2016

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.

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Canadian Plant Disease Survey

Inventaire des maladies des plantes au Canada

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Contents: **DISEASE HIGHLIGHTS** - 2015 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.

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Vegetables / Légumes

Diagnostic Laboratories /Laboratoires Diagnostiques

CROP: Commercial Crops – Plant Health Laboratory Report

LOCATION: British Columbia

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TITLE: DISEASES/SYMPTOMS DIAGNOSED ON COMMERCIAL CROP SAMPLES SUBMITTED TO THE BRITISH COLUMBIA MINISTRY OF AGRICULTURE PLANT HEALTH LABORATORY IN 2015

ABSTRACT: The B.C. Ministry of Agriculture Plant Health Laboratory provides diagnoses for diseases caused by fungi, bacteria, viruses, plant parasitic nematodes and insect pests of agricultural crops grown in British Columbia. In 2015, the laboratory received 810 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 noticeable/new disease detections for B.C. included powdery mildew (*Sphaerotheca macularis*) in raspberry, leaf and petiole blight (*Phytophthora cryptogea*) and leaf spot (*Pseudomonas syringae* pv. *maculicola*) in daruma*, Apple mosaic virus* (ApMV) in hop, postharvest rot (*Aureobasidium pullulans*) in sweet cherry and bacterial stalk and leaf necrosis (*Pantoea agglomerans*) in garlic. These detections were confirmed by molecular tests. New host/pathogen detections/associations have not been confirmed by Koch's postulates. Where possible, such detections were confirmed by more than one test.

METHODS: The B.C. Ministry of Agriculture Plant Health Laboratory provides diagnoses 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 visual and microscopic examination, culturing onto artificial media, biochemical identification of bacteria using BIOLOG®, serological testing of viruses, fungi and bacteria with micro-well and membrane based enzyme linked immunosorbent assay (ELISA). Molecular techniques (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: Overall, the year 2015 was drier and warmer than previous years. Drought-like conditions caused noticeable plant damage especially in unmanaged landscapes. Irrigation needs were higher than normal. A higher number of samples was received at the laboratory starting earlier in the season. The laboratory received a total of 810 samples between January 1 and November 30, 2015. Summaries of diseases and their causal agents diagnosed on crop samples submitted to the laboratory are presented in the following tables (1 to13) organized under crop category. 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, insect-related injury and damage where no conclusive causal factor was identified.

Table 1.0 Summary of diseases diagnosed on **Christmas tree** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Abies fraseri	Needle blight	*Hormonema* sp.	1
	Twig die-back	*Phomopsis* sp.	1
Pseudotsuga menziesii	Botryosphaeria canker	*Botryosphaeria dothidea*	1
	Phomopsis canker	*Phomopsis* sp.	1

Table 2.0 Summary of diseases diagnosed on **field crop** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No of samples
Alfalfa	Root rot	*Cylindrocarpon* sp.	1
	Nematode damage	*Pratylenchus* sp., *Paratylenchus* sp.	1
	Stem and leaf blight	*Phoma medicaginis*	1
Corn	Fusarium stalk rot	*Fusarium subglutinans*	1
Spelt	Kernel mold	*Chaetomium globosum*	1

Table 3.0 Summary of diseases diagnosed on **forest nursery** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Picea glauca	Root rot	*Pythium* sp.	1

Table 4.0 Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Antirrhinum	Rust	*Puccinia antirrhini*	1
Calamagrostis	Leaf spot	*Alternaria* sp., *Cladosporium* sp.	1
	Rust	*Puccinia* sp.	1
Calamagrostis acutiflora	Anthracnose	*Colletotrichum graminicola*	1
	Rhizoctonia leaf blight	*Rhizoctonia solani*	1
Campanula	Cucumber mosaic	*Cucumber mosaic virus*	1
Celosia	Root rot	Oomycete	1
Dahlia	Foliar blight	*Botrytis cinerea*	1
	Leaf spot	*Phyllosticta* sp.	1
	Root rot	*Pythium* sp.	1
	Stem canker	*Rhizoctonia solani*	1
Dracaena	Root rot	*Phytophthora* sp.	1
Echeveria	Stem rot	*Pestalotiopsis* sp.	1

Table 4.0 (contd.)

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Echinacea	Powdery mildew	*Erysiphe cichoracearum*	1
	Stem rot	*Botrytis cinerea*	1
Geum florifera	Root rot	*Thielaviopsis basicola*	1
Helianthus	Downy mildew	*Plasmopara* sp.	1
	Stem rot	*Pythium* sp.	1
Iris	Leaf streaking (yellow)	Potyvirus	1
Nepeta cataria	Downy mildew	*Peronospora* sp.	1
Paeonia	Botrytis blight	*Botrytis cinerea*	1
Salvia officinalis	Downy mildew	*Peronospora lamii*	1
Sedum	Anthracnose	*Colletotrichum* sp.	1
	Root rot	*Fusarium* sp.	1
	Septoria leaf spot	*Septoria sedi*	1
Tulipa	Nematode damage	*Ditylenchus* sp.	1
		Pratylenchus sp., *Ditylenchus* sp., *Aphelenchoides* sp.	

Table 5.0 Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Cucumber	Alternaria leaf spot	*Alternaria* sp.	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Leaf spot	*Alternaria* sp., *Ascochyta* sp., *Phoma* sp. and *Cladosporium* sp.	1
	Pythium root rot	*Pythium* sp.	2
Pepper	Fusarium stem rot	*Fusarium solani*	1
		Nectria haematococca	1
	Root rot	*Phytophthora* sp.	1
		Pythium sp.	2
	Vascular wilt	*Fusarium oxysporum*	1
Tomato	Bacterial canker	*Clavibacter michiganensis* subsp. *michiganensis*	1
	Leaf mold	*Passalora fulva*	1

Table 6.0 Summary of diseases diagnosed on **herbaceous ornamental plant** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Carex	Anthracnose	*Colletotrichum graminicola*	1
	Root rot	Oomycete	1
	Root rot	*Rhizoctonia solani*	1
	Rust	*Puccinia* sp.	1
Festuca	Foliar blight	*Ascochyta* sp.	1
	Root rot	*Pythium* sp.	1
Geum	Leaf bronzing	*Aphelenchoides* sp.	1
Heuchera	Leaf spot	*Botrytis cinerea*	1

Table 7.0 Summary of diseases diagnosed on **nut crop** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Walnut	Armillaria root rot	*Armillaria nabsnona*	1
	Phomopsis canker	*Phomopsis* sp.	1

Table 8.0 Summary of diseases diagnosed on **small fruit (berry)** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Blackberry	Spur blight	*Didymella applanata*	1
Blueberry	Anthracnose	*Colletotrichum gloeosporioides*	2
	Armillaria root rot	*Armillaria cepistipes*	1
		Armillaria nabsnona	1
		Armillaria sp.	3
	Bacterial blight	*Pseudomonas syringae*	5
	Blueberry Scorch	Blueberry scorch virus (BlScV)	8
	Blueberry Shock	Blueberry shock virus (BlShV)	3
	Coniothyrium canker	*Coniothyrium* sp.	9
	Fruit rot	*Botrytis cinerea*	1
	Godronia canker	*Fusicoccum putrefaciens*	1
	Leaf spot	*Alternaria* sp.	5
		Botrytis cinerea	2
		Corynespora sp.	1
		Phyllosticta sp.	1
	Mummy berry	*Monilinia vaccinii-corymbosi*	1

Table 8. (contd.)

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Blueberry	Phomopsis canker	*Phomopsis* sp.	19
	Phytophthora root rot	*Phytophthora* sp.	15
	Stem canker	*Phomopsis* sp., *Fusicoccum* sp.	1
		Phomopsis sp., *Coniothyrium* sp.	1
	Twig blight	*Botrytis cinerea*	2
		Colletotrichum acutatum	3
		Sporocadus sp.	7
	Twig canker	*Cytospora* sp.	1
Cranberry	Twig canker	*Cytospora* sp.	2
	Fruit rot	*Coleophoma empetri*	1
	Fruit rot	*Discosia* sp.	1
	Godronia canker/end rot	*Fusicoccum putrefaciens*	1
	Leaf spot	*Allantophomopsis cytisporea*	3
		Botryosphaeria sp.	1
	Nematode damage	*Paratrichodorus renifer*	2
	Twig blight	*Coniothyrium* sp.	1
	Upright dieback	*Phomopsis* sp.	2
Haskap	Stem canker	*Diplodina* sp.	1
		Sporocadus sp.	1
Raspberry	Anthracnose	*Colletotrichum gloeosporioides*	1
	Cane blight	*Botrytis cinerea*	1
		Coniothyrium sp.	1
	Nematode damage	*Pratylenchus* sp.	5
		Pratylenchus sp., *Xiphinema* sp.	2
	Phomopsis canker	*Phomopsis* sp.	1
	Phytophthora root rot	*Phytophthora* sp.	3
	Powdery mildew	*Sphaerotheca macularis*	2
	Spur blight	*Didymella applanata*	3
	Stem blight	*Botrytis cinerea*	1
Strawberry	Crown and root rot	*Cylindrocarpon* sp.	2
	Black root rot	*Rhizoctonia* sp., *Cylindrocarpon* sp., *Fusarium* sp., *Pratylenchus* sp.	5
	Leaf blotch	*Gnomonia comari*	4
	Leaf spot	*Botrytis cinerea, Alternaria* sp., *Coniella fragariae*	1
	Nematode damage	*Pratylenchus* sp.	6
	Phytophthora root rot	*Phytophthora* sp.	4
	Powdery mildew	*Sphaerotheca macularis* f.sp*. fragariae*	1
	Root rot	*Rhizoctonia fragariae*	10
		Rhizoctonia solani	5
		Phytophthora sp., *Rhizoctonia* sp.	1
	Verticillium wilt	*Verticillium dahliae*	1
		Verticillium sp.	5

Table 9.0 Summary of diseases diagnosed on **specialty crop** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015.

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Basil	Root rot	*Rhizoctonia* sp.	1
Ginseng	Alternaria blight	*Alternaria panax*	2
	Phytophthora root rot	*Phytophthora* sp.	1
	Root rot	*Cylindrocarpon destructans*	3
		Rhizoctonia sp.	3
Hop	Apple mosaic	Apple mosaic virus (ApMV)	3
	Downy mildew	*Peronospora humuli*	1
Wasabi japonica	Powdery mildew	*Erysiphe cruciferarum*	1
Wasabi cv. 'Daruma'	Leaf and petiole blight	*Phytophthora cryptogea*	1
	Leaf spot	*Pseudomonas syringae* pv. *maculicola*	1
Wheatgrass	Mold growth (seed)	*Rhizopus* sp., *Mucor* sp.	1
		Rhizopus sp., *Penicillium* sp.	1
	Mold growth (seedling)	*Trichoderma* sp., *Alternaria* sp., *Penicillium* sp.	1

Table 10.0 Summary of diseases diagnosed on **tree fruit** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Apple	Bacterial canker	*Pseudomonas syringae* pv. *syringae*	1
	Botryosphaeria canker	*Botryosphaeria* sp.	1
	Phytophthora root rot	*Phytophthora* sp.	1
Cherry	Bacterial canker	*Pseudomonas syringae*	6
	Crown rot	*Phytophthora* sp.	1
	Fruit rot	*Alternaria* sp.	2
	Nematode damage	*Mesocriconema* sp.	1
	Postharvest rot	*Aureobasidium pullulans*	4
	Root rot	*Cylindrocarpon* sp., *Fusarium* sp.	1
Grape	Powdery mildew	*Uncinula necator*	1
	Stem canker	*Cadophora luteo-olivacea*	1
Peach	Fruit spot	*Alternaria* sp.	1
	Leaf spot	*Alternaria* sp.	1
	Powdery mildew	*Podosphaera* sp.	1
	Scab	*Cladosporium* sp.	1
Pear	Cytospora canker	*Cytospora* sp.	1

Table 11.0 Summary of diseases diagnosed on **golf course, sod, lawn and sports field turfgrass** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015.

SOURCE	**DISEASE/SYMPTOM**	**CAUSAL/ASSOCIATED ORGANISM**	**No. of samples**
Golf green	Anthracnose	*Colletotrichum graminicola*	2
	Curvularia blight	*Curvularia* sp.	2
	Fairy ring	Basidiomycete fungus	2
	Foliar blight	*Ascochyta* sp., *Pythium* sp., *Fusarium* sp., *Phyllosticta* sp.	1
		Curvularia sp., *Fusarium* sp.	1
		Rhizoctonia sp., *Curvularia* sp., *Leptosphaerulina* sp.	1
	Fusarium blight	*Fusarium* sp.	1
	Localized dry spot	Basidiomycete fungus	1
	Nematode damage	*Helicotylenchus* sp., *Paratrichodorus* sp.	1
		Helicotylenchus sp.	2
		Meloidogyne sp.	3
		Tylenchorhynchus sp.	1
		Meloidogyne sp., *Paratrichodorus* sp., *Pratylenchus* sp.	1
	Root rot	*Pythium* sp.	3
	Rhizoctonia patch	*Rhizoctonia* sp.	2
	Yellow patch	*Rhizoctonia cerealis*	2
Lawn	Brown patch	*Rhizoctonia solani*	1
	Curvularia blight	*Curvularia lunata*	2
	Foliar blight	*Curvularia* sp., *Ascochyta* sp., *Fusarium* sp.	1
	Leaf spot	*Drechslera* sp.	1
	Nematode damage	*Meloidogyne* sp., *Helicotylenchus* sp., *Mesocriconema* sp.	1
		Pratylenchus sp., *Mesocriconema* sp.	1
	Root rot	*Pythium* sp.	2
Sod	Brown patch	*Rhizoctonia solani*	1
	Fusarium blight	*Fusarium avenaceum*	1
	Leptosphaerulina blight	*Leptosphaerulina* sp.	1
	Powdery mildew	*Blumeria graminis*	1

Table 12.0 Summary of diseases diagnosed on **field vegetable** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Bean	Pod mosaic and deformation	Bean yellow mosaic virus (BYMV)	1
Beet	Alternaria leaf spot	*Alternaria* sp.	3
	Phoma root rot	*Phoma betae*	2
	Powdery mildew	*Erysiphe polygoni*	1
	Storage rot	*Fusarium* sp.	3
Brussel sprout	Bacterial soft rot	*Pseudomonas marginalis*	1
Carrot	Alternaria leaf blight	*Alternaria dauci*	1
	Nematode damage	*Pratylenchus* sp.	1
	Nematode damage	*Meloidogyne* sp., *Pratylenchus* sp., *Paratylenchus* sp.	1
Cole crop	Club root	*Plasmodiophora brassicae*	1
Cucumber	Fusarium wilt	*Fusarium oxysporum*	1
Garlic	Blue mold	*Penicillium* sp.	2
	Botrytis rot	*Botrytis porri*	1
	Embellisia skin blotch	*Embellisia allii*	3
	Fusarium basal rot	*Fusarium culmorum*	1
	Fusarium bulb rot	*Fusarium proliferatum*	1
	Leaf blight	*Botrytis allii*	1
	Nematode damage	*Ditylenchus* sp., *Aphelenchoides* sp.	1
		Ditylenchus dipsaci	1
	Scale blotch	*Colletotrichum* sp.	1
	Soft rot	*Pseudomonas marginalis*	1
	Stalk and leaf necrosis	*Pantoea agglomerans*	1
	White rot	*Sclerotium cepivorum*	1
Kale	Petiole canker	*Botrytis cinerea*	1
	Spots on stem	*Alternaria* sp.	1
Lettuce	Powdery mildew	*Erysiphe cichoracearum*	1
	Root damage	*Pratylenchus* sp.	1
	Root rot	*Cylindrocarpon* sp.	1
Pepper	Leaf mottle and necrosis	Tomato spotted wilt virus (TSWV)	1
	Leaf spot	*Alternaria* sp., *Cladoposrium* sp.	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Verticillium wilt	*Verticillium dahliae*	1
Potato	Black scurf	*Rhizoctonia solani*	3
	Dry rot	*Fusarium solani*	2
	Silver scurf	*Helminthosporium solani*	2
	Verticillium wilt	*Verticillium dahliae*	2
Rhubarb	Anthracnose	*Colletotrichum* sp.	5
	Ascochyta leaf spot	*Ascochyta* sp.	1

Table 12.0 (contd.)

