultural Region.

Region	FHB Index %	No. of Fields
Central	0.9	14
Eastern / Interlake	0.3	10
Southwest	2.7	13
Northwest	0.1	10
Provincial Average	**1.0**	**47**

Table 2. Average FHB Index (severity) in Manitoba spring wheat (2003 – 2012).

Year	FHB Index %
2003	1.6
2004	2.3
2005	6.4
2006	0.3
2007	7.2
2008	4.4
2009	1.6
2010	1.7
2011	2.1
2012	1.1
10-Year Average	**2.9**

CROP / CULTURE: Spring wheat
LOCATION / RÉGION: Central and 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 CENTRAL AND EASTERN ONTARIO IN 2014

ABSTRACT: Thirty-one spring wheat crops were surveyed in 2014 in central and eastern Ontario for the presence of diseases. Of the 12 diseases observed, stagonospora glume blotch, septoria/stagonospora leaf blotch, spot blotch and take-all were the most commonly found. Only slight to moderate levels of fusarium head blight were observed and *Fusarium graminearum* was identified as the predominant causal species.

INTRODUCTION AND METHODS: A survey for spring wheat diseases was conducted in central and eastern Ontario in the third week of July when plants were at the soft dough stage of development. Thirty-one crops were chosen at random in regions 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 diagnosis was based on visible symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe infection levels, respectively. Severity of ergot, loose smut, and take-all were based on the percent plants infected. Fusarium head blight (FHB) was rated for incidence (% infected spikes) and severity (% infected spikelets in affected spikes) based on approximately 200 spikes sampled at each of three random sites per field. A FHB Index [(% incidence x % severity)/100] was determined for each field; 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 30 infected spikes collected from each crop. The spikes were air-dried at room temperature and subsequently threshed. Thirty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCI for 60 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 with a 14-hour photoperiod provided by fluorescent and long wavelength ultraviolet lamps. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Twelve diseases or disease complexes were observed (Table 1). Stagonospora glume blotch (*Stagonospora nodorum*), septoria/stagonospora leaf blotch (normally associated with infection by *Septoria tritici* and *Stagonospora* spp.) and spot blotch (*Cochliobolus sativus*) were the most common, found respectively in 31, 31, and 30 surveyed fields at average severities of 2.5, 3.3, and 2.3. Severe levels of stagonospora glume blotch were not observed but were recorded for septoria/stagonospora leaf blotch and spot blotch in 4 and 3 crops, respectively. Yield reductions due to the three diseases were estimated to have averaged at least 5% in affected crops.

Bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*) and tan spot (*Pyrenophora tritici-repentis*) were found in 30 and 29 crops at average severities of 1.6 and 2.1, respectively. No severe levels of these diseases were observed and they likely caused little or no grain yield reductions. Other foliar diseases observed included leaf rust (*Puccinia triticina*), powdery mildew (*Erysiphe graminis* f.sp. *tritici*) and stem rust (*Puccinia graminis*). They were found in 12, 12 and 7 crops at average severities of 3.5, 2.3 and 2.9, respectively. Severe levels of leaf rust were tabulated in three crops and of powdery mildew and stem rust in one crop each. Yield reductions attributable to these diseases were likely <5% in affected crops.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago tritici*) and take-all root rot (*Gaeumannomyces graminis* var. *tritici*) were observed in 30, 30 and 31 crops at incidence levels of 0.9, 0.6 and 1.8%, respectively. These diseases likely resulted in minimum crop damage, except for one crop with 10% ergot and two crops with 10% take-all where damage would have been more substantial.

Fusarium head blight was observed in all fields at a mean FHB Index of 3.4% (range 0.04-16.0%) (Table 1). Severe FHB was not observed. The disease likely resulted in a very small loss of grain yield and quality in 2014. Six *Fusarium* species were isolated from putative fusarium-damaged kernels (Table 2). *Fusarium graminearum* predominated and occurred in all fields and on nearly 50% of kernels. *Fusarium avenaceum* and *F. poae* were less common and found in 52 and 45% of fields and on 5.2 and 4.9% of kernels, respectively. *Fusarium acuminatum, F. equiseti* and *F. sporotrichioides* were least common, occurring in 13-26% of fields and 0.6-1.5% of kernels.

The 12 diseases identified in spring wheat in Ontario in 2014 were the same as those recorded in 2013 (Xue and Chen 2014). Generally, incidence and severity were lower than in 2013, except for spot blotch, which was more severe in 2014. Average severity of leaf rust and powdery mildew in the crops also was higher in 2014, but, these diseases were observed in less than 50% of surveyed crops and did not likely result in substantial losses. Although found in all crops, FHB was considerably less severe than recorded in 2013, and would have caused minimal losses. Low rainfall in June and low July temperatures in Ontario, were likely responsible for a general decrease in disease severities in 2014.

REFERENCE:

Xue, A.G., and Chen, Y. 2014. Diseases of spring wheat in central and eastern Ontario in 2013. Can. Plant Dis. Surv. 94:150-151. (www.phytopath.ca/publication/cpds)

Table 1. Prevalence and severity of spring wheat diseases in central and eastern Ontario in 2014.

DISEASE	NO. CROPS AFFECTED (n=31)	DISEASE SEVERITY IN AFFECTED CROPS*	
		MEAN	RANGE
Bacterial blight	30	1.6	1.0-4.0
Leaf rust	12	3.5	1.0-9.0
Powdery mildew	12	2.3	0.5-7.0
Septoria glume blotch	31	2.5	1.0-5.0
Septoria/Stagonospora leaf blotch	31	3.3	1.0-7.0
Spot blotch	30	2.3	1.0-7.0
Stem rust	7	2.9	1.0-7.0
Tan spot	29	2.1	1.0-5.0
Ergot (%)	30	0.9	0.5-10.0
Loose smut (%)	30	0.6	0.5-2.5
Take-all (%)	31	1.8	0.5-10.0
Fusarium head blight**	31		
Incidence (%)		14.8	2.0-60.0
Severity (%)		18.2	2.0-50.0
Index (%)		3.4	0.04-16.0

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

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

Table 2. Prevalence of *Fusarium* species isolated from fusarium-damaged kernels of spring wheat in central and eastern Ontario in 2014.

***Fusarium* spp.**	**% AFFECTED FIELDS**	**% KERNELS**
Total *Fusarium*	100	62.3
F. acuminatum	13	0.6
F. avenaceum	52	5.2
F. equiseti	26	1.3
F. graminearum	100	49.4
F. poae	45	4.9
F. sporotrichioides	26	1.5

CROP / CULTURE: Winter Wheat
LOCATION / REGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
P. de Rocquigny and H. Derksen
Crops Knowledge Centre, Manitoba Agriculture, Food and Rural Development, 65-3rd Avenue NE, Carman MB R0G 0J0
Telephone: (204) 745-5676; **Facsimile:** (204) 745-5690; **E-mail:** pamela.derocquigny@gov.mb.ca

TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA – 2013

ABSTRACT: In 2013, 43 winter wheat fields in Manitoba were surveyed to monitor the incidence and severity of fusarium head blight (FHB). The mean FHB Index was 1.0%, one of the lower severity levels recorded in the past 10 years. Minimal losses due to FHB were expected.

INTRODUCTION AND METHODS: Forty-three winter wheat fields were surveyed between July 19 and August 7, 2013 across Manitoba to monitor the incidence and severity of FHB. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random. Instead, information on their location, and the management practices used by producers, was obtained from farm production advisors with Manitoba Agriculture, Food and Rural Development (MAFRD).

Fusarium head blight in each field was assessed by non-destructive sampling of 100 plants when most crops were at growth stages ZGS 73 – 85. In each field, the percentage of infected spikes (disease incidence) and the mean spike proportion infected (SPI) were determined. The FHB Index (overall severity) was calculated as (% incidence x % SPI / 100).

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's (MASC) Variety Market Share report, winter wheat was planted on 245,860 ha in the fall of 2012. In addition, there was 10,130 ha of pedigreed winter wheat production insured. However, poor germination in the fall due to dry conditions, followed by an extended winter and cool spring conditions, resulted in poor stand establishment. It is estimated one-third of the total winter wheat acres (approximately 80,000 ha) reported to MASC were terminated and reseeded to another crop type.

'CDC Falcon' once again was the predominant winter wheat cultivar planted by Manitoba producers, occupying 77% of the winter wheat area. It was also the cultivar in 24 of the 43 fields sampled. 'CDC Buteo' was the second most prevalent cultivar grown in Manitoba occupying 12.5% of the area; it was sampled in 4 fields. However, in the field survey, the second most common cultivar sampled (9 of the 43 fields) was 'Flourish'. Interestingly, 'Flourish' was the predominant cultivar planted for pedigreed seed production, occupying 63% of the pedigreed winter wheat area.

Information on fungicide use by producers indicated that 39 of the 43 fields surveyed were treated with foliar applications of either tebuconazole-, metconazole-, prothioconazole- or prothioconazole + tebuconazole-based products, for suppression of FHB.

Symptoms of FHB were observed in 39 of the 43 fields. The average % disease incidence was 5.6% (range 0 – 19.0%), SPI 14.4% (range 0 – 42.4%) and resulting average FHB Index 1.0% (range 0 – 4.2%). Table 1 further illustrates the average FHB Index in the Central, Eastern/Interlake, Southwest and Northwest general agricultural regions, and the number of fields surveyed per region.

The 2013 FHB Index was lower than the 10-year (2003-2012) average of 3.4% (see Table 2). While delayed maturity and favourable weather conditions in the 2013 growing season appeared suitable for inoculum development and subsequent infection, the low levels of FHB in Manitoba in 2011 and 2012 likely resulted in reduced carry-over of *Fusarium* in overwintered straw and stubble. Combined with foliar fungicide application in the majority of fields surveyed, this resulted in reduced FHB severity and little to no yield or quality loss in winter wheat in 2013.

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Tekauz, A., Stulzer, M., Beyene, M., Harris, A. and Le Ba, N. 2012. Fusarium head blight of winter wheat – Manitoba 2011. Can. Plant Dis. Surv. 92:111-112. (www.phytopath.ca/publication/cpds)

Table 1. 2013 winter wheat FHB index (severity) in Manitoba by agricultural region.

Region	FHB Index %	No. of Fields
Central	0.7	23
Eastern / Interlake	1.0	10
Southwest	1.1	6
Northwest	2.3	4
Provincial Average	**1.0**	**43**

Table 2. Average FHB Index (severity) in Manitoba winter wheat, 2003 – 2012.

Year	FHB Index %
2003	0.6
2004	1.3
2005	14.7
2006	0.3
2007	3.3
2008	0.3
2009	0.3
2010	11.8
2011	0.9
2012	0.2
10-Year Average	**3.4**

CROP / CULTURE: Winter Wheat
LOCATION / REGION: Manitoba

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
H. Derksen and P. de Rocquigny
Crops Knowledge Centre, Manitoba Agriculture, Food and Rural Development, 65-3rd Avenue NE, Carman MB R0G 0J0
Telephone: (204) 745-5676; **Facsimile:** (204) 745-5690; **E-mail:** pamela.derocquigny@gov.mb.ca

TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA – 2014

ABSTRACT: Thirty-nine winter wheat fields in Manitoba were surveyed in 2014 to monitor the incidence and severity of fusarium head blight (FHB). The mean FHB Index was 11.6%, more than three times greater than the 10-year average. Yield losses of 5 to 10% were estimated, and additional downgrading occurred due to presence of fusarium damaged kernels (FDK).

INTRODUCTION AND METHODS: Thirty-nine winter wheat fields were surveyed between July 17 and August 7, 2014 across Manitoba to monitor the incidence and severity of FHB. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random. Instead, information on their location and on the management practices used by producers was obtained from farm production advisors with Manitoba Agriculture, Food and Rural Development (MAFRD).

Fusarium head blight in each field was assessed by non-destructive sampling of 100 plants when most crops were at growth stage ZGS 73 – 85. In each field, the percentage of infected spikes (disease incidence) and the mean spike proportion infected (SPI) were determined. The FHB Index (overall severity) was calculated as (% incidence x % SPI / 100).

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share report, winter wheat was planted on 155,620 ha in the fall of 2013. In addition, there was 7900 has of pedigreed winter wheat production insured. However, it is estimated that over one third (approximately (58,000 ha) of the winter wheat acres were terminated and reseeded to another crop type due to adverse environmental conditions in winter and/or spring .

'Flourish' surpassed 'CDC Falcon' as the predominant winter wheat cultivar planted by Manitoba producers, occupying 55.4% of the winter wheat area. It was also the cultivar grown in 23 of the 39 fields sampled. 'CDC Falcon' was the second most common cultivar grown in Manitoba occupying 30.5% of the area; it was sampled in 11 fields. 'Flourish' was the predominant cultivar planted for pedigreed seed production (54.0%), followed by 'Emerson' (35.5%), a new cultivar with a resistant rating for FHB. 'Emerson' was sampled in 3 fields of the survey.

Information on fungicide use by producers indicated that crops in 36 of the 39 fields surveyed were treated with foliar applications of either tebuconazole-, metconazole-, prothioconazole- or prothioconazole + tebuconazole-based products, for suppression of FHB.

Symptoms of FHB were observed in all 39 fields surveyed. The average disease incidence was 32.9% (range 1.0 – 92.0%), SPI 33.8% (range 9.1 – 93.1%) and the resulting average FHB Index 11.6% (range 0.1 – 47.2%). Table 1 further illustrates the average FHB Index in the Central, Eastern/Interlake, and Southwest agricultural regions, and the number of fields surveyed per region. The Central region experienced the most severe levels of FHB. The Northwest agricultural region was not included in the 2014 winter wheat survey.

The 2014 FHB Index was more than three times greater than the 10-year (2004-2013) average of 3.4% (Table 2 and CPDS Vols. 85-94). Favourable conditions for inoculum development and subsequent infection of the crop, variable crop staging resulting in difficulty timing optimal fungicide application, and the large number of acres grown to cultivars rated susceptible (S) to FHB were all contributing factors to the higher levels of FHB measured in 2014.

REFERENCES:

de Rocquigny P. and Derksen, H. 2015. Fusarium head blight of winter wheat in Manitoba - 2013. Can. Plant Dis. Surv. 95 (this issue) (www.phytopath.ca/publication/cpds)

Manitoba Agricultural Services Corporation (MASC). 2014. 2014 Variety Market Share Report.

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Table 1. 2014 Winter Wheat FHB Index (severity) in Manitoba by Agricultural Region.

Region	FHB Index %	No. of Fields
Central	17.2	16
Eastern / Interlake	8.0	11
Southwest	7.6	12
Provincial Average	**11.6**	**39**

Table 2. Average FHB Index (severity) in Manitoba Winter Wheat, 2004 – 2013.

Year	FHB Index %
2004	1.3
2005	14.7
2006	0.3
2007	3.3
2008	0.3
2009	0.3
2010	11.9
2011	0.9
2012	0.2
2013	1.0
10-Year Average	**3.4**

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
L. Tamburic-Ilincic and P. Burlakoti
University of Guelph, Ridgetown Campus, Ridgetown ON N0P 2C0
Telephone: (519) 674-1500 x 63557; **Facsimile:** (519) 674-1600; **E-mail:** ltamburi@uoguelph.ca

TITLE / TITRE: 2014 SURVEY FOR *FUSARIUM GRAMINEARUM* 15-ADON AND 3-ADON CHEMOTYPES OF WINTER WHEAT IN EASTERN ONTARIO

ABSTRACT: Based on results from five winter wheat cultivars having different levels of resistance to fusarium head blight, grown at Ottawa, Ontario, the frequency of the *Fusarium graminearum* 3-ADON chemotype affecting the crop was much higher in 2014 than recorded previously from anywhere in the province.

INTRODUCTION AND METHODS: Grain samples from five winter wheat cultivars included in the '2014 Ontario Performance Trial' planted at Ottawa were selected at harvest to assess the percentage of *Fusarium*- infected kernels, the percentage of *F. graminearum* (as a % of the total *Fusarium*) and the relative frequency of *F. graminearum* 15-ADON and 3-ADON chemotypes. The cultivars chosen were '25R40' and 'Wentworth', classified as highly susceptible to fusarium head blight (FHB), 'Emmit' and 'Princeton, moderately susceptible, and, 'Ava', moderately resistant. One hundred and fifty kernels of each cultivar were surface-sterilized in 0.16% NaOCl (dilute commercial bleach) for three minutes, air dried, and plated on acidified potato dextrose agar. The kernels were incubated for seven days under a 12:12 hr light:dark cycle at room temperature. Subsequently, single spore cultures of *F. graminearum* were recovered and identified morphologically according to the methods described by Nelson *et al.* (1983) as well as molecular markers developed by Nicholson *et al.* (1998). Genomic DNA was extracted from 38 single spore isolates of *F. graminearum.* 15-ADON and 3-ADON chemotypes of the fungal strains were identified using PCR-based molecular markers (Starkey *et al*., 2007 and Ward *et al*., 2002).

RESULTS AND COMMENTS: The highest level of *Fusarium* infected kernels (41.3%) was found in cv. 'Princeton', while the highest level of *F. graminearum* (83.3% of the total *Fusarium*) was detected in cv '25R40' (Table 1). The highest proportion of the *F. graminearum* 15-ADON chemotype (100.0 %) was found in grain of cv. 'Wentworth', while the highest proportion of the 3-ADON chemotype (62.5%) was found in grain of cv. 'Princeton' (Table 2). Overall, the frequency of 3-ADON chemotypes (36.1%, n=38) from eastern Ontario was substantially higher than reported in past years from anywhere in Ontario. In those previous reports, 100%, 93% and 98% of isolates were of the 15-ADON chemotype in 2004, 2008 and 2011, respectively (Tamburic-Ilincic *et al*., 2006; Amarasinghe *et al*., 2009; Burlakoti *et al*., 2013).