CROP	**DISEASE/SYMPTOM**	**CAUSAL/ASSOCIATED ORGANISM**	**No. of samples**
Rhubarb	Crown and root rot	*Cylindrocarpon* sp., *Pratylenchus* sp.	1
		Cylindrocarpon liriodendri	3
		Cylindrocarpon sp.	3
	Leaf spot	*Phoma rhei*	3
	Ramularia leaf spot	*Ramularia rhei*	2
	Root damage	*Pratylenchus* sp., *Paratylenchus* sp.	1
		Pratylenchus sp.	5
	Root rot	*Cylindrocarpon* sp.	1
		Rhizoctonia sp.	1
Spinach	Leaf spot	*Cladosporium* sp.	1
Squash	Fruit blotch	*Pseudomonas syringae* pv. *lachrymans*	1
	Gummy stem blight	*Didymella bryoniae*	1
Watermelon	Alternaria blight	*Alternaria* sp.	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Powdery mildew	*Sphaerotheca fuliginea*	1
Zucchini	Bacterial leaf spot	*Pseudomonas syringae*	4
	Fusarium wilt	*Fusarium oxysporum*	3
	Leaf spot	*Alternaria* sp.	1
	Powdery mildew	*Sphaerotheca fuliginea*	4

Table 13.0 Summary of diseases diagnosed on **woody ornamental** samples submitted to the B.C. Ministry of Agriculture, Plant Health Laboratory in 2015

CROP	**DISEASE/SYMPTOM**	**CAUSAL/ASSOCIATED ORGANISM**	**No. of samples**
Acer	Anthracnose	*Discula* sp.	1
		Kabatiella sp.	1
	Botryosphaeria canker	*Botryodiplodia* sp.	1
	Cytospora canker	*Cytospora* sp.	1
	Leaf spot	*Alternaria alternata*	1
	Leaf spot	*Alternaria* sp.	1
	Phomopsis canker	*Diaporthe* sp.	3
	Verticillium wilt	*Verticillium* sp.	1
Acer palmatum	Anthracnose	*Discella* sp.	1
		Kabatiella apocrypta	1
	Botryosphaeria canker	*Botryodiplodia* sp.	1
	Twig canker	*Diplodina* acerina	2
Araucaria araucana	Twig dieback	*Botryodiplodia* sp.	1
Arbutus	Leaf spot	*Coccomyces* sp., *Pestalotiopsis* sp.	1
Buxus	Boxwood blight	*Cylindrocladium pseudonaviculatum*	3
	Leaf spot	*Phoma* sp.	1
	Leaf spot	*Colletotrichum* sp.	1
	Volutella blight	*Volutella buxi*	5
Calluna	Botrytis blight	*Botrytis cinerea*	1
Celtis	Phomopsis canker	*Phomopsis* sp.	1
Chamaecyparis lawsoniana	Rotted roots	*Pythium intermedium*	1
Cercis canadensis	Botryosphaeria dieback	*Botryosphaeria* sp.	1
Cornus	Septoria leaf spot	*Septoria cornicola*	1
Corylus	Eastern filbert blight	*Anisogramma anomala*	1
Cotoneaster	Fire blight	*Erwinia amylovora*	1
Crataegus	Fire blight	*Erwinia amylovora*	1
Cryptomeria	Needle blight/canker	*Pestalotiopsis* sp., *Diaporthe* sp.	1
Euonymus	Root rot	Oomycete	1
Euonymus fortunei	Leaf spot	*Pestalotia* sp.	1
	Stem canker	*Phomopsis* sp.	1
Fraxinus	Coin canker	*Neofabrea alba*	1
Gaultheria	Anthracnose	*Glomerella cingulata*	1
	Phomopsis canker	*Phomopsis* sp.	1
	Root rot	*Phytophthora* sp.	1
Hippophae rhamnoides	Bacterial blight	*Pseudomonas syringae*	1
	Leaf spot	*Pestalotiopsis* sp.	1
	Phomopsis canker	*Phomopsis* sp.	3

Table 13.0 (contd.)

CROP	**DISEASE/SYMPTOM**	**CAUSAL/ASSOCIATED ORGANISM**	**No. of samples**
Juniperus	Foliar blight	*Lophodermium* sp.	1
	Root rot	*Pythium* sp.	1
Lavandula angustifolia	Root rot	*Phytophthora* sp.	2
Liriodendron tulipifera	Phomopsis canker	*Phomopsis* sp.	1
	Twig canker	*Dothiorella* sp.	1
Mahonia	Black root rot	*Thielaviopsis basicola*	1
Malus	Alternaria blotch	*Alternaria* sp.	2
	Apple scab	*Venturia inaequalis*	1
	Bacterial canker	*Pseudomonas syringae*	3
	Cytospora canker	*Cytospora* sp.	3
	European canker	*Nectria galligena*	1
	Phomopsis canker	*Phomopsis* sp.	1
	Storage mold (root stock)	*Botrytis cinerea*	3
Picea glauca	Root rot	*Pythium* sp.	1
Pinus	Coryneum blight	*Seiridium cardinale*	1
	Foliar blight	*Sclerophoma* sp.	2
	Pestalotiopsis blight	*Pestalotiopsis* sp.	1
Pinus jeffreyi	Western gall rust	*Endocronartium harknessii*	1
Populus	Blister blight	*Taphrina populi-salicis*	1
	Foliar blight	*Septoria musiva*	1
		Venturia macularis	1
	Leaf spot	*Alternaria* sp.	4
		Phyllosticta sp.	1
Populus balsamifera	Armillaria root rot	*Armillaria nabsnona*	1
Prunus	Bacterial canker	*Pseudomonas syringae* pv. *syringae*	2
	Crown rot	*Phytophthora* sp.	1
	Leaf spot	*Alternaria* sp.	1
	Root rot	*Thielaviopsis basicola*	2
	Twig blight	*Colletotrichum gloeosporioides*	1
Pseudotsuga menziesii	Cytospora canker	*Cytospora* sp.	1
	Laminated root rot	*Phellinus weirii*	2
	Needle blight	*Hormonema merioides*	1
		Sclerophoma sp., *Hormonema* sp.	1
	Needle cast	*Rhizosphaera kalkhoffii*	1
		Rhizosphaera sp.	1
Rhododendron	Anthracnose	*Colletotrichum* sp.	1
	Armillaria root rot	*Armillaria* sp.	1
	Leaf spot	*Ascochyta* sp.	1
		Hendersonia sp., *Seimatosporium* sp.	1
		Pestalotia sp.	1

Table 13.0 (contd.)

CROP	DISEASE/SYMPTOM	CAUSAL/ASSOCIATED ORGANISM	No. of samples
Rhododendron	Leaf spot and twig blight	*Pestalotia rhododendri*	1
	Powdery mildew	*Microsphaera* sp.	1
	Root rot	*Phytophthora* sp.	1
Salix	Valsa canker	*Cytospora* sp.	1
Sequoiadendron	Foliar and stem blight	*Monochaetia* sp., *Pestalotiopsis* sp., *Hormonema* sp.	1
	Needle blight	*Pestalotiopsis* sp.	1
Shepherdia	Leaf spot	*Septoria* sp.	1
Sorbus	Fire blight	*Erwinia amylovora*	2
	Phomopsis canker	*Phomopsis* sp.	1
	Root rot	*Phytophthora* sp.	1
Syringa	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	2
	Root rot	*Phytophthora* sp.	1
Taxus	Needle blight	*Macrophoma* sp.	2
Taxus baccata	Root rot	*Phytophthora* sp.	1
Thuja	Crown and root rot	*Phytophthora* sp.	3
	Seiridium blight	*Seiridium cardinale*	1
	Twig blight	*Monochaetia* sp.	1
Thuja plicata	Foliar blight	*Pestalotiopsis* sp.	2
Tilia	Bacterial blight	*Pseudomonas syringae* pv. *syringae*	2
Ulmus	Stem canker	*Botryosphaeria dothidea*	1
Vaccinium	Anthracnose	*Colletotrichum gloeosporioides*	2
Viburnum	Phomopsis canker	*Phomopsis* sp.	1
	Twig dieback	*Botryosphaeria* sp.	1

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

LOCATION: British Columbia

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TITLE: DISEASES DIAGNOSED ON ORNAMENTAL NURSERY AND LANDSCAPE CROPS IN 2015.

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 2015 are listed. This is the first report of anthacnose of *Philadelphus caused by Colletotrichum trichellum* (Fr.) Duke (*Glomerella* sp.). The cause of anthracnose of *Rhododendron* first reported in BC in 2011 as *Colletotrichum acutatum* was confirmed to be *Glomerella acutata* (Guerber and J. C. Correll) (anamorph *C. acutatum*). Both of these species were identified by DNA sequencing and comparison to sequences in GenBank by BLAST analysis.

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 these 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 2015 on ornamental nursery and landscape crops in British Columbia by Elmhirst Diagnostics & Research and Karlsson Crop Consulting

CROP	SYMPTOM/DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Abies balsamea	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Abies procera	Root rot	*Pythium* sp. / *Phytophthora* sp.	2
Acer circinatum	Powdery mildew	*Sawadaea* sp.	1
Acer glabrum	Bacterial leaf spot	*Pseudomonas syringae*	1
Acer macrophyllum	Powdery mildew	*Sawadaea bicornis*	2
Agapanthus sp.	Crown rot	Soft rot bacteria	1

Table 1 (contd.)

Ajuga reptans 'Chocolate Chip'	Botrytis blight	*Botrytis cinerea*	1
Amelanchier alnifolia	Powdery mildew	*Podosphaera* sp.	2
Andromeda polifolia 'Blue Ice'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Araucaria araucana	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Arctostaphylos uva-ursi	Anthracnose	*Colletotrichum gloeosporioides*	1
Arctostaphylos rubra	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Arbutus menziesii	Root rot	*Phytophthora cinnamomi*	2
Arrhenatherum elatius bulbosum 'Variegatum'	Rust	*Puccinia coronata*	2
Asplenium x *ebenoides*	Root rot / dieback	*Pythium* spp.	1
Athyrium filix-femina 'Victoriae', 'Lady in Red'	Root rot /dieback	*Pythium* spp.	1
Athyrium niponicum 'Metallicum'	Root rot /dieback	*Pythium* spp.	1
Athyrium niponicum 'Pictum' x *Athyrium filix-femina* 'Ghost'	Root rot /dieback	*Pythium* spp.	1
Athyrium niponicum 'Regal Red'	Root rot /dieback	*Pythium* spp.	1
Betula glandulosa	Rust	*Melampsoridium betulinum*	1
Betula papyrifera	Leaf spot / shot hole	Unidentified	1
Betula platyphylla 'Parkland Pillar'	Leaf spot / shot hole	Unidentified	1
Blechnum spicant	Root rot /dieback	*Pythium* spp.	2
Buxus sempervirens 'Suffruticosa'	Box blight	*Cylindrocladium buxicola*	2
Buxus sempervirens 'Suffruticosa'	Volutella blight	*Volutella buxi*	2
Buxus sempervirens 'Suffruticosa'	Fusarium blight	*Cyanonectria buxi (Fusarium buxicola = Fusarium lateritium* var. *buxi)*	2
Buxus microphylla koreana x *sempervirens* 'Green Velvet'	Box blight	*Cylindrocladium buxicola*	1
Buxus microphylla koreana x *sempervirens* 'Green Velvet'	Fusarium blight	*Cyanonectria buxi (Fusarium buxicola = Fusarium lateritium* var. *buxi*	1
Buxus microphylla koreana x *sempervirens* 'Winter Gem', 'Green Gem', 'Green Mountain','Green Velvet'	Volutella blight	*Volutella buxi*	4
Calluna vulgaris 'Silver Knight', 'Sun Sprinkles'	Web blight / dieback	*Rhizoctonia solani*	2
Calluna vulgaris 'Allegro', 'Hoyerhagen', 'Rosita' 'Silver Knight', 'Spring Torch', 'Sun Sprinkles', 'Susanne'	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	7

Table 1 (contd.)

Caragana pygmaea	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Cercis canadensis 'Ruby Falls', 'Hearts of Gold'	Leaf shothole	Unidentified (*Pseudocercospora*?)	2
Chamaecyparis pisifera 'Sungold'	Root rot	*Phytophthora* sp.	1
Clematis x 'Esme' and others	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	2
Colocasia esculenta	Root rot	*Pythium* sp. / *Phytophthora* sp. / *Rhizoctonia sp. / Fusarium* sp.	3
Cornus canadensis	Black root rot	*Thielaviopsis basicola*	1
Cornus alba 'Ivory Halo', 'Sibirica','Sibirica Pearls'	Septoria leaf spot	*Septoria cornicola*	3
Cornus nutallii	Powdery mildew	Unidentified	1
Cornus nutallii	Root rot /dieback	*Pythium* sp. / *Phytophthora* sp.	1
Cornus sericea	Septoria leaf spot	*Septoria cornicola*	1
Cornus sericea 'Kelseyi'	Septoria leaf spot	*Septoria cornicola*	1
Cornus sericea 'Kelseyi'	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Cornus sanguinea 'Midwinter Fire'	Septoria leaf spot	*Septoria cornicola*	1
Cotoneaster acutifolia	Fungal leaf spot	Unidentified	1
Daphne x *burkwoodii* 'Carol Mackie'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Daphne x *medfordensis* 'Lawrence Crocker'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Dianthus gratianopolitanus 'Tiny Rubies'	Botrytis blight	*Botrytis cinerea*	1
Dryopteris atrata	Root rot / dieback	*Pythium* spp.	1
Dryopteris carthusiana	Root rot / dieback	*Pythium* spp.	1
Dryopteris filix-mas 'Crispa Cristata'	Root rot / dieback	*Pythium* spp.	1
Dryopteris wallichiana	Root rot / dieback	*Pythium* spp.	1
Empetrum nigrum	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Erica carnea 'Kramer's Red'	Leaf dieback / stem canker / root rot	*Rhizoctonia solani / Phytophthora* sp.	2
Erysimum linifolium	Botrytis grey mould	*Botrytis cinerea*	1
Erysimum linifolium	Rhizoctonia canker /dieback	*Rhizoctonia solani*	1
Erysimum linifolium	Root and crown rot	*Pythium* sp. / *Phytophthora* sp.	1
Euonymus japonicus 'Rokujo Variegata'	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Festuca glauca 'Beyond Blue'	Root and crown rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Forsythia x *intermedia* 'Fiesta'	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Forsythia x 'New Hampshire Gold'	Bacterial leaf spot	*Pseudomonas syringae*	1
Fragaria vesca	Powdery mildew	*Podosphaera aphanis*	1

Table 1 (contd.)

Fragaria x *vescana* 'Sparkle'	Powdery mildew	*Podosphaera aphanis*	1
Gardenia jasminoides 'Summer Snow'	Fungal leaf spot	*Cladosporium* sp.	1
Gaultheria procumbens	Anthracnose	*Colletotrichum gloeosporioides*	3
Hebe odora (Hebe buxifolia)	Fusarium wilt	*Fusarium* sp.	1
Hebe cupressoides 'McKean'	Downy mildew	*Peronospora grisea*	1
Helictotrichon sempervirens 'Saphirsprudel'	Rust	*Puccinia* sp.	2
Heuchera x 'Plum Pudding' and other	Rust		4
Heuchera x 'Plum Pudding', 'Brown Sugar', 'Black Out'	Botrytis blight	*Botrytis cinerea*	3
Heuchera x 'Plum Pudding', 'Brown Sugar', 'Blackout'	Root rot	*Pythium* sp. / *Phytophthora* sp.	3
Hosta x 'City Lights', 'Dream Weaver', 'Hotspur', 'Moonstruck', 'Ocean Isle'	Transparent leaf blotches / bacterial soft rot / botrytis	*Erwinia* spp./ *Botrytis cinerea*	5
Hosta x 'Fire and Ice'	Bacterial blight	Unidentified	1
Hydrangea arborescens 'Annabelle'	Bacterial blight / leaf spot	*Pseudomonas syringae*	1
Hydrangea quercifolia 'Gatsby Pink'	Rhizoctonia web blight	*Rhizoctonia* sp.	1
Hydrangea quercifolia 'Gatsby Pink', 'Pee Wee'	Bacterial leaf spot	*Pseudomonas syringae*	2
Hydrangea macrophylla 'Lets Dance Blue Jangles'	Rhizoctonia web blight	*Rhizoctonia* sp.	1
Hydrangea macrophylla 'Goldrush (Nehyosh)'	Leaf spot / secondary botrytis	*Ascochyta hydrangeae / Botrytis cinerea*	1
Hydrangea macrophylla 'Goldrush (Nehyosh)'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Hydrangea petiolaris	Bacterial leaf spot	*Pseudomonas syringae*	1
Hyssopus officinalis	Botrytis blight	*Botrytis cinerea*	1
Iberis sempervirens 'Little Gem'	Root rot / yellowing	*Pythium* sp. / *Phytophthora* sp.	1
Juniperus chinensis 'Blue Point'	Root rot / dieback	*Phytophthora* sp.	1
Juniperus communis 'Gold Cone'	Root rot / dieback	*Phytophthora* sp.	1
Juniperus communis var. *montana*	Root rot / dieback	*Phytophthora* sp.	1
Juniperus horizontalis 'Blue Chip', 'Blue Prince','Gold Strike', 'Icee Blue', 'Limeglow', 'Mother Lode', 'Prince of Wales','Wiltonii', 'Youngstown','Yukon Belle'	Root rot / dieback	*Phytophthora* sp.	24
Juniperus procumbens 'Nana'	Root rot / dieback	*Phytophthora* sp.	5

Table 1 (contd.)

Juniperus sabina ‘Blue Danube’, ‘Blue Forest’, ’Buffalo’, ‘Calgary Carpet’, ‘Monard (Moor-dense)’, ‘New Blue Tam’, ‘Scandia’	Root rot / dieback	*Phytophthora* sp.	12
Juniperus scopulorum ‘Medora’			2
Juniperus squamata ‘Blue Star’	Root rot / dieback	*Phytophthora* sp.	3
Kalmia latifolia ‘Carousel’, ‘Elf’,’Heart of Fire’, ‘Kaleidoscope’,’Ostbo Red’, ‘Pristine’, ‘Sarah’	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	7
Larix decidua	Root rot / dieback	*Phytophthora* sp.	1
Larix sibirica	Root rot / dieback	*Phytophthora* sp.	1
Linnaea borealis	Root rot / dieback	*Phytophthora* sp.	2
Lithodora diffusa ‘Grace Ward’	Root rot / yellowing	*Pythium* sp. / *Phytophthora* sp.	1
Lonicera ciliosa	Powdery mildew	*Erysiphe* sp.	1
Lonicera caerulea ‘Cinderella’	Root rot / dieback	*Phytophthora* sp.	1
Magnolia x *loebneri ‘Spring Welcome’*	Root rot / dieback	*Phytophthora* sp.	1
Magnolia stellata ‘Royal Star’	Bacterial blight	*Pseudomonas syringae*	1
Magnolia x *soulangeana* 'Susan'	Bacterial blight	*Pseudomonas syringae*	1
Magnolia virginiana ‘Moonglow’	Root rot / dieback	*Phytophthora* sp.	1
Mahonia nervosa	Root rot / dieback	*Phytophthora* sp.	1
Malus fusca	Powdery mildew	*Podosphaera leucotricha*	1
Malus x ‘Gladiator’, ‘Pink Spire’, ‘Purple Spire’, ‘Spring Snow’, ‘Starlight’, ‘Thunderchild’	Scab	*Venturia inaequalis*	9
Matteuccia struthiopteris	Root rot	*Pythium* spp.	1
Microbiota decussata	Root rot	*Phytophthora* sp.	2
Musa basjoo	Botrytis leaf blight	*Botrytis cinerea*	1
Ophiopogon planiscapus ‘Nigrescens’	Root rot / dieback	*Pythium* spp.	1
Osmunda cinnamomea	Root rot / dieback	*Pythium* spp.	1
Pachysandra terminalis	Volutella blight	*Volutella pachysandrae*	2
Paeonia lactiflora	Botrytis blight and leaf spot	*Botrytis cinerea*	2
Parthenocissus quinquefolia ‘Engelmannii’	Downy mildew	*Plasmopara* sp.	1
Parthenocissus quinquefolia ‘Engelmannii’	Bacterial leaf spot	*Pseudomonas syringae*	1
Paxistima myrsinites	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	2

Table 1 (contd.)

Philadelphus coronarius 'Aureus'	Bacterial blight	*Pseudomonas syringae*	1
Philadelphus x *virginalis 'Galahad'*	Anthracnose	*Colletotrichum trichellum**	1
Phlox drummondii	Downy mildew	*Peronospora phlogina*	1
Phlox subulata 'Blue Moss', 'Snowflake'	Downy mildew	*Peronospora phlogina*	2
Phormium tenax	Botrytis leaf spot	*Botrytis cinerea*	1
Photinia x *fraseri*	Fungal leaf spot	*Entomosporium maculatum*	1
Phyllitis scolopendrium	Root rot / dieback	*Pythium* sp. / *Rhizoctonia* sp.	1
Physocarpus opulifolius 'Amber Jubilee', 'Coppertina', 'Diabolo', 'Summer Wine'	Powdery mildew	*Podosphaera aphanis* var. *physocarpi*	4
Picea abies 'Little Gem', 'Pumila Nigra'	Root rot / dieback	*Phytophthora* sp.	2
Picea abies 'Little Gem'	Fungal blight / shoot dieback	*Phomopsis* sp. / *Botrytis cinerea*	2
Picea glauca var. albertiana 'Conica'	Root rot / dieback	*Phytophthora* sp	1
Picea nidiformis	Root rot / dieback	*Phytophthora* sp	1
Picea sitchensis	Root rot / dieback	*Phytophthora* sp.	1
Picea sitchensis	Shoot tip dieback	*Phomopsis* sp.	1
Pieris japonica 'Flaming Silver', 'Mountain Fire', 'Prelude', 'Valley Valentine'	Fungal blight	*Phomopsis* sp.	4
Pieris japonica 'Mountain Fire'	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Pinus mugo 'Slowmound'	Root rot / dieback	*Phytophthora* sp.	1
Podocarpus lawrencei 'Blue Gem'	Root rot / dieback	*Phytophthora* sp.	1
Polystichum acrostichoides	Root rot	*Pythium* spp.	2
Polystichum braunii	Root rot / dieback	*Pythium* spp.	2
Polystichum munitum	Root rot / dieback	*Pythium* spp.	1
Polystichum polyblepharum	Root rot / dieback		1
Populus tremuloides	Bacterial blight	*Pseudomonas syringae*	2
Populus trichocarpa	Rust	*Melampsora* sp.	1
Populus x *tristis*	Rust	*Melampsora* sp.	1
Potentilla fruticosa 'Dakota Goldrush'	Powdery mildew	*Podosphaera aphanis*	1
Potentilla fruticosa 'Marian Red Robin'	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Prunus emarginata	Bacterial blight	*Pseudomonas syringae*	1
Prunus pensylvanica	Bacterial blight / stem canker	*Pseudomonas syringae*	3

Table 1 (contd.)

Prunus virginiana	Bacterial blight	*Pseudomonas syringae*	2
Prunus x *kerrasis* 'Crimson Passion'	Bacterial blight	*Pseudomonas syringae*	1
Prunus x *kerrasis* 'Cupid'	Bacterial blight	*Pseudomonas syringae*	2
Prunus x *kerrasis* 'Cupid'	Rhizoctonia root rot	*Rhizoctonia solani*	1
Prunus x *kerrasis* 'Cupid'	Black root rot	*Thielaviopsis basicola*	1
Prunus maackii 'Goldspur'	Black root rot	*Thielaviopsis basicola*	1
Prunus x 'Carmine Jewel'	Bacterial blight	*Pseudomonas syringae*	2
Pseudotsuga menziesii	Root rot / dieback	*Phytophthora* spp.	1
Rheum x *cultorum* 'Strawberry Red'	Stem rot	*Pythium* sp. and soft rot bacteria	1
Rhododendron impeditum	Root rot / dieback	*Phytophthora* spp.	1
Rhododendron x 'Lem's Cameo'; 'Polynesian Sunset'; 'Rose Walloper'	Anthracnose	*Glomerella acutata (Colletotrichum acutatum)**	3
Rhododendron x 'Hellikki'	Root rot	*Phytophthora* spp.	1
Rhododendron x 'Ramapo'	Root rot / dieback	*Phytophthora* spp.	1
Rhododendron x 'White Lights'	Powdery mildew	*Erysiphe azaleae*	1
Rosa pisocarpa	Powdery mildew	*Podosphaera pannosa*	1
Rosa x 'Adelaide Hoodless', 'JP Connell', 'Morden Blush', 'Morden Fireglow', 'Morden Sunrise; 'Never Alone', 'Pink Meidiland', 'Snow Beauty', 'White Meidiland', 'Winnipeg Parks'	Downy mildew	*Peronospora sparsa*	12
Rosa x 'Morden Sunrise'	Black spot	*Diplocarpon rosae*	2
Rosa x 'Winnipeg Parks'	Root rot / dieback	*Phytophthora* spp.	1
Rubus parviflorus	Bacterial leaf spot	*Pseudomonas syringae*	1
Salix exigua	Rust	*Melampsora* sp.	2
Salvia x 'Blue Queen'	Foliar nematodes	*Aphelenchoides* sp.	1
Sambucus racemosa 'Golden Glow'	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Sambucus racemosa 'Golden Glow', 'Sutherland Gold'	Foliar nematodes	*Aphelenchoides* sp.	2
Shepherdia canadensis	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Sempervivum 'Ruby Heart', 'Silver King'	Botrytis blight	*Botrytis cinerea*	2
Sequoiadendron giganteum	Root rot	*Phytophthora* spp.	1
Spirea japonica 'Dart's Red', 'Firelight', 'Flaming Elf', 'Goldflame', 'Goldmound',' Little Princess', 'Magic Carpet', 'Mini Sunglo', 'Neon Flash'	Powdery mildew	*Podosphaera* sp.	11

Table 1 (contd.)

Styrax japonica	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	1
Symphoricarpos albus	Powdery mildew	Erysiphales	2
Symphoricarpos x *doorenbosii* 'Magic Berry'	Powdery mildew	Erysiphales	1
Syringa vulgaris 'Beauty of Moscow', 'Charles Joly', 'Edward J. Gardener' 'President Grevy', 'Ivory Silk', 'Madame Lemoine', 'Sensation'	Bacterial blight and leaf spot	*Pseudomonas syringae*	10
Syringa vulgaris	Fungal leaf spot	Unidentified (*Phyllosticta)*?	1
Taxus baccata 'Fastigiata Aurea', 'Melford'	Root rot / dieback	*Phytophthora* sp.	3
Taxus brevifolia	Root rot / dieback	*Phytophthora* sp.	1
Taxus cuspidata 'Emerald Spreader', 'Morden', 'Nana Aurescens'			3
Taxus x *media* 'Hicksii', 'Hillii','Tauntonii'	Root rot / dieback	*Phytophthora* sp.	5
Thuja occidentalis'DeGroot's Spire', 'Little Giant Dwarf', 'Smaragd', 'Skybound'	Twig blight / tip blight	*Phomopsis* sp. / *Kabatina thujae / Pestalotiopsis funerea*	5
Thuja occidentalis Brandon', 'Danica', 'Daniello', 'Hetz Midget', 'Holmstrup','Harvest Moon', 'Golden Tuffet', 'Rheingold', 'Technito', 'Wareana'	Root rot / dieback	*Pythium* sp. / *Phytophthora* sp.	11
Tsuga canadensis	Root rot	*Phytophthora* sp.	1
Tsuga mertensiana	Root rot / dieback	*Phytophthora* sp.	1
Ulmus americana 'Brandon'	Black root rot	*Thielaviopsis basicola*	1
Ulmus americana 'Brandon'	Root rot	*Pythium* sp. */ Phytophthora* sp.	1
Ulmus americana 'Brandon'	Fusarium root and crown rot	*Fusarium lateritium*	1
Vaccinium alaskaense	Root rot / dieback	*Phytophthora* sp.	1
Vaccinium corymbosum 'Bluecrop'	Bacterial blight	*Pseudomonas syringae*	1
Vaccinium macrocarpon 'Hamilton'	Root rot / dieback	*Phytophthora* sp.	1
Vaccinium membranaceum	Root rot	*Phytophthora* sp.	1
Vaccinium ovatum	Root rot / dieback	*Phytophthora* sp.	2
Vaccinium parviflorum	Root rot	*Phytophthora* sp.	1
Vaccinium vitis-idaea	Root rot / dieback	*Phytophthora* sp.	2
Vaccinium vitis-idaea 'Koralle'	Root rot	*Phytophthora* sp.	1
Vaccinium x 'Northblue', 'Northsky', Pink Lemonade', 'Top Hat'	Fungal leaf spot	Unidentified	4

Table 1 (contd.)