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Table 1. *Fusarium* spp. (%) and *Fusarium graminearum* (% of total *Fusarium*) isolated from kernels of five winter wheat cultivars grown at Ottawa, Ontario, 2014.

Cultivar	***Fusarium* spp.**	***F. graminearum***
’25R40’	28.0	83.3
‘Wentworth ’	20.7	74.2
‘Emmit’	20.0	46.7
’Princeton’	41.3	38.7
’Ava’	20.7	38.7

Table 2. Relative proportion of *Fusarium graminearum* 15-ADON and 3-ADON chemotypes isolated from kernels of five winter wheat cultivars grown at Ottawa, Ontario, 2014.

Cultivar	***Fusarium graminearum* chemotype (%)**	
	15-ADON	**3-ADON**
‘25R40’	57.1	42.9
‘Wentworth’	100	0
‘Emmit’	62.5	37.5
‘Princeton’	37.5	62.5
‘Ava’	62.5	37.5
Mean	*63.9*	*36.1*

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Ontario

NAME AND AGENCY / NOM ET ÉTABLISSEMENT:
L. Tamburic-Ilincic
University of Guelph, Ridgetown Campus, Ridgetown ON N0P 2C0
Telephone: (519) 674-1500 x 63557; **Fascimile:** (519) 674-1600; **E-mail:** ltamburi@uoguelph.ca

TITLE / TITRE: 2014 SURVEY FOR LEAF DISEASES OF WINTER WHEAT IN ONTARIO

ABSTRACT: Powdery mildew, septoria leaf blotch and leaf rust levels were sampled in plots of soft red winter wheat grown at six locations in Ontario in 2014. Septoria leaf blotch was detected at all locations, mainly at moderate levels. Powdery mildew and leaf rust were recorded at three locations each, at low to moderate severity levels. Disease severities varied somewhat among locations and genotypes.

INTRODUCTION AND METHODS: A survey to document the relative levels of three leaf diseases, septoria leaf blotch (*Septoria tritici),* powdery mildew (*Blumeria graminis)* and leaf rust (*Puccinia triticina*), in soft red winter wheat was conducted in Ontario in 2014. Five genotypes, UGRC GL96, UGRC GL164, UGRC DH5-28, cv. 'Emmit', and cv.'Ava', planted at six locations, Ottawa, Palmerston, Elora, Nairn, Ridgetown and Woodslee were included. Entire leaves from four replicated plots at each location were rated for disease severity in mid-June using a scale of 0 to 9 where 0 = no disease and 9 = more than 90% of leaf tissue affected by characteristic symptoms.

RESULTS AND COMMENTS: Moderate levels of septoria leaf blotch were recorded at most locations, but with no symptoms observed in two genotypes at Palmerston (Table 1). UGRC GL164 soft red winter wheat had the lowest mean level of septoria leaf blotch.

Powdery mildew was only observed at Ottawa and Palmerston at 'moderate' levels and at Elora at a 'low' level; none was seen at the other three sites (Table 2). Genotype UGRC GL96 had the lowest mean level of powdery mildew.

A moderate level (4.4) of leaf rust was recorded at Elora only. Levels were low at Palmerston and Nairn, and nil at the other three sites (Table 3). Genotypes UGRC GL96 and UGRC GL164 showed the lowest mean amounts of leaf rust. A high level (7.0) of leaf rust, and the highest level of any foliar disease, was seen on cv 'Emmit' at Elora (Table 3).

Table 1. Septoria leaf blotch severity (0-9) in soft red winter wheat in Ontario in 2014.

	Genotype					
Location	UGRC GL96	UGRC GL164	UGRCDH5-28	'Emmit'	'Ava'	Mean (SD)
Ottawa	1.8	2.3	3.5	4.5	5.0	3.4 (1.4)
Palmerston	0.5	0.0	0.0	2.0	1.5	0.8 (0.9)
Elora	5.0	3.5	4.5	5.5	4.0	4.5 (0.8)
Nairn	4.3	2.5	3.5	3.5	3.5	3.5 (0.6)
Ridgetown	4.3	4.3	3.8	4.5	3.5	4.1 (0.4)
Woodslee	7.0	3.0	2.0	3.0	2.0	3.4 (2.0)
Mean (SD)	3.8 (2.3)	2.6 (1.5)	2.9 (1.6)	3.8 (1.3)	3.3 (1.3)	

Table 2. Powdery mildew severity (0-9) in soft red winter wheat in Ontario in 2014.

	Genotype					
Location	UGRC GL96	UGRC GL164	UGRCDH5-28	'Emmit'	'Ava'	Mean (SD)
Ottawa	2.3	3.0	2.3	5.0	5.0	3.5 (1.4)
Palmerston	3.0	3.5	4.0	4.0	4.0	3.7 (0.4)
Elora	0.0	2.5	3.0	0.0	0.0	1.1 (1.5)
Nairn	0.0	0.0	0.0	0.0	0.0	0.0 (0.0)
Ridgetown	0.0	0.0	0.0	0.0	0.0	0.0 (0.0)
Woodslee	0.0	0.0	0.0	0.0	0.0	0.0 (0.0)
Mean (SD)	0.9 (1.4)	1.5 (1.7)	1.6 (1.8)	1.5 (2.4)	1.5 (2.4)	

Table 3. Leaf rust severity (0-9) in soft red winter wheat in Ontario in 2014.

	Genotype					
Location	UGRC GL96	UGRC GL164	UGRCDH5-28	'Emmit'	'Ava'	Mean (SD)
Ottawa	0.0	0.0	0.0	0.0	0.0	0.0 (0.0)
Palmerston	0.5	0.8	2.0	4.0	2.5	2.0 (1.4)
Elora	2.5	2.0	5.0	7.0	5.5	4.4 (2.1)
Nairn	1.0	1.0	1.0	2.5	1.5	1.4 (0.7)
Ridgetown	0.0	0.0	0.0	0.0	0.0	0.0 (0.0)
Woodslee	0.0	0.0	0.0	0.0	0.0	0.0 (0.0)
Mean (SD)	0.7 (0.9)	0.6 (0.8)	1.3 (2.0)	2.3 (2.8)	1.6 (2.2)	

CROP / CULTURE: Winter wheat
LOCATION / RÉGION: Ontario

NAME AND AGENCY / NOM ET ÉTABLISSEMENT:
L. Tamburic-Ilincic
University of Guelph, Ridgetown Campus, Ridgetown ON N0P 2C0
Telephone: (519) 674-1500 x 63557; **Fascimile:** (519) 674-1600; **E-mail:** ltamburi@uoguelph.ca

TITLE / TITRE: 2014 SURVEY FOR FOLIAR DISEASES AND FUSARIUM HEAD BLIGHT IN WINTER WHEAT IN ONTARIO

ABSTRACT: A moderate level of septoria leaf blotch was observed in 2014 in soft red winter wheat lines grown at Ridgetown, Ontario. This was in contrast to very low levels of powdery mildew and fusarium head blight. The level of fusarium head blight was much lower than in 2013.

INTRODUCTION AND METHODS: The levels of two foliar diseases, septoria leaf blotch (*Septoria tritici)* and powdery mildew (*Blumeria graminis)*, and of fusarium head blight (FHB), were estimated in soft red winter wheat lines grown in experimental plots at Ridgetown, Ontario in 2014. Entire leaves from four replicated plots of each line were rated for foliar disease in mid-June using a severity scale from 0 to 9 where 0 = no disease and 9 = more than 90% of foliar tissues affected. Spikes (Heads) were rated for FHB incidence at the end of June on a whole plot basis, using a scale of 0 to 9 where 0 = no disease apparent and 9 = more than 90% of heads affected.

RESULTS AND COMMENTS: A moderate overall level of septoria leaf blotch was detected compared to very low levels of powdery mildew and FHB across all soft red winter wheat lines (Table 1). Several lines, e.g C6-97 and C6-71, had nil or very low levels of powdery mildew and the highest level was in C6-88. Lines differed little for severity of septoria leaf blotch. Fusarium head blight levels were low (range 1.0 – 2.3) and considerably lower than those reported in 2013 (Tamburic-Ilincic et al. 2014).

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Table 1. Powdery mildew, septoria leaf blotch and fusarium head blight (FHB) severity (0-9 scale) in experimental soft red winter wheat lines grown at Ridgetown, Ontario in 2014.

Line	Disease		
	Powdery Mildew	**Septoria Leaf Blotch**	**FHB**
C6-97	0.0	4.0	1.0
C6-88	4.8	4.3	2.0
C6-105	1.0	4.8	2.3
C6-96	1.0	4.3	1.0
C6-87	0.3	3.8	2.0
C6-71	0.0	3.8	1.0
Dh5-7	0.3	4.3	1.3
Dh5-15	0.3	4.0	1.0
Dh5-10	1.5	4.3	2.0
Dh5-12	1.8	4.3	1.0
Dh5-4	0.5	4.5	1.0
Dh5-14	0.8	4.0	1.0
Dh5-30	0.3	4.3	2.0
Mean (SD)	1.0 (1.2)	4.2 (0.3)	1.4 (0.5)

Oilseeds, Pulses, Forages and Special Crops/Oléagineux, Protéagineux, Plantes fourragères, et Cultures spéciales

CROP / CULTURE: Seed alfalfa (*Medicago sativa*)
LOCATION / RÉGION: Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
J. Reich and S. Chatterton
Agriculture and Agri-Food Canada, Lethbridge Research Centre, P.O. Box 3000, Lethbridge AB T1J 4B1
Telephone: (403) 317-2226; **Facsimile:** (403) 382-3156; **E-mail:** syama.chatterton@agr.gc.ca

TITLE / TITRE: BLOSSOM BLIGHT AND STEM ROT OF SEED ALFALFA IN SOUTHERN ALBERTA IN 2014

ABSTRACT: Blossom blight and stem rot surveys were conducted in nineteen seed alfalfa fields throughout the 2014 growing season to determine the seasonal cycles of the pathogens. Signs and symptoms were low in most fields surveyed, though several crops had moderate *Sclerotinia sclerotiorum* infection concentrated in areas where the canopy was dense and matted down. Plating florets and pods revealed high levels of infection in a few fields, suggesting that the crop may be at greater risk of disease in subsequent years.

INTRODUCTION AND METHODS: Nineteen seed alfalfa fields were surveyed for blossom blight and stem rot, caused by *Botrytis cinerea* and *Sclerotinia sclerotiorum*, every 2-3 weeks from July 3 to August 20, 2014. In each field, ten sites in a U-shaped pattern were surveyed. At each sampling date, twenty stems at each site were examined for blossom blight and stem rot, and incidence and severity ratings were assigned. Severity of blossom blight was rated on a scale of 1 (no infection) to 4 (75-100% florets infected), and severity of stem rot was rated on a scale of 1 (no infection) to 6 (>50% of plant infected). In addition, at each site 3-5 floral or pod racemes were collected for processing in the lab. Once the crops were harvested, a final sample of seed was collected from each site. Florets, pods, and seeds were surface sterilized and plated on semi-selective media for *B. cinerea* (1) and *S. sclerotiorum* (2). Incidence of infection by each pathogen was recorded after 5-7 days incubation.

RESULTS AND COMMENTS: Above average rainfall in both June and August may have contributed to the development of *S. sclerotiorum* signs (white, fluffy mold and sclerotia) observed in some fields during the survey period. Despite this moisture, overall incidence and severity of blossom blight remained low. Signs of blossom blight and stem rot caused by *S. sclerotiorum* in several fields were associated with areas of thick, matted-down canopy. Incidence and severity of both pathogens were low (<2% and <1.5 incidence and severity, respectively, for both pathogens**)** for each sampling period when averaged across all fields. A maximum *S. sclerotiorum* incidence of 55% and a maximum stem rot severity of 4 were observed at two sites in a single field; however the overall incidence and severity within the field remained low (10% and 1.8, respectively). Only trace levels of *B. cinerea* were observed in the field surveys.

From plated samples, *S. sclerotiorum* infected an average of 12% of florets at the beginning of July, and declined steadily throughout the season to 4% in pods at the end of August (Table 1). Conversely, *B. cinerea* infected an average of 5% of florets at the beginning of July to 9% at the beginning of August. In pods, infection increased from 2% at the end of July to 6% at the end of August. Levels of seed infection for both pathogens were low (≤1%). Some fields had much higher incidence of pathogens than the average, with between 30 and 40% incidence on plated samples.

ACKNOWLEDGEMENTS: We gratefully acknowledge the Alfalfa Seed Commission (Alberta) and the Alberta Crop Industry Development Fund (ACIDF) for financial support. We thank all the producers who cooperated with the field surveys. We also thank Ben Leyland for his help with collecting and processing the samples.

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Table 1: Mean incidence (percent) of blossom blight pathogens on floret, pod, and seed samples from nineteen seed alfalfa fields in southern Alberta in 2014.

	Florets		Pods		Seeds	
Date	Bc[a]	Ss[b]	Bc	Ss	Bc	Ss
Jul 3 – Jul 5	4.5	11.8	-[c]	-	-	-
Jul 21 – Jul 24	3.8	12.0	1.6	11.6	-	-
Aug 4 – Aug 6	9.7	7.8	6.4	8.5	-	-
Aug 18 – Aug 20	-	-	5.6	4.0	0.4	1.1

[a]Bc = *Botrytis cinerea*; [b]Ss = *Sclerotinia sclerotiorum*; [c] no plant samples were collected for the period specified.

CROP / CULTURE: Field bean (*Phaseolus vulgaris* L.)
LOCATION / RÉGION: Southern Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENTS:
S. Chatterton[1], R.S. Erickson[1], D.A. Burke[2], C.A. Pugh[2] and M.W. Harding[2].
[1]Agriculture and Agri-Food Canada, Lethbridge Research Centre, P. O. Box 3000, Lethbridge AB T1J 4B1
Telephone: (403) 317-2226; **Facsimile:** (403) 382-3156; **E-mail:** syama.chatterton@agr.gc.ca
[2]Crop Diversification Centre South, Alberta Agriculture and Rural Development, Brooks AB T1R 1E6

TITLE / TITRE: DRY BEAN DISEASES IN ALBERTA IN 2014

ABSTRACT: Dry edible bean is produced on 20,000 ha in southern Alberta each year. The main disease affecting production is white mould caused by *Sclerotinia sclerotiorum.* Bacterial blights caused by *Xanthomonas axonopodis* pv. *phaseoli, X. fuscans pv. fuscans, Pseudomonas syringae* pv. *phaseolicola,* and *P. syringae* pv. *syringae* are also common in Alberta but are not as damaging as white mould. Other diseases such as bacterial wilt (*Curtobacterium flaccumfaciens* pv. *flaccumfaciens*), and rust (*Uromyces appendiculatus*) are observed occasionally in a few fields, but have not caused widespread epidemics. A survey of commercial dry bean fields was performed in 2014 in southern Alberta. White mould was again the most common and damaging disease followed by bacterial blights, bacterial wilt and rust.

INTRODUCTION AND METHODS: High yielding, early maturing cultivars of dry edible bean (*Phaseolus vulgaris* L.) are grown in southern Alberta each year. It is an important pulse crop in the rotations of many producers and often provides a high economic return. However, white mould caused by *Sclerotinia sclerotiorum* is a major challenge to the dry bean industry. Other diseases such as bacterial blights can also be problematic in some years. Finally, diseases such as bacterial wilt and rust occur only occasionally. A survey was conducted in June, July and August, 2014 across southern Alberta to assess diseases in dry bean fields and their respective impacts on dry bean production.

Forty-five irrigated dry bean fields in southern Alberta were surveyed in 2014 on 23-24 June, 7-8 July and 5-6 August for bacterial blights (*Xanthomonas axonopodis* pv. *phaseoli, X. fuscans* pv. *fuscans, Pseudomonas syringae* pv. *phaseolicola* and *P. syringae* pv. *syringae*). Bacterial blight disease incidence was recorded as follows: 0 = healthy crop; 1 = less than 1% of the crop affected; 2 = 1% to 10% of the crop affected; 3 = 11% to 25% of the crop affected; 4 = 26% to 50% of the crop affected; 5 = more than 50% of the crop affected. The same 45 fields were surveyed for white mould (*S. sclerotiorum*) on 5-6 August. 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 a row (1). Disease prevalence was calculated as the percent fields showing disease symptoms. Disease incidences were calculated as the percentages of plants in a field with visible disease symptoms. Disease severities were estimated using a 0-4 scale where 0 = no symptoms; 1 = light infection; <25% plant canopy damaged by white mould; mostly small branches and occasional pods infected; normal pod filling observed; 2 = moderate infection; 25-50% canopy damaged; several small/large branches and pods infected and/or slight infection of the main stem; mostly normal pod filling observed; 3 = severe infection; 50-75% canopy damaged; many small/large branches and pods infected and/or moderate infection of the main stem observed; a few pods contain small seed; some plants may be dead; 4 = very severe infection; >75% canopy damaged; most small/large branches and many pods infected; severe infection of the main stem and poor pod filling observed; many plants dead. Twenty-one additional fields were surveyed for white mould on August 18, 2014. For these fields, white mould was assessed at three locations in each field in 2-m of two adjacent rows.

RESULTS AND COMMENTS: Plants with bacterial blight symptoms were found in nine of the 45 fields surveyed, with disease incidence ranging from trace where less than 1% of plants were affected to very high where 75% of plants were affected (Table 1). The severity of bacterial blights was generally light such that less than 10% of leaf area was affected. Identity of the pathogens was confirmed in laboratory tests.

In early August, white mould was found in11% of 45 fields at low disease incidences (Table 1). The survey was not repeated in those 45 fields later in the season when white mould incidence was at peak levels. However, 21 other dry bean fields were surveyed for white mould on August 18th and it was found in 81% of 21 fields with an overall incidence of 4.1% and overall severity of 0.11 (Table 2). The disease incidences ranged from 0 to 13% and severities ranged from 0 to 0.5.

Rust and bacterial wilt were confirmed in two and three fields, respectively. These fields were not part of the surveys, but were visited in response to calls from producers reporting unusual symptoms in affected fields. Occurrence of these diseases is noteworthy as rust is unusual in southern Alberta, and bacterial wilt occurs sporadically, but can cause devastating losses (2).

ACKNOWLEDGEMENTS
This survey was supported by Agriculture and Agri-Food Canada and the Government of Alberta. Thanks to Viterra's Alberta Bean Division for assistance, and to the producers for allowing access to their fields.

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Table 1. Bacterial blight incidences in 45 fields in southern Alberta in 2014.

Bacterial blight Incidence	Number of Fields
None (0%)	36
Trace (< 1%)	1
Low (1% to 10%)	3
Moderate (11% to 25%)	2
High (26% to 50%)	1
Very High (> 50%)	2

Table 2. Disease prevalence, incidence and severity of white mould in dry bean fields in southern Alberta in 2014.

Date(s)	No. crops	Disease Incidence		Disease Severity[2]	
Surveyed	affected	Mean[1]	Range	Mean[1]	Range
5-6 Aug, 2014	5/45 (11%)	2.5	0 – 10	0.1	0 – 0.1
18 Aug, 2014	17/21 (81%)	4.1	0 – 13	0.11	0 – 0.5

[1]Means are based on an average of all the crops surveyed.
[2]Disease severity was assessed using a 0-4 scale

CROP: Field bean
LOCATION: Manitoba

NAMES AND AGENCY:
Maria A. Henriquez[1], Debra L. McLaren[1], Robert L. Conner[2], Waldo C. Penner[2] and Teri J. Kerley[1]
[1]Agriculture and Agri-Food Canada Research Centre, 2701 Grand Valley Rd., Brandon MB R7A 5Y3
Telephone (204) 578-6599; **Facsimile** (204) 578-6524
E-mail: mariaantonia.henriquez@agr.gc.ca
[2]Agriculture and Agri-Food Canada Research Station, Unit 101, Route 100, Morden MB R6M 1Y5

TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2014

ABSTRACT: A total of 41 and 22 bean crops were surveyed for root and foliar diseases, respectively. Fusarium root rot was the most prevalent root disease and common bacterial blight the most common foliar disease throughout the province. Diseases of less importance included rhizoctonia root rot, white mould and halo blight. Anthracnose was not observed for the first time in many years.

METHODS: Crops of field bean in Manitoba were surveyed for root diseases at 41 different locations and for foliar diseases at 22 locations. The survey for root diseases was conducted in late July when most plants were at the early bloom stage. During the root disease survey the severity of halo blight (*Pseudomonas syringae* pv. *phaseolicola*) was also assessed. For foliar diseases, the survey was carried out on August 19, 20 and 26, 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 10 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). Fifteen symptomatic roots were collected from each of 11 crops for fungal isolation and identification. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006). Fifteen roots from each of the 41 crops surveyed were frozen for future PCR analysis of root rot pathogens. 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*), white mould (*Sclerotinia sclerotiorum*) and halo blight (*Pseudomonas syringae* pv. *phaseolicola*) severity were assessed as percentages of infected plant tissue.

RESULTS AND COMMENTS: The 2014 cropping season in Manitoba started with excessive spring moisture and cool conditions which delayed seeding in many areas (Manitoba Crop Report, 2014a). Later in the summer, warm, dry weather conditions prevailed. However symptoms of excess moisture and crop death continued to be noted across most regions of the province (Manitoba Crop Report, 2014b).

Root rot was observed in all 41 field bean crops surveyed, with severity ratings ranging from 2.1 to 7.2, with a mean of 4.6. Two root diseases were identified (Table 1). Fusarium root rot was detected in all of the 11 crops subsampled for root diseases. It has remained the most prevalent root disease of dry bean for several years (Conner et al. 2011; Henriquez et al. 2013; 2014). A number of *Fusarium* spp. including *F. redolens and F. acuminatum* were isolated from symptomatic root tissue. Crops from which *Fusarium* spp. were isolated had root rot severity ratings ranging from 4.2 to 7.2 with a mean of 5.7. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 1 of the 11 crops sub-sampled with a severity rating of 6.5. Pythium root rot was not detected in any of the crops surveyed. Thirty-two crops had average root rot severity ratings above 4 (i.e., symptoms were present on 50% of the root system and plants were stunted) and this would have had a detrimental effect on yield. Halo blight was detected in nine of the crops surveyed, with a mean disease severity of 29% infected plant tissue.

Two diseases were observed during the survey of foliar diseases (Table 2). Common bacterial blight was the most prevalent and symptoms were observed in 22 crops. The incidence of CBB ranged from 2.0 to 40.0% with a mean of 19.8%, while severity ranged from 0.3 to 3.7, with a mean of 2.3. Anthracnose was not detected for the first time in many years. Rust was not observed in any of the crops surveyed. White mould symptoms were detected in 7 crops with an incidence of tissue infection that ranged from 0.3% to 2.0%, and an average of 0.6%. This represents a considerable reduction from 2013 in the incidence and severity (Henriquez et al. 2014). Dry conditions and reduced canopy cover contributed to the lowered risk of white mould in bean fields in 2014.

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Table 1. Prevalence and severity of root diseases and halo blight in 11 and 41 crops, respectively of field bean in Manitoba in 2014.

Disease	No. crops affected	Disease Severity	
		Mean[1]	Range
Fusarium root rot[2]	11	5.7	4.2-7.2
Rhizoctonia root rot[2]	1	6.5	6.5
Halo blight (%)	9	29%	1-90%

[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).

Table 2. Prevalence and severity of foliar diseases in 22 crops of field bean in Manitoba in 2014.

Disease	No. crops affected	Disease Severity[1]		Incidence of Leaf Infection	
		Mean[2]	Range	Mean[2]	Range
Common bacterial blight[3]	22	2.3	0.3-3.7	19.8%	2.0-40.0%
Anthracnose (%)	0	0	0		
Rust (%)	0	0	0		
White mould (%)	7	0.6	0.3-2.0%		

[1]White mould severity was rated as the percentage of infected plant tissue; common bacterial blight severity was rated on a scale of 0 (no disease) to 5 (50-100% of leaf area diseased).
[2]Means are based on an average of the crops in which the diseases were observed.

CROP: Field bean
LOCATION: Western Ontario

NAMES AND AGENCY:
Maria A. Henriquez[1], Debra L. McLaren[1], Robert L. Conner[2], Brian E. Hall[3], Waldo C. Penner[2] and Teri J. Kerley[1]
[1]Agriculture and Agri-Food Canada Research Centre, 2701 Grand Valley Rd., Brandon MB R7A 5Y3
Telephone (204) 578-6599; **Facsimile** (204) 578-6524
E-mail: mariaantonia.henriquez@agr.gc.ca
[2]Agriculture and Agri-Food Canada Research Station, Unit 101, Route 100, Morden MB R6M 1Y5
[3]Ontario Ministry of Agriculture, Food and Rural Affairs, 581 Huron Street, Stratford, Ontario N5A 5T8.

TITLE: ROOT DISEASES OF FIELD BEAN IN WESTERN ONTARIO IN 2014

ABSTRACT: A total of 25 bean crops were surveyed for root diseases in the main production regions of western Ontario. Fusarium root rot was the most prevalent root disease and was observed in all crops surveyed.

METHODS: Crops of field bean in western Ontario were surveyed for root diseases at 25 different locations. The survey was conducted from late July to early August with crops ranging from the 4th trifoliolate to late vegetative growth stages. The crops were selected from the counties of Huron, Perth, Middlesex, Lambton, Norfolk, Brant and Oxford where most field bean crops are grown.

At least 10 plants were sampled at each of three random sites within each crop surveyed. Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant) (Conner et al. 2010). Fifteen roots with disease symptoms per crop were chosen for isolation of the causal organisms in the laboratory by plating onto potato dextrose agar. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006).

RESULTS AND COMMENTS: The 2014 cropping season in southern Ontario began with heavy rains in some areas. As the season progressed, dry soils and crusting caused additional plant stand issues. Heavy rainfall and frequently saturated soils in early July hampered growth of many plant stands and root rot was widespread in these areas (OMAFRA Field Crop Report, 2014). Many of the crops sampled had visible symptoms of root rot.

Three root diseases were observed (Table 1). Fusarium root rot (*Fusarium* spp.) was detected in all 25 crops surveyed for root diseases. Similar results have been reported elsewhere in Canada (Conner et al. 2011; Henriquez et al. 2013; 2014). Crops in which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 4.0 to 7.9 with a mean of 5.9. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 2 of the 25 crops surveyed with severity ratings of 5.4 to 5.6 and a mean of 5.5. Pythium root rot was detected in three of the crops surveyed, with severity ratings of 5.5 to 7.8 and a mean of 6.8. Twenty-four of 25 crops had an average root rot severity rating above 4 (i.e., symptoms were present on 50% of the root system and plants were stunted) and this would have had a detrimental effect on yield.

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Table 1. Prevalence and severity of root diseases in 25 crops of field bean in Ontario in 2014.

		Disease Severity	
Disease	**No. crops affected**	**Mean[1]**	**Range**
Fusarium root rot[2]	25	5.9	4.0-7.9
Rhizoctonia root rot[2]	2	5.5	5.4-5.6
Pythium root rot[2]	3	6.8	5.5-7.8
Other[2]	9	6.1	4.3-7.9

[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).

CROP: Canola
LOCATION: Alberta

NAMES AND AGENCIES:
S.E. Strelkov[1], V.P. Manolii[1], M.W. Harding[2], S.F. Hwang[3], W. Fei[1,4], S. Rong[1,4], D.A. Burke[2], C.A. Pugh[2], J.M. Nielsen[2], A. Barnes[5], C. Jacobsen[5], M. Vadnais[6], and D. Feindel[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]Alberta Agriculture and Rural Development, Crop Diversification Centre South, 301 Horticultural Station Road East, Brooks AB T1R 1E6
[3]Alberta Agriculture and Rural Development, Crop Diversification Centre North, 17507 Fort Road NW, Edmonton AB T5Y 6H3
[4]Anhui Academy of Agricultural Sciences, Hefei, 40 Nongkenan Road, Hefei, Anhui, 230031, China
[5]Canola Council of Canada, P.O. Box 96, Lethbridge AB T1J 3Y3
[6]Alberta Agriculture and Rural Development, 7000-113 Street, Edmonton AB T6H 5T6

TITLE: THE SPREAD OF CLUBROOT ON CANOLA IN ALBERTA IN 2014

ABSTRACT: A survey of 648 commercial canola crops in 36 counties and municipalities in Alberta revealed 104 new fields with clubroot infestation. Additional surveys by county and municipal personnel identified another 279 new records of pathogen infestation, for a total of 383 clubroot-infested fields in 2014. A grand total of 1868 clubroot-infested fields have been confirmed in Alberta since surveys began in 2003.

METHODS: A total of 648 commercial canola (*Brassica napus* L.) crops in 36 counties and municipalities in central and southern Alberta were surveyed for the prevalence and severity of clubroot disease caused by *Plasmodiophora brassicae* Woronin (Table 1). All of these crops were located in fields that had either not been previously surveyed for clubroot, or had been inspected in earlier surveys and found to be free of the pathogen. Of the fields surveyed in 2014, 35 were confirmed to have been planted to clubroot-resistant canola hybrids, while the others contained susceptible hybrids or hybrids of unknown resistance. All of the clubroot-resistant canola crops were located in central Alberta. Surveys were conducted mainly in September shortly after swathing. When inspecting fields, a 20 to 30 m^2 area was selected near the field entrance and a minimum of 50 canola roots were sampled randomly within that area. If no symptoms of clubroot were found, no more sampling was performed. If clubroot was found, then the crop was surveyed more extensively by examining the roots of all plants within a 1 m^2 area at each of 10 locations along the arms of a 'W' sampling pattern. This approach was taken because most clubroot infestations are known to be initiated at field entrances (1). The severity of root infection on each sampled plant was assessed on a scale of 0 to 3, adapted from Kuginuki et al. (2), where: 0 = no galling, 1 = a few small galls, 2 = moderate galling, and 3 = severe galling. The individual ratings were then used to calculate an index of disease (ID) for each crop, based on the method of Horiuchi and Hori (3) as modified by Strelkov et al. (4). Survey activities were coordinated with the agricultural fieldman in each municipality. Data from independent clubroot inspections conducted by county and municipal staff were also collected and combined with the data from the pan-Alberta clubroot survey, to provide the most complete assessment possible of clubroot infestation in the province. In the cases of Barrhead, Camrose, Lac Ste. Anne, Parkland, Stettler, St. Paul, Strathcona, and Westlock counties, which were not included as part of the provincial survey in 2014, the only information on clubroot prevalence this year came from the municipal inspections.

RESULTS AND COMMENTS: A total of 104 of the 648 canola crops inspected were found to have symptoms of clubroot, all of which represented new cases of pathogen infestation. Clubroot severity ranged from mild to severe, with an average ID <10% in 70 crops, 10% to 60% in 26 crops, and >60% in 8 crops. All cases of severe clubroot were found in susceptible hybrids or hybrids of unknown resistance. In the 35 canola crops confirmed to be resistant hybrids, symptoms of clubroot were generally absent (12 crops) or very mild (17 crops). Nonetheless, IDs ranging from 10.4% to 12.6% were observed on six

resistant cultivars, and the corresponding *P. brassicae* populations will be isolated and tested for any shifts in virulence patterns. A strain of *P. brassicae* able to overcome the resistance in most clubroot resistant canola hybrids was identified from collections made in a 2013 survey (S.E. Strelkov, unpublished data).

In addition to the 104 new records of clubroot infestation found in the Alberta-wide survey, another 279 new field infestations were identified in independent surveys conducted by municipal personnel in the counties of Athabasca, Barrhead, Camrose, Clearwater, Lacombe, Lac Ste. Anne, Lamont, Leduc, Parkland, Red Deer, Stettler, St. Paul, Strathcona, Westlock, Wetaskiwin, Woodlands, and Yellowhead (Table 1). Collectively, surveillance activities in 2014 revealed 383 new records of clubroot infestation in Alberta, representing the second largest single-year increase in the number of new reports of infestation since surveys commenced in 2003. While still concentrated mainly in central Alberta (Fig. 1), the clubroot outbreak continues to spread, with the first confirmed infestations in the Municipal District of Lesser Slave River and in the counties of Clearwater, Smoky Lake and St. Paul. The first case of clubroot within the Town of Stettler had been identified in 2013, but was reported too late for inclusion in the 2013 survey report (5). Despite its increasing prevalence in many regions, clubroot remains relatively uncommon in southern Alberta. Aside from three unconfirmed reports of the disease in the County of Newell, no other new clubroot infestations were identified south of the counties of Red Deer and Stettler in 2014.

What was believed to be the sole confirmed clubroot infestation in Cypress County, first identified in 2009 (6), has now been correctly located just within the city limits of Medicine Hat, and the map of clubroot distribution in Alberta has been updated accordingly (Fig. 1). This change does not affect the total number of documented clubroot infestations in the province, which now number 1868.

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Table 1. Distribution of *Plasmodiophora brassicae*-infested canola fields identified in Alberta in 2014

County or municipality	Number of fields assessed in provincial survey	Number of new cases of *P. brassicae*-infested fields	Additional new cases identified by county/municipal staff	Total new cases
Acadia	10	0	0	0
Athabasca	20	11	1	12
Barrhead	0	--	6	6
Beaver	27	1	0	1
Brazeau	21	0	0	0
City of Edmonton	2	2	0	2
Camrose	0	--	53	53
Cardston	15	0	0	0
Clearwater	20	1	1	2
Cypress	13	0	0	0
Flagstaff	29	8	0	8
Forty Mile	15	0	0	0
Lacombe	22	8	19	27
Lac Ste. Anne	0	--	5	5
Lamont	22	7	1	8
Leduc	31	15	68	83
Lethbridge	25	0	0	0
Lesser Slave River	26	1	0	1
Minburn	24	3	0	3
Newell*	15	0	0	0
Parkland	0	--	59	59
Pincher Creek	16	0	0	0
Ponoka	23	5	0	5
Rocky View	15	0	0	0
Red Deer	21	6	2	8
Smoky Lake	28	6	0	6
Special Area 2	7	0	0	0
Special Area 3	1	0	0	0
Special Area 4	7	0	0	0
Starland	15	0	0	0
Stettler	0	--	9	9
St. Paul	0	--	1	1
Strathcona	0	--	35	35
Sturgeon	31	18	0	18
Taber	16	0	0	0
Vermilion River	21	1	0	1
Vulcan	15	0	0	0
Warner	10	0	0	0
Westlock	0	--	8	8
Wainwright	24	0	0	0
Wetaskiwin	25	7	5	12
Wheatland	15	0	0	0
Woodlands	21	4	4	8
Yellowhead	0	--	2	2
TOTAL	648	104	279	383

*Three new fields with suspicious symptoms were reported from the County of Newell but have not been confirmed.