Veronica spicata 'Royal Candles'	Fungal leaf spot	Unidentified	2
Viburnum trilobum 'Bailey's Compact'	Bacterial blight	*Pseudomonas syringae*	2
Viburnum opulus 'Nanum'	Downy mildew	*Plasmopara viburni*	1
Vinca minor	Bacterial leaf spot	*Pseudomonas syringae*	1
Vinca minor	Root rot	*Pythium* sp. / *Phytophthora* sp.	1
Weigela florida 'Minuet'	Foliar nematodes	*Aphelenchoides* sp.	1
Woodwardia fimbriata	Root rot	*Pythium* spp.	1
Total			**386**

*Confirmed by DNA sequencing and BLAST comparison to GenBank sequences.

CROPS: Commercial crops – Diagnostic Laboratory Report

LOCATION: Saskatchewan

NAMES AND AGENCIES:
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TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED IN 2015 TO THE SASKATCHEWAN MINISTRY OF AGRICULTURE CROP PROTECTION LABORATORY

ABSTRACT: Saskatchewan's Crop Protection Laboratory received 507 disease samples in 2015. The causes were fungi, bacteria, viruses, herbicide injury and environmental stress. Fifty - six percent of the samples were elm samples diagnosed with Dutch elm disease or Dothiorella wilt. Common problems diagnosed included wheat streak mosaic virus (WSMV) in cereals, herbicide injury on oilseeds and injury on many crops due to dry growing conditions that occurred from June until late July.

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 were also received from clients located in Alberta and Manitoba in 2015. 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, diseased samples are sent to research laboratories for identification of associated pathogens by other means such as polymerase chain reaction (PCR). Injuries suspected to be due to herbicide, nutrient, and / or fertilizer application are based on visual observation. Viral and bacterial diagnoses are also based on visible symptoms. Enzyme-linked immunosorbent assay **(**ELISA**)** testing is used to identify wheat streak mosaic virus (WSMV).

RESULTS: A total of 507 disease samples were submitted to the CPL from April 1 to October 20, 2015. Out of this, 56% (285 samples) were elm samples submitted for DED testing. Categories and percentages of samples received (excluding DED samples) were: special crops (35%), cereals (24.5%), oilseeds (18.6%), ornamental shade trees (other than elm) (9.1%), forages (7.7%), vegetables (3.2%) and fruit (1.8%). Hot dry conditions in May, June and early July of the year resulted in a high number of samples expressing moisture and / or heat stress symptoms. 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 2015 are presented in Tables 1 to 7 by crop category.

Table 1: Summary of diseases diagnosed on **cereal crop samples** submitted to the Saskatchewan Crop Protection Laboratory in 2015

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Barley	Spot blotch	*Cochliobolus sativus*	1
	Mold infestation	*Rhizopus* sp.	1
	Fusarium head blight	*Fusarium* sp.	3
	Environmental stress	Lack of moisture and / or excess heat	7
	Nutrient deficiency	Nitrogen deficiency	1
	Fertilizer injury	Fertilizer toxicity	1
	Virus	Wheat Streak Mosaic Virus	1
	Virus	Barley Yellow Dwarf Virus	1
Durum wheat	Virus	Wheat Streak Mosaic Virus	5
	Root rot	*Fusarium* sp., *Rhizoctonia* sp.	2
	Herbicide injury		1
	Environmental stress	Lack of moisture and / or excess heat	6
	Leaf spot	*Septoria tritici*	2
Oat	Leaf blotch	*Stagonospora avenae*	1
	Herbicide injury		1
	Environmental stress	Lack of moisture and / or excess heat	1
Wheat	Leaf streak	Wheat Streak Mosaic Virus	2
	Leaf spot	*Septoria* sp.	3
	Spot blotch	*Cochliobolus sativus*	1
	Prematurity blight		2
	Environmental stress	Lack of moisture and / or excess heat	8
	Physiological leaf spot		3

Table 2: Summary of diseases diagnosed on **specialty crop samples** submitted to the Saskatchewan Crop Protection Laboratory in 2015

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canaryseed	Herbicide injury		1
Chickpea	Herbicide injury		2
	Environmental stress	Lack of moisture and / or excess heat	2
	Root rot	*Fusarium* sp.	1
Coriander	Anthracnose	Undetermined	1
	Leaf blight	Undetermined	1
Faba bean	Environmental stress	Lack of moisture and / or excess heat	6
	Chocolate spot	*Botrytis* spp.	5
	Root rot	*Fusarium* sp., *Pythium* sp. *Aphanomyces* sp.	3
Field pea	Environmental stress	Frost, lack of moisture and / or excess heat	12
	Herbicide injury		7
	Root rot	*Fusarium* sp., *Pythium* sp. / *Aphanomyces* sp.	5
	Nutrient deficiency		2
	Leaf spot and pod spot	*Ascochyta pisi*	1
Lentil	Root rot	*Fusarium sp., Rhizoctonia* sp. *Pythium sp./ Aphanomyces* sp.	11
	Herbicide injury		10
	Environmental stress	*Lack of moisture and / or excess heat*	3
	Leaf blight	*Stemphylium* sp.	1
	Nutrient deficiency		1
	Mold infestation	*Alternaria* sp.	1
Soybean	Brown spot	*Septoria glycines*	1

Table 3: Summary of diseases diagnosed on **shade tree samples** submitted to the Saskatchewan Crop Protection Laboratory in 2015

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Aspen	Herbicide injury		1
Elm	Herbicide injury		1
	Dothiorella wilt	*Dothiorella ulmi*	25*
	Dutch elm disease (DED)	*Ophiostoma novo-ulmi*	112*
Fir	Environmental stress		2
Lilac	Leaf blight	Undetermined	1
Maple	Leaf blight	Undetermined	1
Oak	Herbicide injury		1
Peony	Leaf discoloration (mosaic)	Undetermined	1
Poplar	Leaf blight	*Marssonina* sp.	2
	Leaf blight	*Venturia inaequalis*	1
	Environmental stress		1
	Bronze disease	*Apioplagiostoma populi*	1
Spruce	Environmental stress		4

*Number of positive disease diagnoses out of 285 elm samples as of October 2, 2015.

Table 4: Summary of diseases diagnosed on **oilseed crop samples** submitted to the Saskatchewan Crop Protection Laboratory in 2015

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Damping-off / seed rot	*Rhizoctonia solani*	2
	Brown girdling	*Rhizoctonia solani*	2
	Black spot / grey stem	*Alternaria* spp.	2
	Fusarium wilt	*Fusarium oxysporum*	1
	Root rot	*Fusarium* spp.	3
	Grey stem	*Pseudocercosporella capsellae*	2
	Herbicide injury		10
	Nutrient deficiency	Sulphur and nitrogen deficiency	4
	Environmental stress	Cold / frost and excess heat	3
Flax	Boll blight	Undetermined	1
	Pasmo	*Septoria lini*	1
	Environmental stress	Stress	1
Mustard	Herbicide injury		1

Table 5: Summary of diseases diagnosed on **forage crop and turf grass samples** submitted to the Saskatchewan Crop Protection Laboratory in 2015

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bromegrass	Physiological leaf spot		2
	Ascochyta leaf blight	*Ascochyta* sp.	1
	Environmental stress	Lack of moisture and / or excess heat	1
Fescue	Root rot	*Fusarium* sp.	2
Kentucky bluegrass (turf grass)	Environmental stress	Lack of moisture and / or excess heat	1
Red clover	Target Spot	*Stemphylium* sp.	2
	Northern anthracnose	*Aureobasidium caulivorum*	1
	Environmental stress	Lack of moisture and / or excess heat	1
Ryegrass	Leaf blight	*Leptosphaerulina trifollii*.	1
	Environmental stress	Lack of moisture and / or excess heat	1
	Ascochyta leaf blight	*Ascochyta* sp.	1
Timothy	Leaf rust	*Puccinia brachypodii*	1
	Environmental stress	Lack of moisture and / or excess heat	3
	Purple eye spot	*Cladosporium phlei*	1

Table 6: Summary of diseases diagnosed on **vegetable samples** submitted to the Saskatchewan Crop Protection Laboratory in 2015

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Potato	Scab / Pythium leak / pink rot	*Streptomyces* sp./ *Pythium* sp. / *Phytophtora erythroseptica*	2
	Pink rot	*Phytophtora erythroseptica*	3
	Herbicide injury		1
	Leaf malformation	Undetermined	1
	Environmental stress		1
Tomato	Environmental stress		1
	Leaf malformation	Undetermined	1

Table 7: Summary of diseases diagnosed on **fruit samples** submitted to the Saskatchewan Crop Protection Laboratory in 2015

CROP	SYMPTOM / DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Environmental stress		1
Choke cherry	Leaf spot / canker	*Coccomyces* sp. , *Pseudomonas syringe*	1
Pear	Environmental stress		1

CROP: Diagnostic Laboratory Report

LOCATION: Manitoba

NAME AND AGENCY:
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TITLE: 2015 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

ABSTRACT: This report summarizes the diseases and disorders diagnosed on plant samples analyzed by the Manitoba Crop Diagnostic Centre for the year 2015. Samples received by the laboratory covered most crops grown in Manitoba and also included ornamentals, turf grasses and trees.

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 representatives and the general public. Diagnostic methods used included visual examination for symptoms, microscopy, moist chamber incubation, culturing onto artificial media (general and pathogen specific), Agdia ImmunoStrips® and ELISA testing.

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, 2015.

Table 1. Summary of diseases diagnosed on **herbaceous ornamental plants** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Petunia	Stem blight	*Botrytis cinerea*	1

Table 2. Summary of diseases diagnosed on **greenhouse crops** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Day lily	Leaf blight	*Aureobasidium microstictum*	2
Peony	Herbicide injury		

Table 3. Summary of diseases diagnosed on **cereal crop samples** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Wheat	Bacterial leaf blight	*Pseudomonas syringae* pv. *syringae*	6
	Bacterial leaf streak	*Xanthomonas* sp.	3
	Black head moulds	*Epicoccum nigrum*, *Alternaria* sp.	1
	Black point	*Alternaria* sp., *Cladosporium* sp., *Epicoccum nigrum*	2
	Common root rot	*Cochliobolus sativus*	4
	Downy mildew	*Sclerophthora* sp.	1
	Fusarium head blight	*Fusarium* sp.	1
	Glume blotch	*Septoria* sp.	1
	Leaf spot	*Septoria* sp.	3
	Powdery mildew	*Blumeria graminis*	5
	Root rot	*Fusarium* sp., *Pythium* sp., *Rhizoctonia solani*	5
	Tan spot	*Pyrenophora tritici-repentis*	7
	Wheat streak mosaic	Wheat Streak Mosaic Virus (WSMV)	2
	Environmental injury		13
	Physiological disorders	Undetermined	2
	Physiological leaf spot	Chloride deficiency	3
	Herbicide injury		9
	Nutrient deficiency		19
Barley	Bacterial leaf blight	*Pseudomonas syringae* pv. *syringae*	1
	Bacterial leaf streak	*Xanthomonas translucens* pv. *translucens*	1
	Common root rot	*Cochliobolus sativus*	1
	Fusarium head blight	*Fusarium graminearum; F. avenaceum*	6
	Leaf spot	*Septoria* sp.	1
	Net blotch	*Drechslera teres*	1
	Root rot	*Fusarium* sp.	1
	Herbicide injury		2
	Environmental injury		3
	Nutrient deficiency	Undetermined	1
Oat	Bacterial blight	*Pseudomonas syringae*	5
	Black head moulds	*Epicoccum nigrum*, *Alternaria* sp.	1
	Root rot	*Fusarium* sp.	1
	Physiological disorder	Undetermined	3
	Blast	Environmental injury	1
	Environmental injury		2
	Herbicide injury		2
	Nutrient deficiency	Undetermined	2
Rye	Bacterial leaf streak	*Xanthomonas* sp.	1
	Herbicide injury		1

Table 4. Summary of diseases diagnosed on **vegetable crop samples** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Asparagus	Crown and root rot	*Fusarium oxysporum; Fusarium* spp.	1
Beet	Rhizomania	Undetermined	1
	Root rot	*Rhizoctonia solani*	1
Carrot	Root rot	*Fusarium oxysporum*	2
		Pythium spp.	2
Cabbage	General stress	Environmental stress	2
	Herbicide injury		3
Cauliflower	Bacterial leaf spot	*Pseudomonas syringae*	1
	Bacterial blight	*Pseudomonas syringae*	2
	Black rot	*Xanthomonas campestris* pv. *campestris*	
Chive	Leaf rust	*Puccinia allii*	1
Cucumber	Angular leaf spot	*Pseudomonas syringae* pv. *lachrymans*	1
Garlic	Fusarium basal rot	*Fusarium culmorum*	4
	Blue mould	*Penicillium* spp.	2
	Stem and bulb nematode	*Ditylenchus* spp.	2
Onion	Neck rot	*Botrytis allii*	1
Pea	Root rot	*Fusarium oxysporum, Fusarium* spp.	2
	Nutrient deficiency	Environmental stress	1
	Herbicide injury		1
Pepper	Early blight	*Alternaria solani*	1
	General stress	Environmental stress	1
Radish	Common scab	*Streptomyces scabies*	1
Tomato	Cercospora leaf mould	*Pseudocercospora fuligena*	1
	Early blight	*Alternaria solani*	1
	General stress	Environmental stress	2
	Late blight	*Phytophthora infestans*	1
	Herbicide injury		3
Zucchini	Gummy stem blight	*Phoma cucurbitacearum*	1
	General stress	Environmental stress	1
	Herbicide injury		1

Table 5. Summary of diseases diagnosed on **potato crops** submitted to the MAFRD Crop Diagnostic Centre in 2015.

SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	3
Black dot, on tuber	*Colletotrichum coccodes*	2
Blackleg	*Pectobacterium carotovorum* subsp. *atrosepticum*	1
Black scurf (tuber)	*Rhizoctonia solani*	4
Brown spot	*Alternaria alternata*	1
Common scab	*Streptomyces scabies*	1
Early blight, foliar	*Alternaria solani*	6
Fusarium dry rot	*Fusarium sambucinum*	3
Late blight foliar	*Phytophthora infestans*	2
Pink eye	Unknown	6
Pink rot	*Phytophthora erythroseptica*	2
Potato mop top	Potato Mop Top Virus (PMTV)	1
Powdery scab (roots)	*Spongospora subterranea* f.sp. *subterranea*	1
Root rot	*Rhizoctonia solani, Fusarium* spp.	2
Silver scurf	*Helminthosporium solani*	6
Verticillium wilt	*Verticillium dahliae*	2
Physiological disorders		4

Table 6. Summary of diseases diagnosed on **shelterbelt trees** and **woody ornamental plants** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alpine currant (*Ribes alpinum*)	Anthracnose	*Gloeosporium ribis*	1
Ash (*Fraxinus* sp.)	Herbicide injury		4
Birch (*Betula* sp.)	Anthracnose	*Gloeosporium betularum*	1
	Canker	*Cytospora* sp.	2
	Twig blight	*Phomopsis* sp.	1
Caragana (*Caragana* sp.)	Canker	*Cytospora* sp.	1
	Environmental injury		1
Cottonwood (*Populus* sp.)	Environmental injury		1
Crabapple (*Malus* spp.)	Canker	*Cytospora* sp.	3
	Fire blight	*Erwinia amylovora*	2
	Frogeye leaf spot	*Botryosphaeria obtusa*	1
	Environmental injury		2
	Nutrient deficiency		1
Elm, American (*Ulmus americana*)	Botryosphaeria canker	*Botryosphaeria* sp.	9
	Coniothyrium canker	*Coniothyrium* sp.	2
	Cytospora canker	*Cytospora* sp.	3
	Dutch elm disease	*Ophiostoma ulmi*	49

Table 6 (contd.)

Elm, American (*Ulmus americana*)	Verticillium wilt	*Verticillium albo-atrum*	8
	Environmental injury		9
Fir (*Abies* sp.)	Needle cast	*Rhizosphaera kalkhoffii*	1
	Environmental injury		3
Lilac (*Syringa vulgaris*)	Herbicide injury		1
Maple, Manitoba (*Acer negundo*)	Herbicide injury		1
Maple, silver (*Acer saccharinum*)	Environmental injury		1
Oak (*Quercus macrocarpa)*	Canker	*Botryosphaeria* sp.	1
	Canker	Udetermined	1
	Canker	*Phoma* sp.	1
	Environmental injury		1
Pine, Scots (*Pinus sylvestris*)	Needle cast	*Cyclaneusma minus*	2
	Winter injury	Environmental stress	1
Poplar (*Populus* spp.)	Canker	*Cytospora* sp.	2
	Leaf spot	*Marssonina populi*	2
	Leaf spot	*Phyllosticta* sp.	1
	Twig blight	*Venturia macularis*	1
	Herbicide injury		2
	Environmental injury		1
	Nutrient deficiency	Iron deficiency	1
Spruce (*Picea* spp.)	Canker	Undetermined	2
	Canker	*Cytospora* sp.	3
	Needle blight	*Lirula* sp.	1
	Needle cast	*Rhizosphaera kalkhoffii*	5
	Stigmina needle blight	*Stigmina lautii*	6
	Twig canker	*Phoma* sp.	1
	Environmental injury		22
	Herbicide injury		1
Willow (*Salix* spp.)	Canker	*Glomerella miyabeana*	1
	Herbicide injury		2

Table 7. Summary of diseases diagnosed on **oilseed crop samples** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Canola	Blackleg	*Leptosphaeria maculans*	32
	Black spot	*Alternaria brassicae*	4
	Clubroot	*Plasmodiophora brassicae*	1
	Root rot	*Fusarium* sp., *Pythium* sp.	15
	Root rot	*Rhizoctonia solani*	6
	Stem rot	*Sclerotinia sclerotiorum*	1
	Wilt	*Fusarium oxysporum*	3
	Wilt	*Verticillium* sp.	8
	Nutrient deficiency	Possible boron deficiency	1
	Nutrient deficiency	Possible sulphur deficiency	5
	Nutrient deficiency	Possible nitrogen deficiency	1
	Nutrient deficiency	Undetermined	2
	Physiological disorders	Undetermined	3
	Environmental injury		16
	Herbicide injury		66
Flax	Boll blight	*Alternaria linicola*	1
	Pasmo	*Septoria linicola*	2
	Nutrient deficiency	Possible nitrogen deficiency	2
	Environmental injury		1
	Herbicide injury		3
Sunflower	Leaf spot	*Alternaria* sp.	2
	Bacterial stem rot	*Erwinia* sp.	
	Root rot	*Fusarium* sp.	4
	Root rot	*Pythium* sp.	1
	Head rot	*Sclerotinia sclerotiorum*	1
	Stem canker	*Phomopsis helianthi*	2
	Stalk rot	*Sclerotinia sclerotiorum*	1
	Environmental injury		2
	Herbicide injury		7

Table 8. Summary of diseases diagnosed on **fruit crop samples** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Fire blight	*Erwinia amylovora*	4
	Leaf spot	*Phyllosticta* sp.	1
	Twig canker	*Botryosphaeria obtusa*	1
		Cytospora sp.	5
	Environmental injury		1
	Nutrient deficiency		1
Apricot	Fire blight	*Erwinia amylovora*	1
	Twig canker	*Cytospora sp.*	1

Table 8 (contd.)

Cherry	Twig blight	*Coniothyrium sp.*	1
Currant, red	Anthracnose	*Gloeosporium ribis*	1
Grape	Flower blight	*Botrytis cinerea*	1
	Herbicide injury		1
Raspberry	Anthracnose	*Elsinoë veneta*	1
	Bacterial blight	*Pseudomonas syringae*	2
	Fire blight	*Erwinia amylovora*	1
	Spur blight	*Didymella applanata*	1
Saskatoon berry	Rust	*Gymnosporangium clavipes*	1
	Twig canker	*Cytospora sp.*	4
	Environmental injury		2
	Herbicide injury		1
Strawberry	Anthracnose	*Colletotrichum acutatum*	4
	Flower blight	*Botrytis cinerea*	3
	Fruit rot	*Botrytis cinerea*	1
	Root rot	*Rhizoctonia* sp., *Fusarium* sp., *Cylindrocarpon* sp.; *Phytophthora* sp.	4
	Slime mould	Slime mould	1
	Environmental injury		3

Table 9. Summary of diseases diagnosed on **forage legume crop samples** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	**SYMPTOM/ DISEASE**	**CAUSAL AGENT**	**NUMBER OF SAMPLES**
Alfalfa	Brown root rot	*Phoma sclerotioides*	4
	Spring black stem/ leaf spot	*Phoma medicaginis*	2
	Stemphylium leaf spot	*Stemphylium* sp.	1
	Leptosphaerulina leaf spot	*Leptosphaerulina briosiana*	2
	Environmental injury		1
	Nutrient deficiency		3
	Herbicide injury		1

Table 10. Summary of diseases diagnosed on **forage grass** and **turfgrass samples** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	**SYMPTOM/ DISEASE**	**CAUSAL AGENT**	**NUMBER OF SAMPLES**
Timothy	Alternaria leaf spot	*Alternaria* sp.	1
	Brown leaf stripe	*Cercosporidium graminis*	1
Turfgrass	Root rot	*Pythium* sp.	1

Table 11. Summary of diseases diagnosed on **special crop samples** submitted to the MAFRD Crop Diagnostic Centre in 2015.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Corn	Common smut	*Ustilago zeae*	1
	Goss's wilt	*Clavibacter michiganensis* subsp. *nebraskensis*	18
	Northern corn leaf spot	*Bipolaris sp.*	1
	Root rot	*Fusarium* sp.	2
	Environmental stress		1
	Nutrient deficiency	Sulphur deficiency	1
Dry bean	Brown spot	*Pseudomonas syringae* pv. *syringae*	1
	Common blight	*Xanthomonas axonopodis* pv. *phaseoli*	4
	Halo blight	*Pseudomonas syringae* pv. *phaseolicola*	3
	Stem rot	*Sclerotinia sclerotiorum*	2
	Environmental stress		2
Faba bean	Chocolate spot	*Botrytis* sp.	1
	Root rot	*Fusarium* spp.	1
Field pea	Anthracnose	*Colletotrichum pisi*	1
	Bacterial blight	*Pseudomonas syringae* pv. *pisi*	3
	Leaf spot	*Mycosphaerella pinodes*	1
	Root rot	*Fusarium* sp.	3
	Root rot	*Fusarium* sp., *Pythium* sp.	1
	Stem rot	*Sclerotinia sclerotiorum*	1
Hemp	Brown blight	*Alternaria alternata*	2
	Flower blight	*Fusarium graminearum, F. sporotrichioides*	1
	Root and stem rot	*Fusarium oxysporum*	2
	Stem rot	*Sclerotinia sclerotiorum*	2
	Environmental stress		1
Quinoa	Leaf and stem spot	*Ascochyta* sp.	1
Soybean	Alternaria leaf spot	*Alternaria alternata*	3
	Anthracnose	*Colletotrichum* sp.	2
	Bacterial blight	*Pseudomonas* sp.	4
	Brown spot	*Septoria glycines*	12
	Downy mildew	*Peronospora manshurica*	5
	Leaf spot	*Phyllosticta sojicola*	1
	Root rot	*Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*	22
	Root rot	*Phytophthora sojae*	6
	Stem blight	*Phomopsis longicolla*	3
	Stem blight	*Phomopsis* sp.	5
	Stem rot	*Sclerotinia sclerotiorum*	3
	Environmental stress		19
	Nutrient deficiency		11
	Herbicide injury		23

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

LOCATION: Ontario

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TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE PEST DIAGNOSTIC CLINIC, UNIVERSITY OF GUELPH IN 2015

ABSTRACT: Diseases and their causal agents diagnosed on plant samples received by the Pest Diagnostic Clinic, University of Guelph in 2015 are summarized in this report. Samples included greenhouse vegetables, annual and perennial ornamental plants, field crops, berry crops, tree fruits, 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 2015. Diagnoses were accomplished using microscopic examination, culturing on artificial media, biochemical identification of bacteria using BIOLOG®, enzyme-linked immunosorbent assay (ELISA), and polymerase chain reaction- (PCR) based techniques including DNA multiscan, PCR and RT-PCR and DNA sequencing.

RESULTS AND COMMENTS: In 2015, from January 1 to December 17, the Pest Diagnostic Clinic received samples for disease diagnosis representing plants in over 100 genera. Results are presented in Tables 1- 6 below. Problems caused by plant parasitic nematodes, insects and abiotic factors are not listed. The frequency of samples submitted to the laboratory does not reflect the prevalence of diseases in the field. The majority of disease diagnoses in 2015 were of common diseases.

Table 1. Summary of plant diseases diagnosed on **vegetable** samples (including **greenhouse vegetables**) submitted to the University of Guelph Pest Diagnostic Clinic in 2015.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Asparagus (*Asparagus officinalis*)	Crown and root rot	*Fusarium oxysporum*	2
	Crown and root rot	*Fusarium solani*	3
	Crown and root rot	*Phytophthora* sp.	1
Bean (*Phaseolus vulgaris*)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Fusarium solani*	1
	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium ultimum*	1
	White mould	*Sclerotinia sclerotiorum*	1
Beet (*Beta vulgaris*)	Leaf spot	*Stemphylium* sp.	1
Brassica sp.	Clubroot	*Plasmodiophora brassicae*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium* sp.	1

Table 1 (contd.)

Brassica spp.	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1
Cabbage (*Brassica oleracea* var. *capitata*)	Black rot	*Xanthomonas campestris*	14
	Leaf spot	*Alternaria* sp.	1
	Root rot	*Fusarium oxysporum*	3
	Root rot	*Pythium irregular*	2
	Root rot	*Pythium sylvaticum*	2
	Root rot	*Pythium ultimum*	2
Carrot (*Daucus carota*)	Root dieback	*Pythium* sp.	1
	Root dieback	*Pythium sylvaticum*	1
	Root dieback	*Pythium ultimum*	1
Celery (*Apium graveolens*)	Leaf curl	*Colletotrichum acutatum*	7
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Pythium ultimum*	1
Cilantro (*Coriandrum sativum*)	Leaf spot	*Alternaria* sp.	1
Cucumber (*Cucumis sativus*)	Bacterial wilt	*Erwinia tracheiphila*	2
	Blight	*Corynespora* sp.	1
	Crown and root rot	*Fusarium oxysporum*	5
	Crown and root rot	*Fusarium solani*	4
	Crown and root rot	*Phytophthora capsici*	1
	Crown and root rot	*Pythium aphanidermatum*	4
	Crown and root rot	*Pythium dissotocum*	2
	Crown and root rot	*Pythium ultimum*	1
	Cucumber Green Mottle Mosaic Virus	Cucumber Green Mottle Mosaic Virus (CGMMV)	16
	Downy mildew	*Pseudoperonospora cubensis*	1
	Gummy stem blight	*Didymella bryoniae*	3
	Leaf spot	*Corynespora cassicola*	3
	Root rot	*Fusarium oxysporum*	12
	Root rot	*Fusarium solani*	2
	Root rot	*Pythium* sp.	4
	Root rot	*Pythium aphanidermatum*	1
	Root rot	*Pythium dissotocum*	3
	Root rot	*Pythium irregulare*	2
	Root rot	*Pythium sylvaticum*	3
	Bacterial stem rot	*Pectobacterium carotovorum*	1
	Tobacco Ringspot Virus	Tobacco Ringspot Virus (TRSV)	1
Eggplant (*Solanum melongena*)	Root rot	*Pythium dissotocum*	1
	Verticillium wilt	*Verticillium dahlia*	1
Fava bean (*Vicia faba*)	Root rot	*Fusarium* sp.	1

Table 1 (contd.)

Fava bean (*Vicia faba*)	Root rot	*Pythium sylvaticum*	1
	Root rot	*Rhizoctonia solani*	1
Garlic (*Allium sativum*)	Garlic Common Latent Virus	Garlic Common Latent Virus (GCLV)	9
	Plate rot	*Fusarium oxysporum*	7
	Plate rot	*Fusarium solani*	6
	Potyvirus	Potyvirus	28
	Root rot	*Pythium aphanidermatum*	2
	Root rot	*Pythium dissotocum*	2
	Root rot	*Pythium sylvaticum*	5
	Root rot	*Pythium ultimum*	2
	Rot	*Fusarium oxysporum*	5
	Stalk rot	*Stemphylium* sp.	1
Leek (*Allium porrum*)	Anthracnose	*Colletotrichum* sp.	2
	Bacterial soft rot	*Pseudomonas fluorescens*	2
	Bacterial soft rot	*Pseudomonas marginalis*	1
	Basal rot	*Fusarium* sp.	1
	Leaf blight	*Stemphylium* sp.	3
Lettuce (*Lactuca sativa*)	Botrytis blight	*Botrytis cinerea*	2
	Crown and root rot	*Rhizoctonia solani*	2
	Crown rot	*Rhizoctonia solani*	1
	Grey mold	*Botrytis cinerea*	3
	Root rot	*Fusarium* sp.	4
	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	13
	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium polymastum*	1
	Root rot	*Pythium sylvaticum*	1
Lima bean (*Phaseolus lunatus*)	Anthracnose	*Colletotrichum* sp.	1
Musk melon (*Cucumis melo*)	Powdery mildew	*Oidium* sp.	1
Onion (*Allium cepa*)	Leaf blight	*Stemphylium* sp.	1
Pea (*Pisum sativum*)	Root rot	*Aphanomyces euteiches*	2
Pepper (*Capsicum* sp.)	Alfalfa Mosaic Virus	Alfalfa Mosaic Virus (AMV)	1
	Bacterial leaf spot	*Pseudomonas syringae*	1
	Bacterial leaf blight	*Pseudomonas cichorii*	1
	Blight	*Phytophthora capsici*	1
	Fruit rot	*Fusarium* sp.	3
	Fruit rot	*Fusarium lactis*	1
	Fruit rot	*Rhizopus* sp.	1
	Crown and root rot	*Fusarium oxysporum*	4
	Crown and root rot	*Fusarium solani*	3
	Crown and root rot	*Phytophthora capsici*	2
	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Pythium dissotocum*	1
	Root rot	*Fusarium oxysporum*	5
	Root rot	*Fusarium solani*	3
	Root rot	*Phytophthora capsici*	1

Table 1 (contd.)