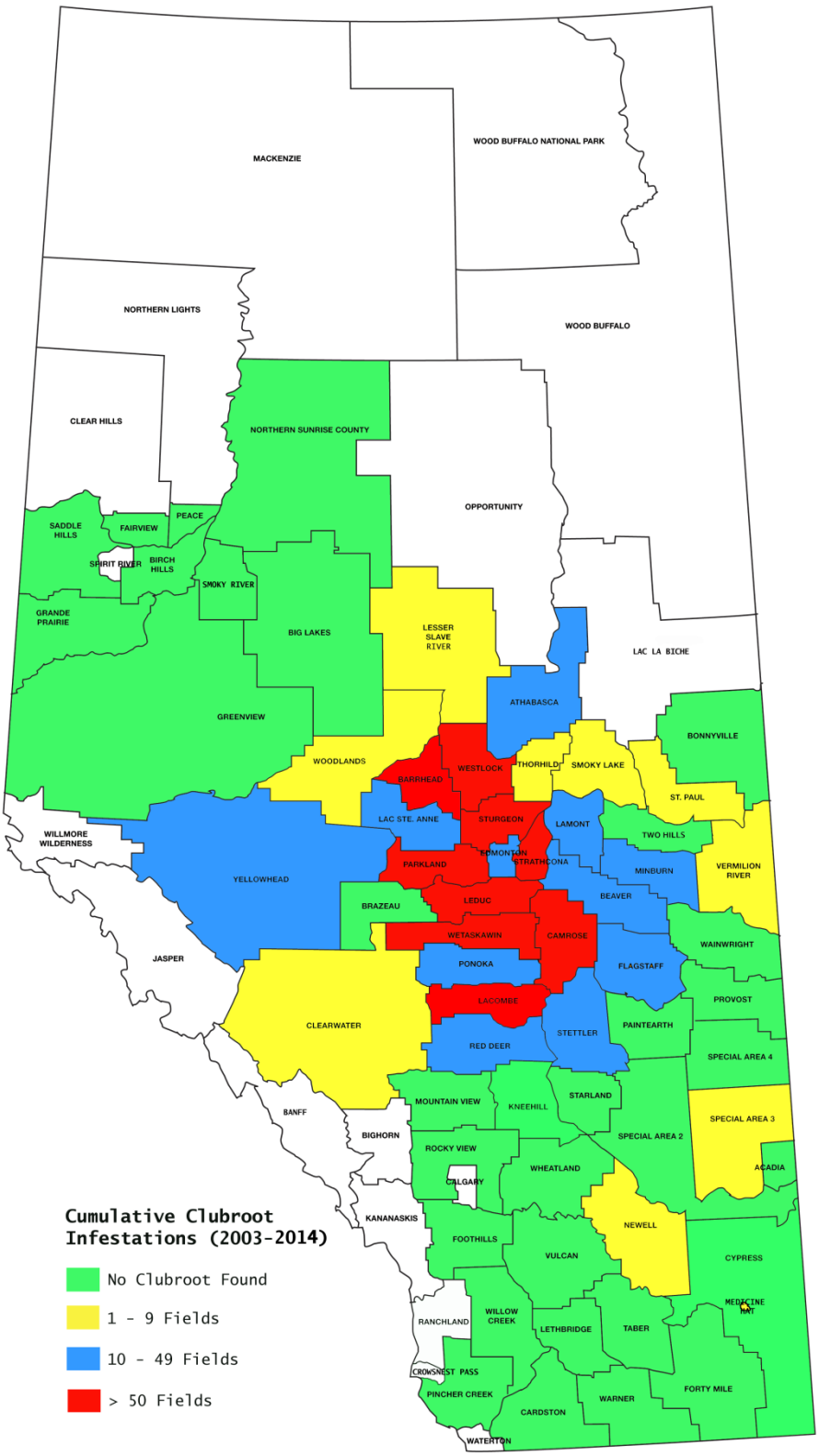

Figure 1. The occurrence of clubroot on canola in Alberta as of November 2014. Since clubroot surveys were initiated in 2003, the disease has been confirmed in a total of 1868 fields representing 28 counties and municipal districts in the province, as well as in rural areas of Edmonton, Medicine Hat, and the Town of Stettler. The presence of *Plasmodiophora brassicae* inoculum was detected in one field in Kneehill County in 2008 by means of PCR analysis and a bioassay, but no symptoms of clubroot on canola have been reported from that county since then.

CROP: Canola
LOCATION: Saskatchewan

NAMES AND AGENCIES:

F.L. Dokken-Bouchard[1], K. Anderson[2], K.A. Bassendowski[3], C. Bauche[4], M. Bergsveinson[2], S. Bruce[2], N. Cugnet[2], E. Campbell[1], S. Chant[1], L.E. Cowell[4], M. Crone[2], D. Cubbon[5], D. Dunlop[1], S. Friesen[1], L. Hicks[1], J. Ippolito[1], C. Jurke[6], C.L. Kirkham[3], J. Kowalski[1], S. Lemmerich[4], T. Lenard[6], J. Loverin[2], S. Kassir[1], G. Peng[3], R.G. Platford[7], S. Roberts[1], C. Scott[2], S. Senko[6], D.T. Stephens[1], K. Stonehouse1 and W. Ward[6].

[1] Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina, Saskatchewan S4S 0B1
Telephone: (306) 787-4671; **Facsimile:** (306) 787-0428; **E-mail:** faye.bouchard@gov.sk.ca
[2] Bayer CropScience, 295 Henderson Drive, Regina, Saskatchewan S4N 6C2
[3] Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, Saskatchewan S7N 0X2
[4] Crop Protection Services, Tisdale Saskatchewan, S0E 1T0
[5] Prairie Co-op, Meadow Lake, Saskatchewan, S9X 1A0
[6] Canola Council of Canada, 400 - 167 Lombard Avenue, Winnipeg, Manitoba R3B 0T6
[7] 103-20 Nova Vista Dr., Winnipeg, Manitoba R2N 1V4

TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2014

ABSTRACT: The annual survey in Saskatchewan covered 276 fields in six large regions. Sclerotinia stem rot was the most prevalent disease, occurring in 80% of the crops surveyed. The mean incidence in Saskatchewan was 14%, but ranged from 6% to 19% among regions. Blackleg symptoms in the lower stem (reported as basal cankers) were observed in 55% of crops surveyed. The mean incidence in Saskatchewan was 8%, with mean incidence ranging from 1% to 20% among regions.

METHODS: A total of 276 canola (*Brassica napus*) crops were surveyed between August 2 and October 7 in the major canola production regions of Saskatchewan. The number of fields per region was targeted to be approximately proportionate to the area of canola production in each of the regions and consisted of northwest (68 fields), northeast (38 fields), west-central (45 fields), east-central (39 fields), southwest (38 fields), and southeast (48 fields). Most of the fields 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 (*Candidatus* Phytoplasma asteris), foot rot (*Rhizoctonia* spp., *Fusarium* spp.), fusarium wilt (*F. oxysporum* f.sp. *conglutinans*), and clubroot (*Plasmodiophora brassicae*).

For sclerotinia stem rot, each plant was also rated for disease severity using the 0 to 5 scale in Table 1 (Kutcher and Wolf 2006). Every plant was also cut at the stem base and rated for blackleg. Plants were then scored for either basal stem cankers (if blackening was observed when stem was cut) or any other type of blackleg stem lesion (if external symptoms observed elsewhere on the plant). Plants with severe basal stem cankers were also rated for disease severity using the 0 to 5 scale in Table 2 (Western Canada Canola/Rapeseed Recommending Committee 2009). For alternaria black spot (*Alternaria brassicae*, *A. raphani*), percent severity of lesions on the pods of each plant was assessed using the scale of Conn and coworkers (Conn et al. 1990). When diseases were observed in the field, but not in the sample of 100 plants, they were recorded as “trace” and counted as 0.1% incidence. Mean disease incidence or severity values were calculated for each region across all crops surveyed (disease-free crops were included in the means). Mean incidence or severity values ≤ 0.1% were reported as “trace”. Soil samples (~1L) were collected from 98 fields and analyzed at the Saskatchewan Ministry of Agriculture Crop Protection Laboratory using the PCR-based diagnostic test of Cao et al. (2007) for the presence of *P. brassicae*.

RESULTS AND COMMENTS: Approximately 4.31 million ha (10.65 million acres) of canola were seeded in Saskatchewan in 2014 (Saskatchewan Ministry of Agriculture 2014). Moisture and cool weather delayed crop development in the spring and persisted into summer leading to further delays in some areas. Harvest was also delayed in 2014 due to weather conditions. In mid-September only about a quarter of the provincial crop had been harvested, which was about half of the five year average for that time. However, with warmer weather later in September and continuing into October, harvest continued, and by October 20, 97% of canola crops had been harvested.

Sclerotinia stem rot was observed in 80% of the canola crops surveyed. The average incidence across all crops surveyed in the province was 14% (18% incidence in infected crops). Average incidence was highest in the NW region (19%) and lowest in the SW region (6%). However, the average incidence based on infected crops only was highest in the SW region (22%) where only 28% of the crops had sclerotinia stem rot. The average severity of sclerotinia in canola crops in Saskatchewan was rated at 2.2. The average severity of sclerotinia across all crops surveyed was highest in the WC region (3.0) and lowest in the SW region (0.5). The overall mean incidence for the province was substantially higher in 2014 than 2013 (5%) (Miller et al. 2013). Results were comparable to previous seasons with normal to above-normal precipitation in most areas throughout late June and July (for example, 2010 at 20% and 2012 at 19%) (Miller et al 2014). See Table 3.

Blackleg reported as basal cankers (rated after cutting of lower stems) were present in 55% of Saskatchewan canola crops. The average incidence across all crops surveyed in the province was 8% (15% incidence in infected crops). Average incidence was highest in the NW region (20%), where 94% of the crops surveyed had blackleg symptoms. Average incidence was lowest in the NE region (1%), where only 11% of the crops surveyed had blackleg symptoms. The average severity of blackleg basal cankers in the province was 0.7. The average severity was highest in the NW region (1.2) and lowest in the NE region (0.2). The average severity of blackleg stem lesions in the province was 0.7 (Table 4).

Blackleg stem lesions were reported in only 29% of canola crops with an average incidence of 3%, which was lower than previous years (Miller et al 2014). The highest average incidence was in the west-central region (7.8%). The lowest incidence was in the NW region (0.4). Overall, mean incidence for the province was higher than the range experienced from 2000 to 2013 (1.5 to 5% total blackleg).

Alternaria occurred in 63% of canola crops surveyed in the province with 42% of crops identified as having pod spot. The highest incidence of pod spot was in the NW (37%) and NE regions (38%). The lowest incidence of pod spot was in the west-central region (4%).

Aster yellows was observed in 9% of canola crops with an average incidence of 0.4% (4% in infected crops) which was lower than in 2012 and 2013 when it was observed in 77% and 21% of canola crops, respectively with average incidences of 8% in 2012 and 0.6% in 2013 (3% in infected crops). The highest prevalence of aster yellows was in the NW (18%) and SE (17%) regions with an average incidence of 1.1% and 0.6%, respectively.

Other diseases were reported at low levels (see Table 5), but were not confirmed with diagnostic tests. Brown Girdling Root Rot was reported earlier in the season through the Canola Council of Canada Canola Watch newsletter; however it was reported at only trace levels in some fields in east-central, NW, and west-central regions. Downy mildew and grey stem were also reported at trace levels in some fields.

A total of 98 soil samples were collected for the Saskatchewan clubroot survey; conventional PCR tests were all negative for clubroot and further quantitative PCR tests were not conducted. Three suspicious plant samples submitted by disease survey volunteers tested negative for clubroot; symptoms were attributed to phenoxy damage or hybridization nodules.

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Table 1. Sclerotinia rating scale (Kutcher and Wolf 2006)

Disease Rating	Lesion Location	Symptoms
0	None	No symptoms
1	Pod	Infection of pods only
2	Upper plant parts	Lesion situated on main stem or branch(es) with potential to affect up to ¼ of seed formation and filling on plant
3		Lesion situated on main stem or on a number of branches with potential to affect up to ½ of seed formation and filling on plant
4		Lesion situated on main stem or on a number of branches with potential to affect up to ¾ of seed formation and filling on plant
5	Lower plant part	Main stem lesion with potential effects on seed formation and filling of entire plant

Table 2. Blackleg rating scale (**WCC/RRC 2009)**

Rating	Description
0	No disease visible in the cross section
1	Diseased tissue occupies up to 25% of cross-section
2	Diseased tissue occupies 26 to 50% of cross-section
3	Diseased tissue occupies 51 to 75% of cross-section
4	Diseased tissue occupies more than 75% of cross-section with little or no constriction of affected tissues
5	Diseased tissue occupies 100% of cross-section with significant constriction of affected tissues; tissue dry and brittle; plant dead

Table 3. Mean percent incidence and severity of sclerotinia stem rot of canola in Saskatchewan in 2014

REGION (NO. OF FIELDS)	Sclerotinia Stem Rot All Fields Surveyed		Sclerotinia Stem Rot Infected Fields Only	
	Incidence	Severity[1]	Incidence	Severity[1]
Northwest (68)	19	2.5	20	2.6
Northeast (38)	7	2.3	9	3.3
West-central (45)	18	3.0	19	3.2
East-central (39)	13	2.9	14	3.1
Southwest (38)	6	0.5	22	1.9
Southeast (48)	15	1.8	19	2.3
Overall mean (276)	14	2.2	18	2.8

[1] Sclerotinia rating as per Table 1.

Table 4. Mean percent incidence and severity of blackleg basal stem symptoms (recorded as cankers) in Saskatchewan in 2014

REGION[1] (NO. OF FIELDS)	Blackleg Basal Cankers All Fields Surveyed			Blackleg Basal Cankers Infected Fields Only	
	Prevalence	Incidence	Severity[1]	Incidence	Severity[1]
Northwest (68)	94	20	1.2	21	1.2
Northeast (38)	11	1	0.2	6	2.3
West-central (45)	56	4	0.7	8	1.2
East-central (39)	64	7	1.0	11	1.5
Southwest (38)	28	4	0.3	13	1.1
Southeast (48)	45	5	0.7	11	1.6
Overall mean (276)	55	8	0.7	15	1.3

[1] Blackleg rating as per Table 2.

Table 5. Mean percent incidence of alternaria pod spot, aster yellows, foot rot, and fusarium wilt of canola in Saskatchewan in 2014

REGION (NO. OF FIELDS)	Alternaria Black Spot	Aster Yellows	Foot Rot	Fusarium Wilt
Northwest (68)	38	1.1	0	0.7
Northeast (38)	37	0.03 (trace)	0.8	0.05 (trace)
West-central (45)	4	0	0.5	0
East-central (39)	13	0.08 (trace)	1.0	0.05 (trace)
Southwest (38)	25	0.03 (trace)	0	0.2
Southeast (48)	9	0.6	1.8	0.07 (trace)
Overall mean (276)	5.6	0.4	0.6	0.2

CROP: Canola
LOCATION: Manitoba

NAME AND AGENCY:
D.L. McLaren[1], R.G. Platford[2], A. Kubinec[3], H. Derksen[3], V.Bisht[3], E. Bargen[4], A. Brackenreed[5], T. Buss[6], D. Chomokovski[7], A. Farooq[8], D. Hausermann[1], T. Henderson[1], S. Jersak[9], E. Kaskiw[10], L. Kaskiw[11], I. Kristjanson[12], D. Lange[13], M. McCracken[14] and R. Picard[15]

[1]Agriculture and Agri-Food Canada, 2701 Grand Valley Rd., Brandon MB R7A 5Y3.
Telephone: (204) 578-6561; **Facsimile:** (204) 578-6524; **E-mail:** Debra.Mclaren@agr.gc.ca.
[2]103-20 Nova Vista Dr. Winnipeg, MB R2N 1V4. [3]Manitoba Agriculture, Food and Rural Development (MAFRD), Box 1149, Carman MB R0G 0J0. [4]MAFRD, Unit C-284 Reimer Ave., Steinbach MB R5G 0R5. [5]Canola Council of Canada, 400 – 167 Lombard Avenue, Winnipeg MB R3B 0T6. [6]MAFRD, Box 50, Beausejour MB R0E 0C0. [7]MAFRD, Box 70, Teulon, MB R0C 3B0. [8]MAFRD, Box 50, Hamiota, MB R0M 0T0. [9]MAFRD, Box 370, Swan River MB R0L 1Z0. [10]MAFRD. Box 1198. Minnedosa MB R0J 1E0. [11]MAFRD, Box 850, Souris, MB R0K 2C0. [12]MAFRD, Box 100, Morris, MB R0G 1K0. [13]MAFRD, Box 969, Altona MB R0G 0B0. [14]MAFRD, Box 2550, The Pas MB R9A 1M4. [15]MAFRD, Box 189, Somerset MB R0G 2L0.

TITLE: SURVEY OF CANOLA DISEASES IN MANITOBA IN 2014

ABSTRACT: A total of 150 canola crops were surveyed in Manitoba for the prevalence and incidence or severity of sclerotinia stem rot, blackleg, fusarium wilt, alternaria pod spot, aster yellows, foot rot and clubroot. Blackleg and sclerotinia stem rot were the most prevalent diseases throughout the province. Clubroot was not observed in any of the canola crops surveyed in 2014.

METHODS: A total of 150 canola crops were surveyed in the southwest (64), northwest (29), eastern/interlake (20) and central (37) regions of Manitoba from August 2 to September 23. All crops were *Brassica napus* and were surveyed before swathing while plants were between growth stages 5.1 and 5.5 (Harper and Berkenkamp,1975). 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. For soil collection, samples were obtained from each of the five points of the "W", or if the field entrance was identifiable, they were collected at 5 points near the entrance.

Canola crops were assessed for the prevalence (percent crops infested) and incidence (percent plants infected per crop) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), aster yellows (*Candidatus* Phytoplasma asteris), foot rot (*Fusarium* spp. and *Rhizoctonia* sp.), blackleg (*Leptosphaeria maculans*), fusarium wilt (*F. oxysporum* f. sp. *conglutinans*) and clubroot (*Plasmodiophora brassicae*). For sclerotinia stem rot, each plant was also scored based on the possible impact of infection on yield using a disease severity scale of 0 (no symptoms) to 5 (main stem lesion with potential effects on seed formation and filling of entire plant) (Kutcher and Wolf, 2006). Blackleg lesions that occurred on the upper portions of the stem were assessed separately from basal stem cankers. Stem lesions were recorded as present or absent. Basal stem cankers were scored using a disease severity scale of 0 to 5 based on area of diseased tissue in the stem cross-section where 0 = no diseased tissue visible in the cross section and 5 = diseased tissue occupying 100% of the cross section and plant dead (WCC/RRC, 2009). If present, clubroot symptoms were rated using a scale of 0 to 3 where 0 = no galling and 3 = severe galling (Kuginuki et al. 1999).The prevalence and percent severity (Conn et al. 1990) of alternaria pod spot (*Alternaria* spp.) were also determined. When diseases were observed in the crop, but not in the sample of 100 plants, they were recorded as "trace" for incidence and counted as 0.1%. Mean disease incidence or severity values were calculated for each region. In addition to the visual assessment of diseases, soil samples were collected from 95 canola fields in Manitoba for DNA analysis (Cao et al., 2007) to test for the presence of the clubroot pathogen.

RESULTS: A number of diseases were present in each of the four regions of Manitoba. However, no clubroot symptoms were observed in Manitoba canola crops in 2014. Further information on the monitoring and occurrence of clubroot in Manitoba in 2011, 2012 and 2013 is provided by Derksen et al. (2013) and Kubinec et al. (2014).

Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province in 2014 (Tables 1, 2 and 3). The prevalence of sclerotinia-infested crops ranged from a high of 90% in the eastern/interlake region to 49% in the central region with a provincial mean of 67%. Mean disease incidence averaged across all crops was 6% and ranged from 11.2% in the northwest region to 4.0% in the southwest region. For infested crops only, mean disease incidence was 9.6%. Throughout the province, mean severity of sclerotinia stem rot was low at <2.0. In 2013 and 2014, the prevalence and severity of sclerotinia were similar, but the incidence of the disease was lower in 2014.

Aster yellows was observed in 2% of canola crops in Manitoba with a mean disease incidence of 1% in these crops (Table 2). The prevalence of this disease was substantially less than in 2012, when aster yellows was observed in 95% of canola crops with a mean disease incidence of 9.9%. Contributing factors to the record high level of aster yellows in all regions of Manitoba in 2012 included drought in the midwestern United States, the early arrival of aster leafhoppers from the southern U.S. and the higher than normal percentage of infected individuals in the leafhopper population. In 2013 and 2014, aster leafhopper numbers were considerably lower than in 2012 due in part to the later occurrence of south winds that carry aster leafhoppers from the southern U.S.to Manitoba (Canola Council of Canada, 2013; Manitoba Agriculture, Food and Rural Development, 2014).

Blackleg basal cankers occurred in 93% of the crops surveyed in 2014 (Table 1), with prevalence ranging from 100% in the central region to 83% in the northwest region. The mean incidence of basal cankers averaged across all crops was 23.8%, while the incidence in infested crops was 25.7%. In 2013, basal cankers were found in 75% of crops surveyed with a mean disease incidence of 16.6% in infested crops. The severity of blackleg basal cankers was similar in both years, with mean ratings of 2 or less. A value of 2 indicates that 26-50% of the basal stem cross-section was diseased. The mean prevalence of blackleg stem lesions in 2014 was 71%. In previous years, 56%, 66%, 64%, 68% and 63% of crops had stem lesions in 2009, 2010, 2011, 2012 and 2013, respectively (McLaren et al. 2012; 2013; 2014). The mean incidence of blackleg stem lesions was 11.9% in infested crops and 8.4% in all crops.

The mean prevalence of alternaria pod spot in 2014 was 22%, 55%, 14% and 5% for crops surveyed in the central, eastern/interlake, northwest and southwest regions, respectively (Table 2). The severity of alternaria pod spot was low with means < 2% in all regions.

Fusarium wilt was observed in 1.6% of canola crops surveyed in Manitoba, with a mean incidence of 3.5% in these fields (Table 1). No fusarium wilt was observed in the central and southwest regions. Foot rot occurred in 11% of canola crops surveyed with a provincial mean incidence of <3%. The prevalence of crops reported to be affected by foot rot was highest in the central region (22%) and lowest in the southwest region (8%). No foot rot was observed in the eastern/interlake region. White rust (*Albugo candida*) has not been confirmed in any crop of *B. napus* since 2011 (McLaren et al. 2012).

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Table 1. Mean prevalence, incidence and severity of sclerotinia stem rot and blackleg in Manitoba in 2014.

Crop Region	Sclerotinia stem rot					Blackleg basal cankers					Blackleg stem lesions		
(No. of crops)	P[1]	Inc.[2]	Inc[3]	Sev.[2]	Sev.[3]	P[1]	DI[2]	DI[3]	Sev.[2]	Sev.[3]	P[1]	DI[2]	DI[3]
Central	49	6.9	14.2	1.0	2.0	100	38.8	38.8	1.6	1.6	73	19.7	27.0
(37)													
East./Inter.	90	6.5	7.2	1.5	1.6	95	24.3	25.6	1.3	1.4	70	4.8	6.9
(20)													
Northwest	83	11.2	13.5	1.9	2.3	83	17.6	21.3	1.1	1.3	59	3.1	5.4
(29)													
Southwest	64	4.0	6.2	1.9	2.9	92	17.9	19.4	1.6	1.8	75	5.4	7.3
(64)													
All regions	67	6.4	9.6	1.6	2.4	93	23.8	25.7	1.5	1.6	71	8.4	11.9
(150)													

[1] Prevalence (P). [2] Disease incidence (DI) or severity (Sev.) across all surveyed crops. [3] Disease incidence or severity in infested crops.

Table 2. Mean prevalence and incidence or severity of alternaria pod spot, aster yellows, fusarium wilt and foot rot in Manitoba in 2014.

Crop Region	Alternaria pod spot		Aster yellows			Fusarium wilt					Foot rot		
(No. of crops)	P	Sev.[3]	P	Inc.[2]	Inc.[3]	P[1]	Inc.[2]	Inc.[3]	Sev.[2]	Sev.[3]	P[1]	Inc.[2]	Inc.[3]
Central	22	0.8	0	0	0	0	0	0	0	0	22	8.7	40.4
(37)													
East./Inter.	55	0.6	0	0	0	5.0	0.2	4.0	1.1	2.0	0	0	0
(20)													
Northwest	14	0.1	0	0	0	3.5	0.1	3.0	1.1	3.7	10	0.8	7.7
(29)													
Southwest	5	0.1	4.7	0.1	1.0	0	0	0	0	0	8	0.5	6.4
(64)													
All regions	17	0.5	2.0	0.1	1.0	1.6	0.1	3.5	1.0	2.9	11	2.5	23.6
(150)													

[1] Prevalence (P). [2]Disease incidence (DI) and severity (Sev.) across all surveyed crops. [3]Disease incidence and severity in infested crops.

Table 3. Distribution of incidence (sclerotinia, blackleg, aster yellows, fusarium wilt and foot rot) and severity (alternaria pod spot) classes in 150 crops of *Brassica napus* in Manitoba in 2014.

	Percentage of crops with						
Incidence range	Sclerotinia stem rot	Blackleg basal cankers	Blackleg stem lesions	Aster yellows	Fusarium wilt	Foot rot	Alternaria pod spot
0%	33	7	29	98	99	90	85
1-5%	33	21	40	2	1	5	15
6-10%	15	13	11	0	0	1	0
11-20%	10	18	10	0	0	1	0
21-50%	9	22	5	0	0	1	0
>50%	0	19	5	0	0	2	0

CROP: Flax
LOCATION: Manitoba/Saskatchewan

NAMES AND AGENCY:
K. Y. Rashid[1], H.R. Kutcher[2], L.P. Cholango Martinez[2], F. Dokken-Bouchard[3], M.L. Desjardins[4] and S. Duguid[1],
[1] Agriculture and Agri-Food Canada, Research Station, 101, Route 100, Morden MB R6M 1Y5
Telephone: (204) 822-7520; **Facsimile**: (204) 822-7507; **E-mail**: Khalid.rashid@agr.gc.ca
[2] Crop Development Centre, University of Saskatchewan, 51 Campus Drive, College of Agriculture and Bioresources, Saskatoon SK S7N 5A8.
[3] Crops Branch, Saskatchewan Ministry of Agriculture, 3085 Albert Street, Regina SK S4S 0B1
[4] Manitoba Agriculture, Food and Rural Development, Crop Diagnostic Centre
201-545 University Crescent, Winnipeg MB R3T 5S6

TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2014

ABSTRACT: A survey of 75 flax crops revealed that pasmo was the most prevalent disease in 96% of crops surveyed in 2014, followed by fusarium wilt in 46%, alternaria blight in 43% and powdery mildew in 4%. A trace of aster yellows was observed in 4% of crops, much less than in 2012 and 2013. Rust and sclerotinia stem infections were absent.

METHODS: A total of 75 flax crops were surveyed in 2014: 30 in southern Manitoba and 45 in central, southern and eastern Saskatchewan. Thirty-six crops were surveyed in the last week of August and 39 in the first week of September. Crops surveyed were selected at random along pre-planned routes in the major areas of flax production. Each crop was sampled by two people walking ~100 m in opposite directions to each other following an "M" pattern. Diseases were identified by visible 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 (*Candidatus* Phytoplasma asteris) 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, 17 samples of flax plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Development (MAFRD) by agricultural representatives and growers.

RESULTS AND COMMENTS: Ninety percent of the flax crops surveyed in 2014 had excellent stands and the rest were good. Seventy-three percent of the crops surveyed were maturing earlier than usual. Seventy percent of the crops had excellent vigour and the rest were poor. Ninety percent of the crops were brown seed-colour flax, and the remainder yellow. The 2014 growing season in Manitoba started with normal growing conditions. However above normal precipitation in June resulted in wet soils along the Manitoba and Saskatchewan border which delayed seeding and crop maturity. Subsequently growing conditions were relatively normal but with a dry July-August in Manitoba and above normal precipitation in Saskatchewan which resulted in record low powdery mildew and aster yellows levels. Total flax area was ~550,000 ha, 80% in Saskatchewan according to Statistics Canada. The 2014 disease survey showed some minor differences between Manitoba and Saskatchewan; incidences of wilt/root rot and alternaria blight were higher in Manitoba than in Saskatchewan. Lodging was at record low levels with only a trace to 5% in 10% of flax crops in both provinces.

Pasmo, the most prevalent disease in 2014, was observed in 96% of the crops surveyed in both provinces especially those crops surveyed in September (Table 1). The prevalence and severity on stems were generally lower than in previous years (1, 2, 3, 4), due perhaps to dry conditions or normal temperatures in July-August. Pasmo severity was mostly at trace to 5% levels in crops surveyed in August but the disease developed further towards the end of the season and reached a severity of 20-40% stem area affected in 50% of flax crops (Table 1).

Root infections and fusarium wilt were observed in 63% of the flax crops in Manitoba and in 27% in Saskatchewan. Incidence was very low (trace to 5%) even in the most affected crops (Table 1). The

prevalence of these diseases in 2014 was similar to 2012 and 2013 but slightly higher than in 2011 (1, 2, 3, 4).

Powdery mildew was present in 4% of the crops surveyed in the two provinces in 2014 (Table 1); severity ranged from trace to 1% leaf area affected. Powdery mildew infections started very late, and severity was at a record low, lower than in 2012 and 2013, due to low humidity in July and August (1, 2, 3, 4).

Rust was not observed in any of the crops surveyed in 2014, nor in flax rust trap nurseries planted at Morden and Portage la Prairie in Manitoba, and at Indian Head and Saskatoon in Saskatchewan.

Aster yellows was present at trace levels in 10% of the crops surveyed in Manitoba but not in Saskatchewan in 2014. This was much less than in 2012 and 2013 (1, 2), but similar to previous years (3, 4). This disease is transmitted by the aster leafhopper *(Macrosteles quadrilineatus)* that usually migrates from the south during the growing season; the migration of this insect was very late in 2014. Alternaria blight was observed at trace levels in 50% of the crops in Manitoba and 37% of crops in Saskatchewan. No sclerotinia stem infections were evident in any of the crops surveyed in 2014.

Of the 17 samples submitted to the MAFRD Crop Diagnostic Centre in 2014, four were affected by pasmo, five by fusarium wilt / root rot, one by aster yellows, one by alternaria blight, one by sclerotinia stem rot, one by environmental injury, and four by herbicide injury.

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Table 1. Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 75 crops of flax in Manitoba and Saskatchewan in 2014

Fusarium Wilt				**Pasmo**				**Powdery Mildew**			
Disease Level		Crops		Disease Level		Crops		Disease Level		Crops	
Incid.[1]	Sever.[2]	No	%	Incid.[1]	Sever.[2]	No	%	Incid.[1]	Sever.[2]	No	%
0%	0%	44	59	0%	0%	3	4	0%	0%	72	96
1-5%	1-5%	31	41	1-10%	1-5%	21	28	1-10%	1-5%	3	4
5-20%	5-10%	0	0	10-30%	5-10%	13	17	10-30%	5-10%	0	0
2-40%	10-20%	0	0	30-60%	10-20%	20	27	30-60%	10-20%	0	0
>40%	10-40%	0	0	>60%	20-50%	18	24	>60%	20-50%	0	0

[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 leaf area affected by powdery mildew.

CROP / CULTURE: Field pea (*Pisum sativum* L.)
LOCATION / RÉGION: Alberta

NAMES AND AGENCIES / NOMS ET ÉTABLISSMENTS:
S. Chatterton[1], M. Harding[2], R. Bowness[3], S. Strydhorst[4], C. Cleland[1], Q. Storozynsky[1], T. Dubitz[3], J. Nielsen[2] and M. Olson[5]
[1]Agriculture and Agri-Food Canada, Lethbridge Research Centre, P. O. Box 3000, Lethbridge AB T1J 4B1
Telephone: (403) 317-2226; **Facsimile:** (403) 382-3156; **E-mail:** Syama.Chatterton@agr.gc.ca
[2]Crop Diversification Centre South, Alberta Agriculture and Rural Development, Brooks AB T1R 1E6
[3]6000 C&E Trail, Alberta Agriculture and Rural Development, Lacombe, AB T4L 1W1
[4] 2nd Floor, 6203-49 Street, Alberta Agriculture and Rural Development, Barrhead AB T7N 1A4
[5]106, 4707-44 Avenue, Alberta Agriculture and Rural Development, Stony Plain AB T7Z 1N4

TITLE / TITRE: SURVEY OF ROOT ROT IN ALBERTA FIELD PEA IN 2014

ABSTRACT: A total of 170 field pea crops were surveyed in Alberta for root rot and mycosphaerella blight. Fusarium root rot and mycosphaerella blight were present in all regions, and in 100% and 90% respectively of fields surveyed. Roots with symptoms of aphanomyces root rot were observed in southern Alberta, but confirmation of the pathogen with a PCR test is ongoing. Root rot incidence and severity were highest in east-central Alberta, and lowest in northern Alberta.

INTRODUCTION AND METHODS: Field pea is the pulse crop with the largest acreage in Alberta, with 510,000 ha (1.2 million acres) harvested in 2014 (1). Since 2006, root rots caused by *Fusarium* spp. have become a severe problem for many Alberta pea producers and a great need for further investigation of the problem has been noted (2,3). The destructive root rot pathogen *Aphanomyces euteiches* was reported to be present in Alberta pea fields in 2013 (4). To assess the prevalence, incidence and severity of root rot in *Pisum sativum* in Alberta, 170 pea fields were surveyed at flowering in July 2014 for above- and below-ground symptoms. Representative samples were collected from each field to allow the causal agents of disease to be isolated and identified. Approximately 50% of crops surveyed were randomly chosen, whereas the other 50% were targeted, in that pea producers with root rot problems responded to a call posted by the Alberta Pulse Growers on their website and on Twitter.