Pepper (*Capsicum* sp.)	Root rot	*Pythium dissotocum*	2
	Root rot	*Pythium ultimum*	1
	Verticillium wilt	*Verticillium dahlia*	1
Potato (*Solanum tuberosum*)	Black dot	*Colletotrichum coccodes.*	2
	Black scurf	*Rhizoctonia solani*	2
	Common scab	*Streptomyces scabies*	6
	Dry rot	*Fusarium* sp.	5
	Late blight	*Phytophthora infestans*	1
	Leak	*Pythium ultimum*	2
	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	2
	Silver scurf	*Helminthosporium solani*	1
	Verticillium wilt	*Verticillium dahlia*	2
Pumpkin (*Cucurbita pepo*)	Bacterial leaf spot	*Pseudomonas syringae*	2
	Bacterial leaf spot	*Xanthomonas campestris*	1
	Anthracnose	*Colletotrichum* sp.	1
	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Fusarium solani*	1
	Crown and root rot	*Phytophthora capsici*	1
	Crown and root rot	*Pythium ultimum*	1
	Bacterial fruit spot	*Pseudomonas syringae*	2
	Bacterial fruit spot	*Xanthomonas campestris*	2
	Potyvirus	Potyvirus	1
Rutabaga (*Brassica napus*)	Downy mildew	*Peronospora* sp.	3
	Leaf spot	*Phoma* sp.	1
	Root rot	*Fusarium* sp.	2
	Root rot	*Pythium* sp.	2
	Root rot	*Pythium irregular*	1
	Root rot	*Pythium ultimum*	1
Spinach (*Spinacia oleracea*)	Verticillium wilt	*Verticillium dahlia*	8
Squash (*Cucurbita argyrosperma*)	Leaf spot	*Septoria* sp.	1
	Squash Mosaic Virus	Squash Mosaic Virus (SqMV)	1
Tomato (*Lycopersicon esculentum*)	Anthracnose	*Colletotrichum* sp.	2
	Anthracnose	*Colletotrichum coccodes*	5
	Bacterial leaf spot	*Pseudomonas syringae*	
	Bacterial leaf spot	*Xanthomonas campestris*	21
	Bacterial speck	*Pseudomonas syringae*	2
	Corky root rot	*Pyrenochaeta lycopersici*	1
	Crown and root rot	*Fusarium oxysporum*	12
	Crown and root rot	*Fusarium solani*	5
	Crown and root rot	*Phytophthora capsici*	1
	Crown and root rot	*Phytophthora cryptogea*	1
	Crown and root rot	*Phytophthora polymastum*	2
	Crown and root rot	*Pythium* sp.	2
	Crown and root rot	*Pythium aphanidermatum*	2
	Crown and root rot	*Pythium dissotocum*	4
	Crown and root rot	*Pythium ultimum*	1

Table 1 (contd.)

Tomato (*Lycopersicon esculentum*)	Crown and root rot	*Rhizoctonia solani*	3
	Fruit rot	*Penicillium* sp.	1
	Fruit rot	*Rhizopus* sp.	1
	Gray mold	*Botrytis cinerea*	1
	Late blight	*Phytophthora infestans*	4
	Pepino Mosaic Virus	Pepino Mosaic Virus (PepMV)	12
	Powdery mildew	*Oidium* sp.	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Fusarium oxysporum*	19
	Root rot	*Fusarium solani*	6
	Root rot	*Phytophthora cryptogea*	2
	Root rot	*Pythium* sp.	5
	Root rot	*Pythium aphanidermatum*	2
	Root rot	*Pythium dissotocum*	8
	Root rot	*Pythium sylvaticum*	3
	Root rot	*Pythium ultimum*	4
	Root rot	*Rhizoctonia solani*	3
	Stem canker	*Botrytis* sp.	1
	Stem rot	*Fusarium oxysporum*	1
	Stem rot	*Pectobacterium carotovorum*	3
	Stem rot	*Phytophthora* sp.	1
	Stem rot	*Phytophthora capsici*	2
	Stem spot	*Septoria* sp.	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	47
	Tomato bacterial canker	*Clavibacter michiganesis* subsp. *michiganesis*	16
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	1
	Verticillium wilt	*Verticillium* sp.	1
	Verticillium wilt	*Verticillium albo-atrum*	3
	Verticillium wilt	*Verticillium dahlia*	3
Turnip (*Brassica rapa* subsp. *rapa*)	Club root	*Plasmodiophora brassicae*	1
Watermelon (*Citrullus lanatus*)	Fruit spot	*Pseudomonas syringae*	2
	Gummy stem blight	*Didymella bryoniae*	1
Wild leek (*Allium tricoccum*)	Leaf spot	*Septoria* sp.	1
Zucchini (*Cucurbita pepo*)	Bacterial leaf spot	*Pseudomonas syringae*	1

Table 2. Summary of plant diseases diagnosed on **fruit** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2015.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Apple (*Malus* sp.)	Blister bark	*Pseudomonas syringae*	2
	Canker	*Botryosphaeria* sp.	2
	Canker	*Cryptosporiopsis curvispora*	1
	Canker	*Cytospora* sp.	2
	Canker	*Fusarium* sp.	1
	Canker	*Nectria cinnabarina*	1
	Canker	*Neofabraea* sp.	1
	Canker	*Phomopsis* sp.	1
	Collar rot	*Phytophthora* sp.	1
	Fire blight	*Erwinia amylovora*	13
	Scab	*Venturia inaequalis*	1
	Twig blight	*Nectria cinnabarina*	3
Blueberry (*Vaccinium sp.*)	Blueberry Shoestring Virus	Blueberry Shoestring Virus (BSSV)	1
	Blueberry stunt	*Candidatus* Phytoplasma sp.	2
Cherry (*Prunus* sp.)	Canker	*Fusarium* sp.	1
Grape (*Vitis* sp.)	Crown gall	*Agrobacterium vitis*	2
	Grapevine Leafroll-associated Virus	Grapevine Leafroll-associated Virus (GLRaV)	18
	Grapevine Red Blotch-associated Virus	Grapevine Red Blotch-associated Virus (GRBaV)	1
Haskap (*Lonicera caerulea*)	Crown and root rot	*Pythium ultimum*	1
	Grey mould	*Botrytis cinerea*	1
	Root rot	*Cylindrocarpon* sp.	1
Peach (*Prunus persica*)	Root rot	*Fusarium sp.*	3
	Root rot	*Pythium dissotocum*	1
Raspberry (*Rubus* sp.)	Root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora fragariae*	1
	Rust	*Phragmidium rubi-idaei*	1
	Tomato Ringspot Virus	Tomato Ringspot Virus (ToRSV)	1
Rhubarb (*Rheum* sp.)	Crown and root rot	*Phytophthora cactorum*	1
Strawberry (*Fragaria* sp.)	Anthracnose	*Colletotrichum* sp.	4
	Anthracnose	*Colletotrichum acutatum*	10
	Crown rot	*Fusarium* sp.	1
	Crown and root rot	*Fusarium oxysporum*	4
	Crown and root rot	*Fusarium solani*	2
	Crown and root rot	*Gnomonia* sp.	3
	Crown and root rot	*Phytophthora* sp.	1
	Crown and root rot	*Phytophthora cactorum*	4
	Crown and root rot	*Phytophthora fragariae*	1
	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium intermedium*	1
	Crown and root rot	*Rhizoctonia solani*	6
	Gray mold	*Botrytis cinerea*	2

Table 2 (contd.)

Strawberry (*Fragaria* sp.)	Leaf blotch	*Gnomonia* sp.	2
	Leaf scorch	*Marssonina fragariae*	3
	Leaf spot	*Mycosphaerella fragariae*	3
	Powdery mildew	*Oidium* sp.	1
	Root rot	*Cylindrocarpon* sp.	1
	Root rot	*Pythium ultimum*	3
	Strawberry Mild Yellow Edge Virus	Strawberry Mild Yellow Edge Virus (SMYEV)	5
	Strawberry Mottle Virus	Strawberry Mottle Virus (SMoV)	8
	Strawberry Pallidosis Virus	Strawberry Pallidosis Virus (SPaV)	1
	Strawberry Vein Banding Virus	Strawberry Vein Banding Virus (SVBV)	3
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium intermedium*	1
	Root rot	*Pythium ultimum*	2
	Root rot	*Rhizoctonia solani*	2
	Verticillium wilt	*Verticillium dahlia*	2

Table 3. Summary of plant diseases diagnosed on **herbaceous ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2015.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
African violet (*Saintpaulia* sp.)	Crown and root rot	*Phytophthora nicotianae*	1
	Crown and root rot	*Pythium* sp.	1
Alstroemeria (*Alstroemeria* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Fusarium solani*	1
	Crown and root rot	*Pythium ultimum*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Begonia (*Begonia* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Grey mold	*Botrytis cinerea*	1
	Bacterial leaf spot	*Xanthomonas campestris*	1
Boston fern (*Nephrolepis exaltata*)	Root rot	*Fusarium solani*	1
Boxwood (*Buxus* sp.)	Canker	*Volutella buxi*	25
	Crown and root rot	*Rhizoctonia solani*	1
	Leaf blight	*Volutella buxi*	86
	Leaf spot	*Macrophoma* sp.	17
	Root rot	*Fusarium oxysporum*	6
	Root rot	*Fusarium solani*	6
	Root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora nicotianae*	1
	Root rot	*Pythium* sp.	4
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium irregulare*	1
	Root rot	*Rhizoctonia solani*	2

Table 3 (contd.)

Boxwood (*Buxus* sp.)	Root rot	*Thielaviopsis basicola*	13
	Stem canker	*Colletotrichum* sp.	1
Buttercup (*Ranunculus* sp.)	Bacterial leaf spot	*Xanthomonas campestris*	1
Butterfly bush (*Buddleia* sp.)	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
	Downy mildew	*Peronospora* sp.	2
	Root rot	*Pythium irregulare*	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
Butterfly bush (*Buddleia davidii*)	Cucumber Mosaic Virus	Cucumber Mosaic Virus (CMV)	1
	Downy mildew	*Peronospora* sp.	2
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	2
Buddleia (*Buddleia weyeriana*)	Downy mildew	*Peronopsora* sp.	3
Calathea (*Calathea* sp.)	Crown rot	*Fusarium oxysporum*	1
Calibrachoa (*Calibrachoa* sp.)	Grey mold	*Botrytis cinerea*	1
	Root rot	*Pythium dissotocum*	2
	Root rot	*Thielaviopsis basicola*	1
Calla lily (*Zantedeschia* sp.)	Bacterial soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	1
Chrysanthemum (*Chrysanthemum* sp.)	Stem rot	*Sclerotinia sclerotiorum*	1
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	1
Cimicifuga sp.	Crown and root rot	*Fusarium solani*	1
	Root rot	*Pythium irregulare*	1
Coleus (*Solenostemon* sp.)	Downy mildew	*Peronospora* sp.	1
	Grey mold	*Botrytis cinerea*	1
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Thielaviopsis basicola*	1
Cordyline (*Cordyline* sp.)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Phytophthora nicotianae*	1
Coreopsis sp.	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Phytophthora drechsleri*	1
	Crown and root rot	*Rhizoctonia solani*	1
Dipladenia (*Dipladenia* sp.)	Root rot	*Fusarium* sp.	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Phytophthora nicotianae*	1
	Root rot	*Pythium aphanidermatum*	1
Echinacea (*Echinacea* sp.)	Grey mold	*Botrytis cinerea*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	2
Euonymus (*Euonymus* sp.)	Dieback	*Phomopsis* sp.	1
Geranium (*Pelargonium* sp.)	Root rot	*Fusarium oxysporum*	1
Geranium (*Pelargonium* sp.)	Root rot	*Fusarium solani*	1
	Root rot	*Pythium irregulare*	1
	Root rot	*Rhizoctonia solani*	1

Table 3 (contd.)

Gerbera (*Gerbera* sp.)	Crown and root rot	*Phytophthora* sp.	1
	Crown and root rot	*Phytophthora cryptogea*	1
	Crown and root rot	*Pythium dissotocum*	2
	Root rot	*Pythium ultimum*	1
	Root rot	*Rhizoctonia solani*	1
Grasses (Gramineae)	Anthracnose	*Colletotrichum graminicola*	7
	Anthracnose	*Microdochium bolleyi*	3
	Blight	*Curvularia* sp.	5
	Blight	*Fusarium* sp.	1
	Blight	*Fusarium culmorum*	1
	Crown and root rot	*Fusarium* sp.	1
	Crown and root rot	*Pythium* sp.	7
	Crown and root rot	*Pythium aphanidermatum*	1
	Crown and root rot	*Pythium graminicola*	1
	Crown and root rot	*Pythium irregulare*	4
	Crown and root rot	*Rhizoctonia solani*	1
Heather (*Calluna vulgaris*)	Root rot	*Pythium irregulare*	1
Heuchera sp.	Grey mold	*Botrytis cinerea*	2
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Thielaviopsis basicola*	2
Hosta (*Hosta* sp.)	Crown and root rot	*Fusarium* sp.	1
	Crown and root rot	*Fusarium oxysporum*	2
	Crown and root rot	*Fusarium solani*	3
	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Pythium ultimum*	1
Hydrangea (*Hydrangea* sp.)	Crown and root rot	*Rhizoctonia solani*	5
	Crown rot	*Fusarium* sp.	1
	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	2
	Root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora cactorum*	1
	Root rot	*Pythium* sp.	3
	Root rot	*Pythium dissotocum*	3
	Root rot	*Thielaviopsis basicola*	1
Impatiens (*Impatiens walleriana*)	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium irregulare*	1
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	1
Kalanchoe (*Kalanchoe* sp.)	Crown and root rot	*Phytophthora nicotianae*	1
	Grey mold	*Botrytis cinerea*	2
	Root rot	*Pythium dissotocum*	2
	Root rot	*Pythium irregulare*	2
Laeliocattleya canhamiana	Odontoglossum Ringspot Virus	Odontoglossum Ringspot Virus (ORSV)	3
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	3
Lavender (*Lavandula* sp.)	Alfalfa Mosaic Virus	Alfalfa Mosaic Virus (AMV)	1
	Crown and root rot	*Pythium* sp.	2
	Grey mold	*Botrytis* sp.	4

Table 3 (contd.)