Sixteen fields were surveyed in northern Alberta (north of Hwy 16), 50 in east-central Alberta (east of Hwy. 36 between Hwy 1 and Hwy 16), 50 in southern Alberta (south of Hwy. 1) and 54 in west-central Alberta (west of Hwy. 36 between Hwy 1 and Hwy 16). These regions represent the primary field pea growing areas in Alberta. Crops were evaluated at 10 sites per field along a U-shaped pattern, with a minimum of 20 m between sites. To assess mycosphaerella blight, each site was assigned a score based on spread of mycosphaerella blight in the lower (=1), mid (=2) and upper (=3) canopy. To assess root rot, roots from 5-10 plants were dug up at each of the 10 sampling sites per field, bagged and stored at 4^{o}C until processing. Roots were washed under running tap water for 10 min, and individual roots were assigned a visual rating for disease severity (from 1=healthy up to 7=dead) (5). Roots with a severity rating of 5, 6 or 7 were retained for pathogen isolation. For pathogen isolations, the tap root was cut into 1-cm pieces, surface sterilized with 1.0% NaOCl solution for 1 min and roots pieces were plated onto acidified potato dextrose agar (APDA) and pentachloronitrobenzene peptone agar (PPA) (6). *Fusarium* cultures isolated on APDA are currently being identified using cultural morphology characteristics and PCR with species-specific primers.

RESULTS AND DISCUSSION: Southern Alberta received above-normal levels (150-200%) of precipitation in June. Most regions in central Alberta received normal to slightly above normal precipitation, while northern Alberta received below normal levels of precipitation (7). In July, precipitation was normal or below normal for most pea-growing areas of central and southern Alberta, and below normal in northern Alberta. Field pea crops produced average yields estimated at 2800 kg/ha (39 - 49 bushels/acre) (1, 8).

Root rot symptoms were found in all of the crops surveyed. Disease incidences ranged from 30 to 100%, with means of root rot incidence and severity of 88% and 3.0, respectively (Table 1). In east-central

Alberta, 91% of sample sites had root rot, and 89% of roots showed root rot symptoms. The mean severity was highest in this region at 4.3, and 17% of roots had a rating of 7. Particularly, roots from most fields surveyed in Kneehill and Starland counties in this region showed complete decay; producers indicated that these crops had significantly reduced yields, and that some crops were not worth harvesting. In west-central Alberta, root rot was found at 86% of sites, and in 64% of roots, with a mean severity of 3.2. In southern Alberta, a mean root rot incidence of 87% was observed, 73% of roots had root rot and the mean severity was 2.9. Disease incidence and severity were lowest in northern Alberta where a mean root rot incidence of 88% was observed and 42% of roots had root rot with a mean disease severity of 1.6.

All crops in eastern and southern Alberta had symptoms of mycosphaerella blight, with mean disease scores of 1.3 and 1.0, respectively; indicating that at the time of survey mycosphaerella blight was primarily present in the lower canopy in southern Alberta, but had moved into the mid canopy in some sites in eastern Alberta (Table 2). In western Alberta, mycosphaerella blight was observed in 92% of crops, with a mean score of 1.2. Northern Alberta had the lowest incidence of mycosphaerella blight, with 25% of crops showing symptoms, and a mean disease score of 0.7.

Fusarium spp. were the predominant fungi isolated from roots. *Rhizoctonia solani* and *Pythium* spp. were also isolated, but at much lower frequencies. Identification of *Fusarium* spp. from cultures and directly from infected roots is on-going using species-specific PCR primers. To date, *F. avenaceum, F. solani* f. sp. *pisi*, *F. redolens, F. oxysporum, and F. acuminatum* have been identified in root samples collected from crops throughout Alberta. *Aphanomyces euteiches* has been confirmed using PCR assays (9) from 5 out of 17 fields in southern Alberta screened to date, but screening of all fields is not yet complete. The high incidence and severity of root rots found in Alberta, and particularly in east central Alberta, substantiates the concern that producers have expressed in recent years regarding root rot of field pea, and indicates that further investigation into causal agents and control strategies are warranted.

ACKNOWLEDGEMENTS: Funding for this project is provided by the Alberta Crop Industry Development Fund and the Alberta Pulse Growers Commission. We thank all producers that co-operated with surveillance efforts and field sampling. We would like to thank Carol Mueller, Ahmad Esmaeili Taheri, Samira Safarieskandari, and Danielle Collyer for technical assistance. The assistance provided by Emily Flock, Suzanne Spearin, Chelsea Jager, Sydney Vos, Leanne Kruger and Don Pittman is also gratefully acknowledged.

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Table 1: Root rot prevalence, incidence and severity in 170 field pea crops in Alberta in 2014.

	Root rot prevalence (%)	Root rot incidence (%)	% roots with symptoms	Severity (1-7)	Severity Range
Northern AB	100	88	42	1.6	1.0 – 4.4
East-central AB	100	91	89	4.3	1.0 – 7.0
Southern AB	100	87	73	2.9	1.0 – 7.0
West-central AB	100	86	64	3.2	1.0 – 7.0
Total	100	88[1]	67[2]	3.0[3]	1.0 – 7.0

[1] standard error of the mean for root rot incidence = 1.60
[2] standard error of the mean for % root rot symptoms = 1.52
[3] standard error of the mean for disease severity = 0.08

Table 2: Mycosphaerella blight prevalence, incidence and mean disease score in 170 field pea crops in Alberta in 2014.

	MB prevalence (%)	MB incidence (%)	Mean disease score[1]
Northern AB	25	15	0.7
East-central AB	100	100	1.3
Southern AB	100	97	1.0
West-central AB	92	91	1.2
Total	80	75	1.05

[1]Only crops positive for mycosphaerella blight are included in disease score calculation; 0=not present, 1, 2, and 3 = low, mid and upper canopy, respectively

CROP: Field pea
LOCATION: Manitoba

NAMES AND AGENCIES:
D.L. McLaren[1], D.J. Hausermann[1], M.A. Henriquez[1], K.F. Chang[2] and T.J. Kerley[1]
[1] Agriculture and Agri-Food Canada (AAFC) Research Centre, 2701 Grand Valley Road, Brandon, Manitoba R7A 5Y3
Telephone: (204) 578-6561; **Facsimile:** (204) 578-6524; **E-mail:** debra.mclaren@agr.gc.ca
[2] Alberta Agriculture and Rural Development, Crop Diversification Centre-North, 17507 Fort Road N.W., Edmonton, Alberta T5Y 6H3

TITLE: FIELD PEA DISEASES IN MANITOBA IN 2014

ABSTRACT: A total of 34 and 33 pea crops were surveyed in Manitoba for root and foliar diseases, respectively. Fusarium root rot was the most prevalent root disease and mycosphaerella blight was the most widespread foliar disease throughout the province. Diseases less frequently observed included sclerotinia stem rot, anthracnose and downy mildew.

METHODS: Field pea crops were surveyed for root and foliar diseases at 34 and 33 different locations, respectively, in Manitoba. The crops surveyed were randomly chosen from regions in south-central and southwest Manitoba, where field pea is commonly grown. The area seeded to field pea in Manitoba increased by over 50% from 2011 to 2012, with growers attempting to maximize the planting area and return to pre-flood levels (McLaren et al. 2013). In 2012, 2013 and 2014, the areas seeded to field pea were approximately 22,000, 20,000 and 22,000 ha, respectively (Manitoba Pulse Growers Association 2014).

The survey of root diseases was conducted during mid- to late July when most plants were at the early to late flowering stages. 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). To confirm the visual disease identification, 15 symptomatic roots were collected from a sub-sample of 10 crops for fungal isolation and identification. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006). Fifteen roots from each of the 34 pea crops were frozen for future PCR analysis of root rot pathogens.

Foliar diseases were assessed during the first two weeks of August when most plants were at the intermediate to round pod stages. A minimum of 30 plants (10 plants at each of 3 sites) was assessed in each field. Foliar diseases were identified by symptoms. The severity of mycosphaerella blight, sclerotinia stem rot and anthracnose was estimated using a scale of 0 (no disease) to 9 (whole plant severely diseased). Powdery mildew and downy mildew severity were rated as the percentage of foliar area infected.

RESULTS AND COMMENTS: The 2014 cropping season in Manitoba started with excessive spring moisture and cool conditions which delayed seeding in many areas (Manitoba Crop Report, 2014). Later in the summer, warm, dry weather conditions prevailed.

Root rot was observed in all 34 pea crops surveyed, with root rot severity ratings ranging from 1.1 to 5.8, and a mean of 3.1. Three diseases were identified based on laboratory assessment of the roots collected from a sub-sample of 10 pea crops (Table 1). Fusarium root rot was the most prevalent as in previous years (McLaren et al. 2013, 2014). Crops from which *Fusarium* spp. were isolated had root rot severity ratings ranging from 2.9 to 5.8 with a mean of 4.1. The most predominant *Fusarium* species isolated in 2013 and 2014 was *F. acuminatum*. Rhizoctonia root rot (*Rhizoctonia solani*) was not detected in any of the fields sampled. Eight pea crops had average root rot severity ratings above 4 (i.e., symptoms were present on 50% of the root system) and this would have had a detrimental effect on crop yield. *Fusarium*

oxysporum, an efficient root colonizer known to cause wilt of pea, was also detected in six of the ten crops subsampled for fungal isolation and identification.

Four foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*) was the most prevalent, as in previous years (McLaren et al. 2013, 2014), and was present in all crops surveyed. The mean severity of all the foliar diseases except mycosphaerella blight was extremely low. Sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*) was detected in five crops. The prevalence of sclerotinia-infested crops was 15% in 2014 compared with 36% in 2012 and 15% in 2013. Warm, dry weather prevailed in the latter half of the 2013 and 2014 field seasons and contributed to a reduced risk of sclerotinia stem rot. Downy mildew (*Peronospora viciae*) was detected in seven of the crops surveyed with a mean disease severity of 0.1. Anthracnose (*Colletotrichum pisi*) was found in three crops with a mean severity rating of <0.1. Powdery mildew (*Erysiphe pisi*) was not observed in any of the surveyed crops. Because all newly registered pea cultivars are required to have resistance to powdery mildew, the absence of this disease could be mainly attributed to the use of new cultivars by growers or early seeded crops escaping infection. However, powdery mildew was observed very late in the growing season on a few susceptible lines at AAFC-Morden, which suggests that there may have been crops in which powdery mildew developed after the survey. Other foliar diseases, such as septoria blotch (*Septoria pisi*) and bacterial blight (*Pseudomonas syringae* pv. *pisi*) were not observed in the surveyed crops.

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Table 1. Prevalence and severity of root diseases in 10 of 34 crops of field pea in Manitoba in 2014.

		Disease severity (0-9)[1]	
Disease	**No. crops affected**	**Mean**	**Range**
Fusarium root rot	10	4.1	2.9-5.8
Rhizoctonia root rot	0	0	0
Fusarium oxysporum	6	4.0	2.9-5.5

[1]All diseases were rated on a scale of 0 (no disease) to 9 (death of plant). Mean values are based only on crops in which the disease was observed.

Table 2. Prevalence and severity of foliar diseases in 33 crops of field pea in Manitoba in 2014.

		Disease severity (0-9 or % leaf area infected)[1]	
Disease	**No. crops affected**	**Mean**	**Range**
Mycosphaerella blight	33	4.3	1.9-7.5
Sclerotinia stem rot	5	0.1	<0.1-0.1
Powdery mildew	0	0	0
Downy mildew	7	0.1	<0.1-0.1
Anthracnose	3	<0.1	<0.1-0.1

[1]Powdery and downy mildew severity were 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 crops in which the disease was observed.

CROP: Pulse crops (pea and lentil)
LOCATION: Saskatchewan

NAMES AND AGENCIES: C. Armstrong-Cho[1], B. Carriere[2], C. Peluola[3], F. Dokken-Bouchard[3], S. Banniza[1].
[1]Crop Development Centre, University of Saskatchewan, 51 Campus Drive, Saskatoon SK S7N 5A8
[2]Discovery Seed Labs Ltd., 450 Melville Street, Saskatoon SK S7J 4M2
[3]Saskatchewan Ministry of Agriculture, 3085 Albert St., Regina SK S4S 0B1

TITLE: Reports of *Aphanomyces* from Saskatchewan root and soil samples.

ABSTRACT: Root and soil samples were submitted by growers to testing facilities at the Saskatchewan Ministry of Agriculture Crop Protection Laboratory (CPL), Discovery Seed Labs (DSL), and the University of Saskatchewan Crop Development Centre (CDC). A total of 58 root samples (35 pea, 22 lentil, 1 chickpea) and 119 soil samples were received from 39 locations in 15 Saskatchewan crop districts. Oospores were detected in 53% of root samples and *Aphanomyces* DNA was detected in 71% of soil samples. Evidence of the pathogen was found in samples from 38 of 39 locations.

INTRODUCTION AND METHODS: Spring conditions in Saskatchewan have been unusually wet for several years, making root rots an increasing concern for growers. In 2012 the root pathogen *Aphanomyces euteiches* was detected for the first time in the region, although it was previously known in neighbouring Alberta and Manitoba (Banniza et al., 2013). Increasing awareness of this pathogen in Saskatchewan coupled with widespread root rot of pea and lentil in 2014 led to increased demand for testing of root and soil samples for the presence of *Aphanomyces*. Root samples received and/or collected by the CPL and the CDC from June 10 to Aug 15, 2014 were assessed microscopically to determine whether oospores were present in the tissues. Tissue samples submitted to the CPL were further tested by plating on agar medium to attempt to culture the pathogen(s) present. Soil samples received from May 2 to Aug 22, 2014 at DSL were analyzed using PCR-based molecular detection of *Aphanomyces euteiches* (Gangneux et al., 2014).

RESULTS AND COMMENTS: The 2014 growing season was characterized by a cold wet spring, delaying seeding in many areas. Cool conditions persisted through June, delaying crop development. Frequent spring rains led to standing water in many fields throughout the province in late June and early July. Low areas in pea and lentil fields were often easily discernable later in the season through the presence of stunted and yellowed plants affected by root rot.
Samples submitted to the CPL and CDC labs were examined for the presence of oospores in root tissues and plated on a culture medium (CPL only). Eleven of the 22 lentil samples and 19 of the 35 pea samples contained oospores. Although symptoms on these samples were consistent with *Aphanomyces* infection, there is potential for confusion with *Pythium* infection based solely on oospore observations. The efficacy of plate tests is also limited, since culturing of *Aphanomyces* is known to be difficult even with freshly infected tissue. The reliability of tissue observation and plate testing is further limited by the quality of the sample. Root samples are typically submitted once root rot symptoms are noted above ground. At this stage, roots are colonized with a variety of organisms, and much of the tissue infested with *Aphanomyces* has already sloughed off and remains in the ground when plants are dug up (Hagedorn, 1984). Molecular-based testing for *Aphanomyces* is more reliable and definitive than using root observations and plating. Soil testing at DSL for *Aphanomyces* was based on detection of pathogen DNA using PCR (Gangneux et al., 2014). There were 122 soil samples submitted, representing 39 growers at 18 locations around Saskatchewan. Of these, 86 tested positive, 35 tested negative, and 1 was inconclusive. Positive results were observed from at least one sample at each of the 18 locations.

Most root and soil samples (71%) were received from three crop districts; 3BN, 6B and 9AW (Saskatchewan Ministry of Agriculture, 2013) and few samples were obtained from eastern Saskatchewan. Despite limited sample numbers from many crop districts, these data provide further evidence that *Aphanomyces* is widespread in the province (Armstrong-Cho et al., 2014).

Table 1. Incidence of *Aphanomyces* in Saskatchewan root and soil samples submitted to three testing facilities from May to August 2014.

Crop District	No. of samples submitted	No. of samples positive for *Aphanomyces*
1B	1	1
2A	3	1
2B	6	5
3AN	1	1
3BN	29	11
3BS	1	1
4B	5	3
5A	9	6
5B	1	0
6B	65	46
7A	11	9
7B	4	4
9AE	1	1
9AW	31	19
9B	7	5
unknown	2	2
All districts	177	115

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CROP: Pulse crops (Lentil, Pea, and Chickpea)
LOCATION: Saskatchewan

NAMES AND AGENCIES:
R.A.A. Morrall[1] and B. Carriere[2]
[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

TITLE: SEED-BORNE PATHOGENS OF PULSE CROPS IN SASKATCHEWAN IN 2014

ABSTRACT: In a summary of commercial agar plate tests for seed-borne pathogenic fungi of lentil, field pea and chickpea all fungal genera were at near normal levels. The fungi included *Ascochyta* spp., *Botrytis* spp. and *Sclerotinia sclerotiorum* on all three crop species and *Colletotrichum lentis* on lentil.

METHODS: Results from commercial agar plate tests for seed-borne pathogens in samples of lentil, field pea, and chickpea seed from Saskatchewan were summarized. The tests had been conducted by one company between September and the end of December 2014 and these seed samples were assumed to be predominantly from the 2014 crop. Tests were for the following pathogens:

(a) *Didymella* [*Ascochyta*] *lentis,* the cause of ascochyta blight in lentil; *Mycosphaerella* [*A.*] *pinodes*, *Didymella* [*A.*] *pisi* and *Phoma medicaginis* var. *pinodella* [= *A. pinodella*], causes of ascochyta blights in field pea; and *Didymella* [*A*.] *rabiei*, the cause of ascochyta blight in chickpea.
(b) *Botrytis* spp., causes of botrytis stem and pod rot (grey mould) and seedling blight in lentil, chickpea and field pea.
(c) *Sclerotinia sclerotiorum*, the cause of sclerotinia stem and pod rot (white mould) in lentil, chickpea and field pea.
(d) *Colletotrichum lentis* Damm*,* now the new name (2) of the cause of anthracnose in lentil.