Lavender (*Lavandula* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Root rot	*Fusarium oxysporum*	3
	Root rot	*Fusarium solani*	3
	Root rot	*Phytophthora cryptogea*	1
	Root rot	*Phytophthora drechsleri*	1
	Root rot	*Phytophthora nicotianae*	4
	Root rot	*Pythium* sp.	1
	Root rot	*Pythium dissotocum*	1
	Root rot	*Pythium irregulare*	2
	Root rot	*Rhizoctonia solani*	2
	Root rot	*Thielaviopsis basicola*	5
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
Lenten rose (*Helleborus* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Phytophthora cactorum*	5
	Crown and root rot	*Pythium* sp.	1
	Crown and root rot	*Pythium dissotocum*	3
	Crown and root rot	*Pythium irregulare*	1
Lilac (*Syringa vulgaris*)	Root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora cryptogea*	1
	Root rot	*Pythium dissotocum*	2
	Root rot	*Pythium irregulare*	1
	Root rot	*Thielaviopsis basicola*	1
	Twig blight	*Phomopsis* sp.	1
Lisianthus (*Eustoma grandiflorum*)	Crown and root rot	*Pythium irregulare*	1
	Root rot	*Thielaviopsis basicola*	1
	Stem rot	*Fusarium* sp.	
Lobelia (*Lobelia* sp.)	Crown and root rot	*Fusarium oxysporum*	1
	Crown and root rot	*Rhizoctonia solani*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	2
	Tomato Spotted Wilt Virus	Tomato Spotted Wilt Virus (TSWV)	1
Mandevilla (*Mandevilla* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Crown and root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Rhizoctonia solani*	1
Monarda sp.	Grey mould	*Botrytis cinerea*	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium aphanidermatum*	1
Money Tree (*Pachira aquatica*)	Canker	*Botryosphaeria* sp.	1
	Canker	*Phomopsis* sp.	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
Moth orchid (*Phalaenopsis* sp.)	Bacterial leaf spot	*Acidovorax avenae*	1
Nettle (*Lamium* sp.)	Grey mould	*Botrytis cinerea*	1

Table 3 (contd.)

New Guinea Impatiens *(Impatiens* sp.)	Leaf spot	*Myrothecium* sp.	1
	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium* sp.	1
Ninebark (*Physocarpus* sp.)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium* sp.	1
	Root rot	*Rhizoctonia solani*	1
Orchid (Orchidaceae)	Potyvirus	Potyvirus	5
Penstemon sp.	Root rot	*Fusarium solani*	1
	Root rot	*Thielaviopsis basicola*	1
Peony (*Paeonia* sp.)	Bacterial leaf spot	*Xanthomonas campestris*	1
	Crown and root rot	*Pythium intermedium*	1
	Crown and root rot	*Rhizoctonia solani*	1
	Powdery mildew	*Oidium* sp.	1
	Root rot	*Thielaviopsis basicola*	1
Petunia (*Petunia* sp.)	Grey mold	*Botrytis cinerea*	1
	Powdery mildew	*Oidium* sp.	1
Phlox (*Phlox* sp.)	Crown and root rot	*Fusarium* sp.	2
	Crown and root rot	*Pythium irregulare*	1
	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	3
	Root rot	*Thielaviopsis basicola*	3
Poinsettia (*Euphorbia pulcherrima*)	Crown and root rot	*Fusarium oxysporum*	7
	Root rot	*Phytophthora nicotianae*	1
Rose (*Rosa* sp.)	Blight	*Botrytis cinerea*	1
Sedum (*Sedum* sp.)	Stem canker	*Phoma* sp.	1
	Rot	*Fusarium solani*	1
Snap dragon (*Antirrhinum* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	2
Switch grass (*Panicum virgatum*)	Rust	*Puccinia emaculata*	1
Viburnum trilobum	Downy mildew	*Plasmopara* sp.	1
Weigela (*Weigela* sp.)	Root rot	*Rhizoctonia solani*	1

Table 4. Summary of plant diseases diagnosed on **woody ornamental** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2015.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Alder (*Alnus* sp.)	Grey mould	Botrytis sp.	1
	Twig blight	*Phomopsis* sp.	1
American elm (*Ulmus americana*)	Canker	*Botryosphaeria* sp.	1
	Canker	*Phomopsis* sp.	1
	Dutch elm disease	*Ophiostoma novo-ulmi*	1
Ash (*Fraxinus* sp.)	Canker	*Neofabraea alba*	1
Balsam Fir (*Abies balsamea*)	Needlecast	*Rhizosphaera pini*	1
Buckeye (*Aesculus* sp.)	Root rot	*Pythium irregulare*	1
Callery pear (*Pyrus calleryana*)	Anthracnose	*Colletotrichum* sp.	1
	Twig blight	*Phomopsis* sp.	1
Cedar (*Thuja* sp.)	Anthracnose	*Colletotrichum* sp.	1
	Canker	*Botryosphaeria* sp.	1
	Canker	*Cytospora* sp.	1
	Blight	*Phomopsis* sp.	1
	Blight	*Phyllosticta* sp.	1
	Leaf blight	*Phyllosticta thujae*	2
	Root rot	*Cylindrocarpon* sp.	2
	Root rot	*Fusarium* sp.	2
	Root rot	*Pythium sylvaticum*	2
	Tip blight	*Pestalotiopsis* sp.	7
Colorado blue spruce (*Picea pungens*)	Canker	*Phomopsis* sp.	4
	Grey mould	*Botrytis* sp.	1
	Needlecast	*Rhizosphaera kalkhoffii*	3
	Needlecast	*Stigmina* sp.	3
	Root rot	*Cylindrocarpon* sp.	1
	Root rot	*Pythium sylvaticum*	1
Crabapple (*Malus* sp.)	Root rot	*Phytophthora* sp.	3
	Root rot	*Pythium* sp.	3
	Scab	*Venturia inaequalis*	1
Eastern white cedar (*Thuja occidentalis*)	Root rot	*Fusarium* sp.	1
	Root rot	*Fusarium oxysporum*	5
	Root rot	*Fusarium solani*	5
	Root rot	*Pythium irregulare*	6
	Root rot	*Pythium sylvaticum*	1
	Root rot	*Pythium ultimum*	5
	Root rot	*Rhizoctonia solani*	1
	Tip blight	*Pestalotiopsis* sp.	4
Eastern white pine (*Pinus strobus*)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium* sp.	1
Hawthorne (*Crataegus* sp.)	Crown and root rot	*Phytophthora* sp.	1
	Crown and root rot	*Pythium irregulare*	1

Table 4 (contd.)

Hawthorne (*Crataegus* sp.)	Crown and root rot	*Pythium ultimum*	1
	Crown and root rot	*Rhizoctonia solani*	1
Hazelnut (*Corylus* sp.)	Canker	*Phomopsis* sp.	1
	Dieback	*Cryptosporiopsis* sp.	1
	Powdery mildew	*Phyllactinia guttata*	1
Heartnut (*Juglans ailanthifolia*)	Dieback	*Phomopsis* sp.	1
Honey locust (*Gleditsia triacanthos*)	Canker	*Botryosphaeria* sp.	1
Ironwood (*Ostrya virginiana*)	Leaf spot	*Septoria* sp.	2
Japanese maple (*Acer palmatum*)	Twig blight	*Phomopsis* sp.	1
Larch (*Larix* sp.)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Pythium ultimum*	1
Maple (*Acer* sp.)	Wilt	*Verticillium* sp.	1
Mountain ash (*Sorbus* sp.)	Canker	*Cytospora* sp.	1
Pin oak (*Quercus palustris*)	Leaf spot	*Tubakia* sp.	1
Quaking aspen (*Populus tremuloides*)	Anthracnose	*Colletotrichum* sp.	1
Red pine (*Pinus resinosa*)	Root rot	*Fusarium oxysporum*	1
	Root rot	*Fusarium solani*	1
	Root rot	*Pythium irregulare*	2
	Root rot	*Pythium sylvacticum*	1
	Root rot	*Pythium ultimum*	2
	Tip blight	*Pestalotiopsis sp.*	1
River birch (*Betula nigra*)	Potyvirus	Potyvirus	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
Rocky mountain juniper (*Juniperus scopulorum*)	Tip blight	*Pestalotiopsis* sp.	1
Scots pine (*Pinus sylvestris*)	Brown spot needle blight	*Lecanosticta acicola*	1
Serviceberry (*Amelanchier* sp.)	Fire blight	*Erwinia amylovora*	1
Spruce (*Picea* sp.)	Canker	*Phomopsis* sp.	3
	Needlecast	*Lophodermium* sp.	1
	Needlecast	*Rhizosphaera kalkhoffii*	4
	Needlecast	*Setomelanomma holmii*	1
	Needlecast	*Stigmina* sp.	4
Sugar maple (*Acer saccharum*)	Anthracnose	*Aureobasidium* sp.	1
Tilia sp.	Verticillium wilt	*Verticillium* sp.	1
Walnut (*Juglans* sp.)	Canker	*Nectria cinnabarina*	1
	Dieback	*Melanconium* sp.	1
Western catalpa (*Catalpa speciosa*)	Anthracnose	*Colletotricum* sp.	1
White oak (*Quercus alba*)	Anthracnose	*Discula* sp.	1
White spruce (*Picea glauca*)	Needle cast	*Rhizosphaera kalkhoffii*	1
Willow (*Salix* sp.)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1

Table 4 (contd.)

Willow (*Salix integra*)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
	Tobacco Mosaic Virus	Tobacco Mosaic Virus (TMV)	1
Yew (*Taxus* sp.)	Root rot	*Pythium irregulare*	1
	Root rot	*Pythium ultimum*	1

Table 5. Summary of plant diseases diagnosed on **field crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2015.

CROP NAME	**DISEASE**	**CAUSAL AGENT**	**NO. OF SAMPLES**
Adzuki bean (*Vigna angularis*)	Anthracnose	*Colletotrichum* sp.	1
	Bacterial leaf blight	*Pantoea agglomerans*	1
	Brown spot	*Pseudomonas syringae* pv. *syringae*	1
	Charcoal rot	*Macrophomina phaseolina*	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Pythium* sp.	1
	Stem rot	*Fusarium* sp.	2
	White mould	*Sclerotinia sclerotiorum*	1
Bean (*Phaseolus vulgaris*)	Stem rot	*Fusarium oxysporum*	1
	Stem rot	*Fusarium solani*	1
	Stem rot	*Rhizoctonia solani*	1
Corn (*Zea mays*)	Eyespot	*Kabatiella zeae*	2
	Northern corn leaf blight	*Exserohilum turcicum*	3
Oat (*Avena sativa*)	Black stem	*Stagonospora avenae*	2
	Crown rust	*Puccinia coronata*	4
Soybean (*Glycine max*)	Anthracnose	*Colletotrichum* sp.	4
	Crown and root rot	*Fusarium oxysporum*	13
	Crown and root rot	*Fusarium solani*	13
	Crown and root rot	*Pythium* sp.	10
	Crown and root rot	*Pythium dissotocum*	1
	Crown and root rot	*Pythium sylvaticum*	1
	Crown and root rot	*Pythium ultimum*	2
	Crown and root rot	*Rhizoctonia solani*	7
	Leaf spot	*Cercospora sp.*	1
	Pod and stem blight	*Phomopsis phaseoli*	1
	Root and stem rot	*Phytophthora* sp.	2
	Root rot	*Fusarium oxysporum*	9
	Root rot	*Fusarium solani*	8
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium dissotocum*	2
	Root rot	*Pythium irregulare*	6
	Root rot	*Pythium ultimum*	6
	Root rot	*Thielaviopsis basicola*	6
	Tobacco Streak Virus	Tobacco Streak Virus (TSV)	3
Sugar beet (*Beta vulgaris*)	Bacterial leaf spot	*Pseudomonas syringae*	1
	Root rot	*Fusarium oxysporum*	1

Table 5 (contd.)

Sugar beet (*Beta vulgaris*)	Root rot	*Fusarium solani*	1
	Root rot	*Pythium ultimum*	2
Tobacco (*Nicotiana* sp.)	Crown and root rot	*Pythium dissotocum*	1
	Root rot	*Thielaviopsis basicola*	1
Wheat (*Triticum* sp.)	Crown and root rot	*Pythium sylvaticum*	1
	Crown and root rot	*Rhizoctonia solani*	1
	Powdery mildew	*Oidium* sp.	1
	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	2
	Root rot	*Pythium sylvaticum*	2
	Rust	*Puccinia* sp.	2

Table 6. Summary of plant diseases diagnosed on **herb and special crop** samples submitted to the University of Guelph Pest Diagnostic Clinic in 2015.

CROP NAME	DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Amaranth (*Amaranthus* sp.)	Crown rot	*Fusarium oxysporum*	1
	Crown rot	*Fusarium solani*	1
	Crown rot	*Pythium aphanidermatum*	1
	Crown rot	*Pythium ultimum*	1
	Crown rot	*Rhizoctonia solani*	1
Basil (*Ocimum basilicum*)	Impatiens Necrotic Spot Virus	Impatiens Necrotic Spot Virus (INSV)	1
Ginseng (*Panax* sp.)	Root rot	*Cylindrocarpon destructans*	2
	Root rot	*Fusarium oxysporum*	2
	Root rot	*Fusarium solani*	2
		Phytophthora cactorum	1
	Root rot	*Pythium* sp.	2
	Root rot	*Pythium dissotocum*	
	Root rot	*Pythium irregulare*	1
	Rusted root	*Rhexocercosporidium panacis*	1
Hop (*Humulus lupulus*)	Apple Mosaic Virus	Apple Mosaic Virus (ApMV)	1
	Carlavirus	Carlavirus	5
	Crown rot	*Fusarium* sp.	1
	Crown rot	*Fusarium oxysporum*	2
	Crown rot	*Fusarium solani*	2
	Crown rot	*Rhizoctonia* sp.	1
	Crown rot	*Rhizoctonia solani*	1
	Crown and root rot	*Fusarium oxysporum*	1
	Downy mildew	*Pseudoperonospora humuli*	5
	Hop Latent Virus	Hop Latent Virus (HpLV)	2
	Rot	*Rhizoctonia solani*	1
	Verticillium wilt	*Verticillium albo-atrum*	1
Sea buckthorn (*Hippophae rhamnoides)*	Dieback	*Phomopsis* sp.	1
Sunflower (*Helianthus annuus*)	Downy mildew	*Plasmopara* sp.	1
	Root rot	*Fusarium* sp.	1
	Root rot	*Pythium* sp.	1

CROP: Diagnostic Laboratory Report

LOCATION: Bradford/Holland Marsh, Ontario

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TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE MUCK CROPS RESEARCH STATION DIAGNOSTIC LABORATORY IN 2015

ABSTRACT: As part of the integrated pest management program provided by the Muck Crops Research Station (MCRS), diagnostics service is provided to vegetable growers around Holland/Bradford Marsh, Ontario. In 2015, 225 samples were submitted to the diagnostic laboratory for identification and possible control recommendations. Samples included plants with infectious diseases, physiological disorders, 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 forecasting information for diseases and insects and 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 diseased samples on growth media.

RESULTS AND COMMENTS: Weather conditions in the 2015 growing season were conducive for the development of many fungal pathogens including *Stemphylium vesicarium*, *Pythium* spp., *Rhizoctonia* spp*.,* and *Peronospora destructor*. There was below average rainfall in May, July and September and above average rainfall in June. The excessive moisture in June created ideal conditions for both soil-borne and airborne fungal pathogens early in the season and the lack of rainfall provided drought stress later in the season. There were also many fields with issues of flooding and excessive moisture. Onion was mainly affected by *Stemphylium vesicarium* early in the season and *Peronospora destructor* as the season progressed. During the season the main issues on carrot were damping off, drought stress and leaf blights. From 11 May to 6 October, 2015, the diagnostic laboratory of the MCRS received 225 samples for diagnosis. Of these, 81% were diagnosed with infectious diseases (183 in total) and 19% with physiological disorders (42 in total). These samples were associated with the following crops: onion (35.5%), carrot (32.9%), celery (15.5%), lettuce (2.2%), brassicas (1.8%) and other crops (12.0%). Along with plant disease samples, a total of 20 samples of insects or insect damage were assessed and 5 weed samples identified. A summary of diseases diagnosed and causal agents on crop samples submitted to the MCRS diagnostic laboratory in 2015 is presented in Table 1.