All seed samples were tested for the applicable ascochyta blight pathogens and slightly fewer for *Colletotrichum truncatum, Botrytis* spp. or *S. sclerotiorum*. Because of low levels of infection with three of the host-pathogen combinations, mean % seed infection level with specific pathogen(s) was usually not calculated for each Saskatchewan crop district [CD] (5). With the exception of *Ascochyta* spp. on pea (Table 1), mean values were too small for differences among CDs to be meaningful. However, for all host-pathogen combinations the percentages of samples free of infection province-wide were calculated. Seed samples could not be classified according to cultivar or whether the crops had been grown from fungicide-treated seed or had been sprayed with foliar fungicides. Most lentil growers in Saskatchewan plant ascochyta-resistant cultivars and foliar fungicides, especially strobilurin products, are widely used by growers of lentil, pea, and chickpea.

RESULTS AND COMMENTS: The 2014 growing season in Saskatchewan was characterized in most areas by precipitation above average. Some south-central areas traditionally thought of as arid received heavy late summer rainfall for the second year in a row. In these and other wet areas the weather late in the season caused late ripening, poor harvest conditions and infestations by botrytis and sclerotinia stem rots, especially in lentil. However, the main disease problems reported on pulse crops in 2014 were seedling blights and root rots of pea and lentil caused by *Aphanomyces euteiches* and *Fusarium* spp. (1). These root diseases are not reflected in tests for seed-borne pathogens, but were responsible for high yield losses in several areas.

During the period covered by this report 435 lentil, 326 pea and 13 chickpea seed samples were tested by the company reporting results.

Pea –The percentage of *Ascochyta*.-free samples was 4%, much lower than the 28% reported for 2013 (4) or percentages in previous years. Mean % infection overall was 6.8 %, higher than the level of 2.0% reported for 2013 (4). The highest mean values were in CDs 6A to 9B to the north and the lowest in CDs 2B to 4B. (Table 1). However, no samples for testing were received from CDs 1 or 2A. The percentage of

pathogen-free samples was 84% for *Botrytis* spp. and 85% for *Sclerotinia sclerotiorum*. Correspondingly, mean levels of pathogen infection were low at 0.1% for both pathogens.

Lentil –The overall percentage of *Ascochyta*-free samples was 99%, similar to 2012 (3) and 2013 (4). Mean ascochyta infection was 0.01%. With the widespread use of *Ascochyta*-resistant cultivars, ascochyta blight is no longer a significant factor in Saskatchewan (2). However, maintaining this advantage will require careful management of rotations to avoid promoting the future development and spread of new races of *Ascochyta lentis*. The percentages of *Botrytis*-free and of *Sclerotinia*-free samples were 45% and 49% respectively. Mean seed infection levels were 0.5% in both cases and no samples were heavily infected with either pathogen. The presence of a few samples infested with these two pathogens probably reflects the presence of late ripening crops in areas with late-season rainfall. Overall mean anthracnose level in the seed samples was 0.2% while 78% of all samples were anthracnose-free. The latter percentage is a 10% decrease compared with 2103.

Chickpea – Because of the small areas of chickpea production in Saskatchewan, relatively few seed samples are tested, especially in the months before December 31. Thus, even comparisons of numbers for all crop districts combined are of little or no value. In 2014 only about 20 samples of seed (mostly Kabuli chickpea) were tested at the reporting seed lab in the period to December 30. The ranges of infection detected were 0-2.8% for ascochyta in chickpea, 0-10% for botrytis in chickpea, and 0-1.3% for sclerotinia in chickpea.

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Table 1. Numbers of pea seed samples tested from September to mid-December, 2014 and levels of infection with Ascochyta spp. in relation to 20 Saskatchewan Crop Districts (CDs)

CD	No. of tests	Mean % Asc*	CD	No. of tests	Mean % Asc*	CD	No. of tests	Mean % Asc*	CD	No. of tests	Mean % Asc
1A	nd**	nd	**3A-S**	16	1.7	**5A**	3	4.5	**7B**	32	10.5
1B	nd	nd	**3B-N**	24	3.2	**5B**	11	5.7	**8A**	12	8.4
2A	nd	nd	**3B-S**	2	5.0	**6A**	18	6.5	**8B**	15	7.7
2B	5	3.4	**4A**	2	1.5	**6B**	66	6.6	**9A**	36	6.0
3A-N	5	2.4	**4B**	2	2.5	**7A**	39	9.5	**9B**	38	9.4
									All CDs	326	6.8

Asc* = *Ascochyta pinodes, A. pisi, or Phoma medicaginis* var. *pinodella*
nd** = no data

CROP: Soybean
LOCATION: Manitoba

NAMES AND AGENCIES:
D.L. McLaren[1], M.A. Henriquez[1], R.L. Conner[2], K.F. Chang[3], T.L. Henderson[1], W.C. Penner[2] and T.J. Kerley[1]
[1] Agriculture and Agri-Food Canada (AAFC) Research Centre, 2701 Grand Valley Road, Brandon, Manitoba R7A 5Y3.
Telephone: (204) 578-6561; **Facsimile:** (204) 578-6524; **E-mail:** debra.mclaren@agr.gc.ca
[2]AAFC Research Station, Unit 101, Route 100, Morden, Manitoba R6M 1Y5.
[3] Alberta Agriculture and Rural Development, Crop Diversification Centre-North, 17507 Fort Road N.W., Edmonton, Alberta T5Y 6H3

TITLE: SOYBEAN ROOT ROT AND PHYTOPHTHORA ROT IN MANITOBA IN 2014

ABSTRACT: In 2014, 41 soybean crops were surveyed in Manitoba for root diseases and fusarium root rot was the most prevalent root disease. Root rot was severe in low-lying areas of some fields, indicating that seed yield and quality may have been affected.

INTRODUCTION: Soybean production continues to increase with 354,000 ha (875,000 acres), 428,000 ha (1,058,000 acres) and 526,000 ha (1,299,000 acres) seeded in Manitoba in 2012, 2013 and 2014, respectively (Manitoba Pulse Growers Association 2014). This represents the seventh consecutive annual increase in soybean area in Manitoba. Root rot is a constraint in other areas of Canada where soybean production is established (Chang et al. 2013; OMAFRA, 2011) and this disease complex may become an issue in Manitoba as soybean production continues to expand.

METHODS: Soybean crops were surveyed for root diseases at 41 different locations in Manitoba in 2014. The crops surveyed were randomly chosen from regions in south-central and southwest Manitoba, where soybean is commonly grown.

The survey for root diseases was conducted during mid- to late-July when most plants were at the early flowering stage. At least ten plants were sampled by uprooting 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). To confirm the visual disease identification, 15 symptomatic roots were collected from a sub-sample of 10 crops for fungal isolation and identification. Identification of *Fusarium* species involved visual assessment, microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006). Fifteen roots from each of the 41 soybean crops surveyed were frozen for future PCR analysis of root rot pathogens.

All fields that were surveyed for root rot in July were re-assessed in mid-August for phytophthora rot. Three additional fields were also included in the late season survey, which was conducted when most plants were at the R6 stage. Eighteen crops showed some plants that were symptomatic for phytophthora root and stem rot and these were collected for further assessment in the laboratory. Approximately 124 stems were placed on different selective media to identify *Phytophthora* spp. based on morphological characteristics (Gallegly and Hong 2008). Tissue samples from symptomatic plants were frozen for PCR analysis of pathogens at a later date.

RESULTS AND COMMENTS: In 2014, the majority of crops were either close to or behind their expected stages of development due to a later than normal start to seeding in many areas because of cool, wet weather. Crop growth continued to be suppressed by lower temperatures and frequent rainfall in some areas of the province, which favored the prevalence and severity of some diseases. As the summer progressed, warmer weather prevailed. However in some soybean crops, maturity was a concern and harvest did not start until October (Manitoba Agriculture, Food and Rural Development 2014).

Root rot was observed in all soybean crops surveyed in July 2014 and root rot ratings ranged from 1.9 to 6.8 with a mean of 4.6 (Table 1). The microorganisms most frequently isolated from roots of infected plants

were *Fusarium* spp. (Table 1). Crops in which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 3.9 to 6.8 with a mean of 5.4. Rhizoctonia root rot (*Rhizoctonia solani*) was not detected in any of the crops surveyed in 2014. The lower recovery rate of *R. solani* in 2013 and lack of recovery in 2014, suggest that in Manitoba this fungus may not be as important a root rot pathogen of soybean as are *Fusarium* spp., in contrast with other regions in western Canada (Chang et al. 2013).

Phytophthora rot was identified in 25% (11/44) of fields surveyed during mid-August (Table 1). Each symptomatic plant that was positive for *Phytophthora* spp. had a discoloured taproot with lesions that progressed up the stem. This disease is most common in heavy textured soils that are subject to saturation and flooding such as those in the Red River Valley. Cool, wet weather conditions during the first half of the season may have contributed to the occurrence of phytophthora rot in some soybean fields.

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Table 1. Prevalence and severity of root diseases in 41 and 10 crops of soybean in July and prevalence of phytophthora rot in 44 crops of soybean in August 2014.

		Disease severity (0-9)[1]	
Disease	**No. crops affected**	**Mean**	**Range**
Soybean root rot	41	4.6	1.9-6.8
Fusarium root rot[2]	10	5.4	3.9-6.8
Phytophthora rot	11	n/a	n/a

[1]All diseases, excluding phytophthora, were rated on a scale of 0 (no disease) to 9 (death of plant). Mean values are based only on crops in which the disease was observed.
[2]Based on a subsample of ten crops.

CROP: Soybean (*Glycine max* (L.) Merr.)
LOCATION: Southern Alberta

NAMES AND AGENCIES:
R. Nyandoro[1], K.F. Chang[2], S.F. Hwang[2], H.U. Ahmed[2], S.E. Strelkov[1], G.D. Turnbull[2], and M.W. Harding[3]
[1]Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton AB T6G 2P5
[2]Crop Diversification Centre North, Alberta Agriculture and Rural Development (AARD), Edmonton AB T5Y 6H3
Telephone: (780) 644-8352, **Facsimile:** (780) 422-6096, **E-mail:** kan.fa.chang@gov.ab.ca
[3]Crop Diversification Centre South, AARD, Brooks AB T1R 1E6

TITLE: THE OCCURRENCE OF SOYBEAN ROOT ROT IN SOUTHERN ALBERTA, IN 2014

ABSTRACT: A survey was conducted in August 2014 in southern Alberta to determine the incidence and severity of root rot in soybean fields. Twenty eight fields were surveyed across 9 locations with 100 root samples collected per field. Root rot occurred in all locations with incidence averaging 34% and ranging from 18% to 73%, and severity averaging 0.9 and ranging from 0.3 to 1.2 on a scale of 0-4.

INTRODUCTION: Development of short-season cultivars has greatly increased the potential of soybean (*Glycine max* (L.) Merr.) as a profitable cash crop in southern Alberta farms. As a result, soybean is rapidly becoming an important crop in western Canadian agriculture (3, 4). However, production issues have developed, including root rot which has been claimed to be a major challenge in Canada (Fig. 1; ref. 2). A survey was conducted in August 2014 across southern Alberta to assess root rot occurrence and impact in soybean crops.

METHODS: The survey was conducted over the period August 17-23, when soybean crops were at the pod set to early pod filling stages of growth. Root samples were collected from 28 fields in nine different locations (Bow Island, Brooks, Duchess, Jenner, Medicine Hat, Seven Persons, Taber, Tilley, and Vauxhall) in southern Alberta (Fig. 2). The samples were collected from 5 points in each field along W-shaped transects. Twenty plants were dug at each sampling point for a total of 100 root samples per field. Plants were also collected outside the sampling points (primarily in low lying areas of the field), where they were observed to be severely stunted or dead. The roots were gently shaken to rid them of excess soil, sealed in plastic bags, and placed on ice in cooler boxes to avoid spoilage. At the end of each day, the root samples were placed in a 4°C cooler to maintain freshness until the time of disease scoring and processing to isolate and characterize the causal pathogens. In the laboratory, the roots were gently washed under running water and then rated visually for root rot on the 0-4 scale described by Chang et al. (1), in which: 0= normal root color, 1= 1-25% root discoloration, 2= 26-50% root discoloration, 3= 51-75% root discoloration, and 4= 76-100% root discoloration or dead plant. The root samples were also rated for nodulation on a scale of 0-4, with 0= no nodules, 1= 1-5 nodules, 2= 6-10 nodules, 3= 11-15 nodules, and 4= >15 nodules per root system.

RESULTS AND DISCUSSION: Root rot was observed in all 28 fields sampled, but disease severity varied. Severity was highest (1.7) at Tilley and lowest (0.3) at Brooks (Table 1). In low lying areas of fields where water and salts accumulated during storms, plants tended to show severe stunting, or in extreme cases, death. Diseased plants in most cases could be easily pulled out of the ground, especially when the soil was at field capacity. This was a result of severe pruning of the root system. Some plants showed stunting and yellowing of the lower leaves, which broke off as the root system became inadequate to sustain the plant. Some plants, particularly in the low lying areas, had completely dried up after losing the entire root system to the disease.

The lowest incidence of root rot (18%) was found in samples collected at Brooks, while the highest incidence (73%) was recorded at Taber (Table 1). The lower incidence of root rot at Brooks and Duchess may have been a reflection of dry field conditions in that region during much of the summer. Dry conditions are unfavorable for disease development. Root nodulation was highest (3.4) at Jenner and lowest (1.1) in Vauxhall. Overall, root rot disease incidence and severity in the surveyed locations were lower in 2014 than in 2013 (4), but nodulation was superior. This suggests that low disease pressure enables soybean

plants to form more nodules through their symbiotic associations with *Bradyrhizobium japonicum*. Work is underway to isolate and characterize the pathogens causing the root rot symptoms on the samples.

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ACKNOWLEDGEMENTS

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Table 1. Root rot incidence, severity and nodulation in soybean crops in southern Alberta in 2014.

Location	No. of fields surveyed	Root rot incidence (%)		Root rot severity (0-4)		Root nodulation (0-4)	
		Range	Mean	Range	Mean	Range	Mean
Bow Island	2	36-37	37	0.5-0.7	0.6	2.9-3.5	3.2
Brooks	3	9-24	18	0.2-0.4	0.3	2.2-3.8	3.3
Duchess	2	22-25	24	0.4-0.4	0.4	1.4-2.3	1.9
Jenner	2	52-70	61	0.8-1.4	1.1	3.0-3.5	3.4
Medicine Hat	6	10-50	34	0.2-1.1	0.7	0.4-2.7	2.2
Seven Persons	4	14-46	28	0.4-0.7	0.5	0.2-2.6	1.7
Taber	2	61-85	73	1.0-1.8	1.4	2.8-3.0	2.9
Tilley	5	38-62	50	0.7-1.8	1.7	1.1-3.2	2.2
Vauxhall	2	29-72	51	0.5-1.9	1.2	0.9-1.3	1.1
TOTALS	**28**	**9-85**	**40**	**0.2-1.9**	**0.9**	**0.2-3.8**	**2.3**

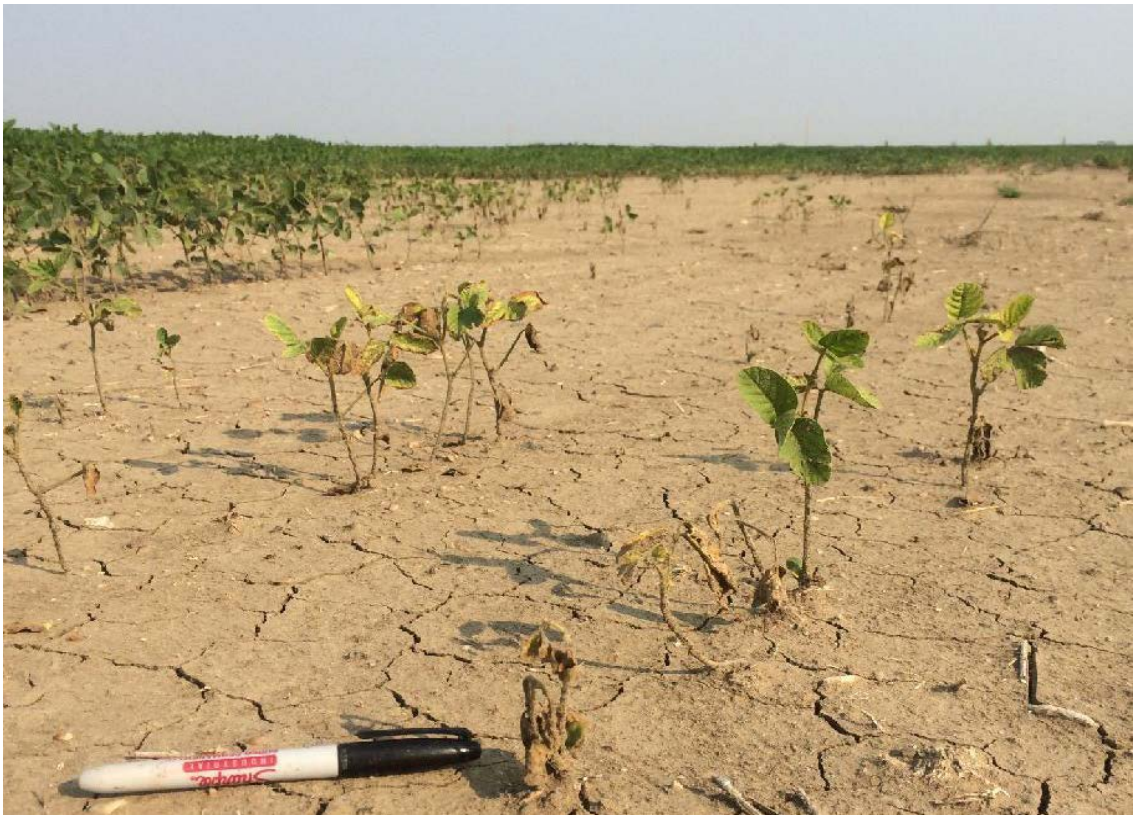

Figure 1. A typical low lying area in a field in Tilley, AB (August 2014) with severe soybean root rot. Note the chlorosis on some plants as well the dead plants.

Figure 2. Map showing the approximate locations of the surveyed soybean crops in southern Alberta.

CROP: Sunflower
LOCATION: Manitoba

NAMES AND AGENCY:
K. Y. Rashid[1] and M.L. Desjardins[2]
[1] Agriculture and Agri-Food Canada, Research Station, 101 Route 100, Morden, Manitoba R6M 1Y5
Telephone: (204) 822-7520; **Facsimile**: (204) 822-7507; **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 2014

ABSTRACT: A survey of 63 sunflower crops in Manitoba in 2014 revealed that verticillium wilt was the most prevalent disease in 91% of the crops, followed by rust in 84%, sclerotinia wilt/basal stem rot in 54%, sclerotinia head rot in 37%, and downy mildew in 44%. Disease severity ranged from low to moderate with no severe infestations.

METHODS: A total of 63 sunflower crops was surveyed in 2014 in Manitoba. Twenty crops were surveyed early in the season for downy mildew infections, 18 in the last week of August, 21 in the first week of September, and 4 in the second week of September. The crops were surveyed along pre-planned routes in the major areas of sunflower production in southern Manitoba. Each crop was sampled by two persons walking ~100 m in opposite directions to each other following an "M" pattern in the field. 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. and *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, 13 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: All sunflower crops surveyed in 2014 had excellent to good stands, but only 63% had good vigour, and the rest had fair to poor vigor. Only 47% of the sunflower crops were early maturing, and the remaining 53% were late to very late (Table 1). The crops surveyed were split 75%:25% between confectionery and oilseed hybrids, thus showing an increase in the confection acreage in 2014 in comparison with 2012-2013 (1, 2, 3). The 2014 growing season started with normal soil moisture and temperature conditions, and this contributed to an increase in area seeded to sunflower (~35,000 ha in 2014 in Manitoba in comparison with 15,000 ha in 2011, according to Statistics Canada). Growing conditions were relatively normal throughout the growing season with dry weather in July and August, and a light frost in mid-September. These conditions in 2014 resulted in relatively low disease incidence and severity compared with previous years (1, 2, 3). The dry conditions in July-August and the lack of an early frost provided a long season and good yields in most sunflower crops.

Sclerotinia wilt/basal stem rot was present in 54% of the crops surveyed in 2014, mostly at trace to 5% disease incidence (Table 1). Sclerotinia head rot and mid-stem infections, caused by airborne ascospores, were observed at trace to 5% levels in most of the 37% of infested crops but with a disease severity of ≥5% in only a few crops surveyed in September. The prevalence and incidence of head rot in 2014 were at a record low in comparison with the 10 previous years (1, 2, 3, 4).

Rust was present in 84% of the crops surveyed, with severity ranging from trace to 5% leaf area affected (Table 1). Rust infections started relatively late in 2013 and did not develop rapidly in most of the crops

surveyed. Preliminary analysis of the rust isolates collected has indicated the prevalence of races 355, 737, 747, and 777 of *P. helianthi*, which are virulent on most commercial sunflower hybrids. Rust incidence and severity levels in 2014 were similar to 2013 and 2012, record low years for rust epidemics (1, 2, 3). These were probably due to late onset of infection and the dry weather and normal temperatures in July and August.

Verticillium wilt was present in 91% of the crops surveyed in 2014 with traces to 5% severity in the oilseed hybrids, and 10-40% severity in 20% of crops which were mainly confection sunflower hybrids (Table 1). This incidence of verticillium wilt was higher in 2014 than in 2013 and previous years (1, 2, 3).

Downy mildew was at a record low in 2014 and observed in only 44% of crops with incidence ranging from trace to 5% (especially in the 20 crops surveyed early in the season for downy mildew) (Table 1). Preliminary analysis of isolates collected indicates the predominance of races 722, 732, 772, and 702. Eighty-eight percent of the downy mildew isolates collected in 2014 are either insensitive or partially insensitive to metalaxyl seed treatment, similar to levels reported in previous years (1, 2, 3). Downy mildew was more prevalent in 2014 than in 2013 and 2012 but at trace levels in most crops. This was perhaps due to normal soil moisture from the seedling stage through the rest of the growing season, and the widespread use of downy mildew resistant hybrids (1, 2, 3).

Traces to 5% leaf area infected by *Septoria helianthi* were observed in 37% of the crops as well as some infection by *Alternaria* spp. in a few crops (Table 1). The disease index values indicate lower severity and prevalence than previous years (1, 2, 3). Traces to 1% of stem lesions caused by *Phoma* or *Phomopsis* spp. were present in 23% of the crops in 2014, similar to 2013 and 2012 but considerably fewer than those observed in previous years (1, 2, 3, 4) .

Traces to 1% infestation with the sunflower beetle (*Zygogramma exclamationis*) were observed in 10% of the crops. Infestations at trace to 1% levels with sunflower midge (*Contarinia schulzi*) were encountered in a few crops. Traces of infestation by grasshoppers were observed in 23% of the crops.

Of the 13 samples received by the MAFRI Crop Diagnostic Centre in 2014, three were affected by fusarium root rot, two by rust, two by phomopsis stem canker, one by alternaria leaf spot, one by nutrient deficiency, and four by herbicide injury.

ACKNOWLEDGMENTS: The technical assistance of Tricia Cabernel, Maurice Penner, and Suzanne Enns is gratefully acknowledged. The assistance of Troy Turner, National Sunflower Association of Canada in providing downy mildew and rust samples is much appreciated.

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Table 1. Prevalence and index of diseases in 63 crops of sunflower in Manitoba in 2014, 20 of which were surveyed early for downy mildew only.

Disease	Crops Affected		Disease Index[1]	
	No. of crops	% of crops	Mean	Range
Sclerotinia wilt/basal stalk rot	23	54%	1.0	T - 1
Sclerotinia head rot/stem rot	16	37%	1.0	T - 2
Verticillium wilt	39	91%	1.4	T - 4
Downy mildew	19	44%	1.3	T - 2
Rust	36	84%	1.6	T - 4
Leaf spots (*Septoria* & *Alternaria*)	16	37%	1.0	T - 1
Stem lesions (*Phoma* & *Phomopsis*)	10	23%	1.0	T - 1
Lateness[2]	23	53%	2.6	1 - 3
Poor Stand	1	2%	1.2	1 - 4
Poor Vigour	16	37%	2.2	1 - 4

[1] Disease index on a scale of T to 5: T (Trace) = < 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 % 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: Garlic (*Allium sativum* L.); Onion (*Allium cepa* L.)
LOCATION / RÉGION: Alberta

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
M.W. Harding[1], R.C.J. Spencer[2], R.M. Lange[3], J. Yang[3], J. Broatch[4], S.L.I. Lisowski[1], and R.J. Howard[5]
Telephone: (403) 362-1338, **Facsimile**: (403) 362-1326, **E-mail**: michael.harding@gov.ab.ca
[1]Alberta Agriculture and Rural Development, Crop Diversification Centre South, 301 Horticultural Station Road East, Brooks, Alberta T1R 1E6;
[2]Alberta Agriculture and Rural Development, Alberta Ag-Info Centre, Provincial Building, Postal Bag 600, Stettler, Alberta T0C 2L0
[3]Alberta Innovates Technology Futures, P.O Bag 4000, Vegreville, Alberta T9C 1T4
[4]Alberta Agriculture and Rural Development, Lacombe Research Centre, 6000 C & E Trail, Lacombe, Alberta T4L 1W1
[5]RJH Ag Research Solutions Ltd., Box 1456, Brooks, Alberta T1R 1C3

TITLE / TITRE: DISEASES OF GARLIC AND ONION IN ALBERTA IN 2014

ABSTRACT: Plant and soil samples were collected from seven garlic and three onion fields in Alberta in 2014. In total, 16 garlic and 13 onion plants were evaluated. Symptoms of disease and signs of fungal pathogens were evaluated visually. Presence of the aster yellows phytoplasma was detected by nested PCR. Eight fungal genera were observed on symptomatic plants, including *Fusarium, Embellisia*, *Penicillium*, *Botrytis*, *Alternaria*, *Rhizoctonia*, *Cladosporium* and *Rhizopus.* The aster yellows phytoplasma was detected in four of the 29 samples. Bacteria (unidentified) were also noted on some samples. Soil and bulb samples were evaluated for the presence of plant parasitic nematode species.

INTRODUCTION AND METHODS: Alberta garlic production is comprised of many, small, less than 1 ha, plantings in market gardens that supply local fresh market consumption. Onion production in Alberta is also found in small plantings, but some large-scale commercial production occurs under irrigation in southern Alberta. Market garden production of onion and garlic is spread across the province and these crops often provide significant income to producers, regardless of size. Diseases, such as fusarium basal plate rot (*Fusarium oxysporum* f. sp. *cepae* (H.N. Hans.) W.C. Snyder & H.N. Hans, white rot (*Sclerotium cepivorum* Berk.), and embellisia skin blotch (*Embellisia allii* (Campanile) E.G. Simmons), have been observed in Alberta plantings in previous years (1). For the present survey, garlic and onion samples were either contributed by growers or collected by researchers. Three to 10 samples (whole plants plus 500-g of soil) were collected or received, including 16 samples from each of seven garlic crops and 13 samples from each of three onion crops. The samples were collected or received in June and July, 2014 from the ten locations shown in Fig. 1. The samples were inspected for symptoms and nearly all showed discolorations on above or below ground parts and were stunted or unthrifty. Damage to the bulb or basal plate was also observed in most samples. Symptomatic tissues were observed with a binocular dissecting microscope at 80x for signs of fungi. When present, fungi were scraped from the host tissues with a clean scalpel and observed with a phase contrast microscope at 400x. Small, 1-cm^2 pieces from symptomatic tissues were excised with a sterile scalpel, surface sterilized in 1% NaOCl, rinsed in sterile water and incubated in agar (acidified-PDA, PDA + antibiotics, or water agar + antibiotic) plates at room temperature. Fungi growing out of symptomatic tissues were scraped from the agar surface with a clean scalpel and examined with a phase contrast microscope at 400x. Identifications of plant pathogenic fungi were made to the genus level based on morphological characteristics of spores and associated structures. Detection of the aster yellows pathogen (*Candidatus* Phytoplasma asteris) was performed using a nested PCR method adapted from E. Boudon-Padieu et al., 2003 (2).

RESULTS AND DISCUSSION: Evidence of eight fungal pathogens on garlic and onion was seen in Alberta in 2014; namely, *Alternaria* sp., *Botrytis* sp., *Cladosporium allii*, *Embellisia allii, Fusarium* spp. *Penicillium* spp., *Rhizoctonia solani* Kühn*,* and *Rhizopus* sp. (Table 1). Fusarium basal plate rot is a very common disease on both onion and garlic in Alberta (2) and *Fusarium* spp. were found at all locations and

on 73% and 100% of garlic and onion samples, respectively. Embellisia skin blotch, which was reported in Alberta for the first time in 2012, was also common; *Embellisia allii* was observed on symptomatic tissues from seven of the ten locations and on 24% and 67% of garlic and onion samples, respectively. *Penicillium* spp. were the third most common fungi isolated and occurred at six of ten locations and on 10% of garlic and 53% of onion samples. *Botrytis* sp. was found in all three onion fields and on 51% of onion samples, but was rare on garlic (one location and on 1% of samples). Other fungi reported at low or trace levels were *Rhizoctonia solani, Alternaria* sp., *Cladosporium* sp. and *Rhizopus* sp. The white rot pathogen, *Sclerotium cepivorum*, which is a regulated pathogen named in the *Alberta Agricultural Pests Act*, was not detected on onion or garlic in Alberta in 2014.

Aster yellows was a severe problem in 2012 that appeared to carry over into the 2013 crop (1). The aster yellows phytoplasma was again detected in garlic in Alberta in 2014, but at only two locations and on 23% of samples. This is a marked reduction from 2013 when it was discovered at all locations sampled (1). The aster yellows phytoplasma was not detected on any onion samples evaluated.

Bacteria, most likely soft-rotting species, were noted on a number of samples, but were not isolated or identified in this study. Nematodes were also observed on many of the samples and may have included both saprophytic and parasitic species. Nematode extractions, isolations and identifications from bulbs and soil were performed. Results of the nematode analyses will be presented in a separate report.

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REFERENCES:

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2. E. Boudon-Padieu, A. Bejat, D. Clair, J. Larrue, M. Borgo, L. Bertotto and E. Angelini. 2003. Grapevine yellows: Comparison of different procedures for DNA extraction and amplification with PCR for routine diagnosis of phytoplasmas in grapevine. Vitis, 42: 141-149

Table 1. Percent incidence of nine fungal pathogens and the aster yellows phytoplasma on garlic (upper rows) and onion samples (lower rows) collected from ten locations in Alberta in 2014.

Location	Crop	ALT[1]	AST	BOT	CLA	EMB	FUS	PEN	RHIC	RHIP	SCL
1	Garlic	0	0	0	0	12	76	6	0	6	0
4	Garlic	0	100	0	0	24	76	0	0	0	0
5	Garlic	0	60	0	0	28	75	26	7	2	0
7	Garlic	0	0	5	5	37	89	0	7	1	0
8	Garlic	0	0	0	0	12	18	41	0	0	0
9	Garlic	0	0	0	0	41	82	0	0	6	0
10	Garlic	0	0	0	0	12	94	0	6	0	0
		0	23	1	2	24	73	10	3	2	0
Location	**Crop**	**ALT**	**AST**	**BOT**	**CLA**	**EMB**	**FUS**	**PEN**	**RHIC**	**RHIP**	**SCL**
2	Onion	20	0	100	0	80	100	60	20	0	0
3	Onion	0	0	20	0	20	100	0	0	0	0
6	Onion	0	0	33	0	100	100	100	0	0	0
		7	0	51	0	67	100	53	7	0	0

[1] Key to abbreviations: ALT = *Alternaria* sp.; AST = aster yellows phytoplasma; BOT = *Botrytis* sp.; CLA = *Cladosporium* sp.; EMB = *Embellisia allii*; FUS = *Fusarium* spp. ; PEN = *Penicillium* spp. (?); SCL = *Sclerotium cepivorum*; RHIC = *Rhizoctonia solani*; RHIP = *Rhizopus* sp.

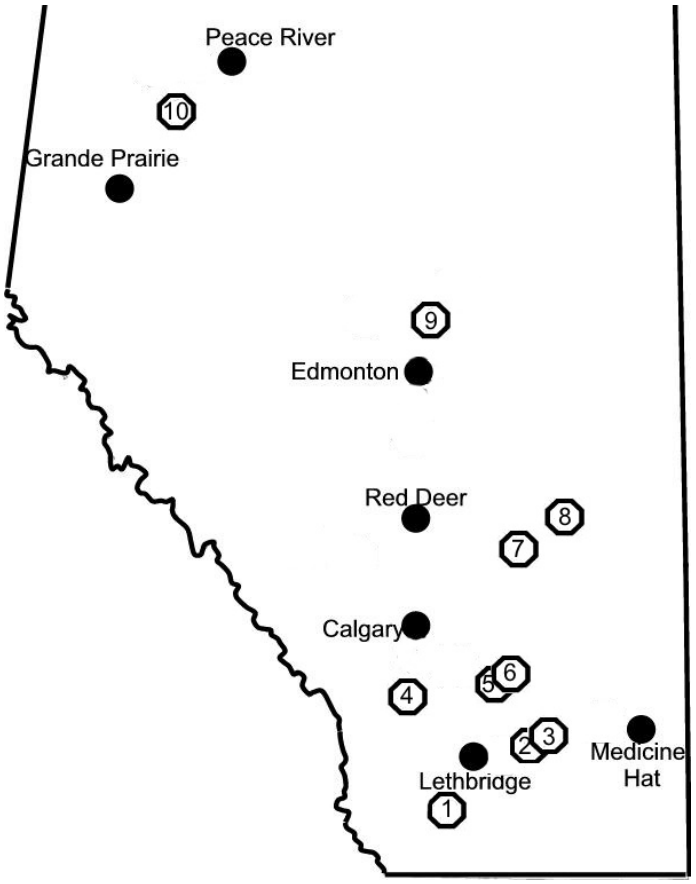

Figure 1. Garlic and onion sampling locations in Alberta in 2014.

LIST OF CPDS AUTHORS IN ALPHABETICAL ORDER

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