Table 1: Summary of diseases diagnosed on plants submitted to the Muck Crops Research Station Diagnostic Laboratory in 2015.

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Beet	Alternaria leaf spot	*Alternaria brassicae*	1
	Cercospora leaf spot	*Cercospora beticola*	2
	Rhizoctonia root rot	*Rhizoctonia* spp.	1
Cabbage	Alternaria leaf spot	*Alternaria brassicae*	1
	Black rot	*Xanthomonas campestris* pv. *campestris*	1
	Sclerotinia head rot	*Sclerotinia sclerotiorum*	1
Carrot	Aster yellows	*Phytoplasma*	7
	Soft rot	*Erwinia carotovora*	1
	Carrot cyst nematode	*Heterodera carotae*	2
	Cavity spot	*Pythium* spp.	1
	Root knot nematode	*Meloidogyne hapla*	1
	Sclerotinia rot	*Sclerotinia sclerotiorum*	4
	Leaf blight	*Alternaria dauci* and *Cercospora carotae*	21
	Growth crack (split)	Fluctuating moisture level	2
	Pythium root dieback	*Pythium* spp.	5
	Crater rot	*Rhizoctonia carotae*	3
	Crown gall	*Agrobacterium tumefaciens*	3
	Damping off	*Pythium* spp. and/or *Rhizoctonia* spp.	15
	Fusarium rot	*Fusarium spp.*	1
	Chemical injury	Herbicide damage	5
	Chemical injury	Fumigant damage	2
	Environmental injury	Excessive moisture	1
Celeriac	Early blight	*Cercospora apii*	1
	Late blight	*Septoria apiicola*	1
Celery	Aster yellows	*Phytoplasma*	1
	Bacterial leaf blight	*Pseudomonas cichorii*	3
	Celery leaf curl	*Colletotrichum* spp.	8
	Early blight	*Cercospora apii*	2
	Late blight	*Septoria apiicola*	3
	Pink rot	*Sclerotinia sclerotiorum*	3
	Soft rot	*Erwinia carotovora*	5
	Physiological disorder	Transplant shock	3
	Chemical injury	Herbicide damage	2
	Blackheart	Calcium deficiency	5
Celery transplants (greenhouse)	Fusarium root rot	*Fusarium oxysporum*	1
Cucumber (field)	Cucumber downy mildew	*Pseudoperonospora cubensis*	1
French purslane (greenhouse)	Environmental injury	High salts	1
Garlic	Stem and bulb nematode	*Ditylenchus dipsaci*	2
	Fusarium rot	*Fusarium oxysporum* f.sp. *cepae*	1
Green onion	Purple blotch	*Alternaria porri*	1
	Downy mildew	*Peronospora destructor*	1
	Tipburn	Environmental injury	1
Lettuce	Lettuce drop	*Sclerotinia sclerotiorum* and *S. minor*	1
	Powdery mildew	*Erysiphe cichoracearum*	1
	Downy mildew	*Bremia lactucae*	3

Table 1 (contd.)

Mint	Powdery mildew	*Erysiphe cichoracearum*	1
Napa cabbage	Alternaria leaf spot	*Alternaria brassicae*	1
Okra (greenhouse)	Environmental Injury	Guttation	1
Onion	Stemphylium leaf blight	*Stemphylium vesicarium*	20
	Purple blotch	*Alternaria porri*	8
	Botrytis leaf blight	*Botrytis squamosa*	5
	Damping off	*Pythium* spp. / *Rhizoctonia* spp.	3
	Smut	*Urocystis cepulae*	10
	White rot	*Sclerotium cepivorum*	3
	Downy mildew	*Peronospora destructor*	9
	Bacterial rot/soft rot	*Erwinia carotovora*	4
	Environmental injury	Excessive moisture	1
	Tipburn	Heat stress	9
	Chemical injury	Herbicide damage	6
	Environmental injury	Pelting rain injury	2
Parsnip	Root knot nematode	*Meloidogyne hapla*	1
Potato	Early blight	*Alternaria solani*	3
	Root knot nematode	*Meloidogyne hapla*	1
	Toxic seed-piece syndrome	Physiological disorder	1
	Virus	Potato Virus Yntn	1
Spinach	Damping-off	*Pythium* spp.	1
Tomato	Bacterial leaf spot	*Xanthomonas campestris* pv. *vesicatoria*	1
	Early blight	*Alternaria solani*	1
DISEASED SAMPLES			**183**
ABIOTIC AND OTHER DISORDERS			**42**
TOTAL SUBMISSIONS			**225**

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CROP: Diagnostic Laboratory Report

LOCATION: New Brunswick

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TITLE: DISEASES DIAGNOSED ON PLANT SAMPLES SUBMITTED TO THE NBDAAF PLANT DISEASE DIAGNOSTIC LABORATORY IN 2015

ABSTRACT: The New Brunswick Department of Agriculture, Aquaculture and Fisheries (NBDAAF) Plant Disease Diagnostic Laboratory provides diagnostic services and disease management recommendations to growers and the agricultural industry in New Brunswick. In 2015, a total of 186 plant tissue samples were submitted to the diagnostic laboratory for problem identification and possible control recommendations. Samples included infectious diseases and physiological disorders.

INTRODUCTION AND METHODS: The NBDAAF Plant Disease Diagnostic Laboratory provides diagnostic services and control recommendations for diseases of various crops to growers and the agricultural industry in New Brunswick as part of an integrated pest management (IPM) service. Disease diagnostics for potato are provided by the NBDAAF's Potato Development Centre located at Wicklow, New Brunswick. Samples are submitted to the diagnostic laboratory by IPM scouts, growers, agribusiness representatives, crop insurance agents and NBDAAF crop specialists and extension officers. Disease diagnoses are based on a combination of visual examination of symptoms, microscopic observations and culturing onto growth media.

RESULTS AND COMMENTS: From 12 January to 15 November, 2015, the Plant Disease Diagnostic Laboratory received 187 diseased plant samples for diagnosis. Of these, 84% were infectious diseases (157 in total) and 16% physiological disorders (30 in total). Samples submitted to the diagnostic laboratory which were associated with insect damage are not included in this report. Also, samples diagnosed during scouting (surveys) and field visits are not included in this report. Summaries of diseases diagnosed and causal agents on crop samples submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2015 are presented in Tables 1 to 5 by crop category.

Table 1: Summary of diseases diagnosed on apples submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2015

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Apple	Black rot	*Botryosphaeria obtusa*	15
	Phytophthora fruit rot	*Phytophthora cactorum*	2
	Fruit rot	Soft rot bacteria	1
	Bitter rot	*Colletotrichum* spp.	5
	Grey mould	*Botrytis cinerea*	1
	Blue mould	*Penicillium* spp.	5
	Alternaria fruit rot	*Alternaria* sp.	3
	Nectria canker	*Neonectria galligena*	3
	Perennial canker	*Neofabraea perennans*	7
	Anthracnose	*Neofabraea* spp.	2
	Silver leaf	*Chondrostereum purpureum*	2
	Apple scab	*Venturia inaequalis*	4

(Table 1 cont.)

Apple	Powdery mildew	*Podosphaera leucotricha*	2
	Canker (black rot)	*Botryosphaeria obtusa*	2
	Frogeye leaf spot	*Botryosphaeria obtusa*	2
	Mouldy core	*Fusarium* spp., *Cladosporium* spp., *Alternaria* spp.	6
	Chemical injury	Pesticide damage	2
	Environmental injury	Frost injury	4
DISEASED SAMPLES			62
ABIOTIC DISORDERS			6
TOTAL SUBMISSIONS			68

Table 2: Summary of diseases diagnosed on berry crops submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2015

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Blackberry	Environmental injury	Drought stress	1
	Physiological disorder	Nutrient deficiency	1
Blueberry (low bush)	Septoria leaf spot	*Septoria* spp.	4
	Valdensinia leaf spot	*Valdensinia heterodoxa*	2
	Botrytis blight	*Botrytis cinerea*	1
	Exobasidium leaf and fruit spot	*Exobasidium vaccinii*	1
	Phomopsis canker	*Phomopsis vaccinii*	1
	Red leaf	*Exobasidium vaccinii*	1
	Chemical injury	Herbicide	3
	Environmental injury	Frost	4
Blueberry (high bush)	Phomopsis canker	*Phomopsis vaccinii*	1
	Chemical injury	Herbicide	2
	Environmental injury	Frost	2
Cranberry	Environmental injury	Frost	2
Raspberry	Spur blight	*Didymella applanata*	2
	Crumbly berry	Virus, physiological disorder or poor pollination	1
Strawberry	Black root rot	*Fusarium* spp., *Pythium* sp., *Rhizoctonia* sp., nematodes	10
	Grey mould	*Botrytis cinerea*	2
	Powdery mildew	*Sphaerotheca macularis* f.sp. *fragariae*	3
	Verticillium wilt	*Verticillium dahliae*	1
	Leaf scorch	*Diplocarpon earlianum*	2
	Leaf blight	*Phomopsis obscurans*	1
	Environmental injury	Drought	1
	Physiological disorder	Nutrient deficiency	1
	Environmental injury	Frost	1
DISEASED SAMPLES			33
ABIOTIC DISORDERS			18
TOTAL SUBMISSIONS			51

Table 3: Summary of diseases diagnosed on vegetable (field and greenhouse) crops submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2015

CROP	**DISEASE**	**CAUSAL AGENT**	**NUMBER OF SAMPLES**
Beet	Scab	*Streptomyces scabies*	1
Broccoli	Black leaf spot	*Alternaria brassicae* and *A. brassicicola*	3
	Physiological disorder	Nutrient deficiency	1
Cabbage	Bacterial soft rot	*Erwinia carotovora* and *Pseudomonas* spp.	1
	Splitting (stem crack)	Physiological disorder	1
Carrot	Leaf blight	*Alternaria dauci and Cercospora carotae*	1
Cauliflower	Black spot	*Alternaria* spp.	1
Celery	Leaf curl	*Colletotrichum* spp.	1
Cucumber	Downy mildew	*Pseudoperonospora cubensis*	3
	Powdery mildew	*Podosphaera xanthii* and *Erysiphe cichoracearum*	2
	Scab	*Cladosponum cucumerinum*	1
Garlic	Basal rot	*Fusarium oxysporum* f. sp. *cepae*	1
	Blue mould	*Penicillium* spp.	2
	Neck rot	*Botrytis* spp.	2
	Purple blotch	*Alternaria porri*	1
	Sunscald	Environmental injury	1
Melon	Fusarium fruit rot	*Fusarium* spp.	1
Pepper	Bacterial soft rot	*Erwinia carotovora* subsp. *carotovora*	3
	Sunscald	Environmental injury	1
Squash	Powdery mildew	*Podosphaera xanthii* and *Erysiphe cichoracearum*	1
	Downy mildew	*Pseudoperonospora cubensis*	1
	Bacterial fruit blotch	*Acidovorax avenae* subsp. *citrulli*	1
	Scab	*Cladosponum cucumerinum*	1
Swiss chard	Cercospora leaf spot	*Cercospora beticola*	1
Tomato	Leaf mould	*Passalora fulva*	8
	Powdery mildew	*Oidium neolycopersici*	9
	Early blight	*Alternaria solani*	1
	Corky root	*Pyrenochaeta* spp.	2
DISEASED SAMPLES			49
ABIOTIC DISORDERS			4
TOTAL SUBMISSIONS			53

Table 4: Summary of diseases diagnosed on field crops and forage legume crop submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2015

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Alfalfa	Lepto leaf spot	*Leptosphaerulina trifolii and L. briosiani*	1
Soybean	Downy mildew	*Peronospora manshurica*	2
Wheat	Stagonospora glume blotch	*Stagonospora* spp.	1
DISEASED SAMPLES			4
ABIOTIC DISORDERS			0
TOTAL SUBMISSIONS			4

Table 5: Summary of diseases diagnosed on trees, shrubs, herb and ornamental plants submitted to the NBDAAF Plant Disease Diagnostic Laboratory in 2015

CROP	DISEASE	CAUSAL AGENT	NUMBER OF SAMPLES
Austrian pine	Brown spot needle blight	*Mycosphaerella dearnessii*	1
Blue spruce	Diplodia tip blight	*Sphaeropsis sapinea*	2
Buckthorn	Crown rust	*Puccinia coronata*	1
Lavender	Root rot	*Rhizoctonia solani*	1
Lilac	Anthracnose	*Colletotrichum* spp.	1
	Physiological disorder	Nutrient deficiency	1
Magnolia	Environmental injury	Drought stress	1
Turfgrass	Pink snow	*Microdochium nivale*	1
Virginia creeper	Guignardia leaf spot	*Guignardia bidwellii*	1
Willow	Leaf spot	*Cladosporium* sp.	1
DISEASED SAMPLES			9
ABIOTIC DISORDERS			2
TOTAL SUBMISSIONS			11

CROP: Diagnostic Laboratory Report - All Crops

LOCATION: Prince Edward Island (PE)

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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROP SAMPLES SUBMITTED TO THE PRINCE EDWARD ISLAND PLANT DISEASE DIAGNOSTIC SERVICE (PDDS) IN 2015

ABSTRACT: The Prince Edward Island Department of Agriculture's Plant Disease Diagnostic Service (PDDS) provides diagnosis and control recommendations primarily for disease problems of commercial crops produced on PE. In total 134 samples were processed for the 2015 crop year. The 2015 growing season was unusually dry with no laboratory-confirmed incidences of potato late blight. The acreage of soybean has increased due to new markets and as a result, the number of soybean samples received increased. For the first time, anthracnose (*Colletotrichum* sp.) was identified on sweet lupin. The number of elm samples submitted for Dutch elm disease (DED) diagnosis was lower than in previous years as the City of Charlottetown implemented a massive effort to remove diseased trees in 2015.

METHODS: The Prince Edward Island Department of Agriculture's Plant Disease Diagnostic Service (PDDS) provides diagnosis and control recommendations primarily for diseases of commercial crops on PE. Samples are submitted to the laboratory by agriculture extension staff, producers, growers, agri-business representatives, crop insurance agents and the general public. Diagnoses are based on a combination of investigative work, visual examination of symptoms, microscopic observation and culturing onto artificial media. In most samples one or more causal agents were identified.

RESULTS: A total of 134 samples were processed in the 2015 crop year and 237 disease diagnoses were completed between June 1 and October 31. Categories of samples received were: potato (47%), cereal and soybean (34%), vegetable and fruit crops (13%), and other (5%). The category 'other' covers samples such as elm, peach, and tobacco. A summary of diseases diagnosed on crop samples is provided in Table 1 by crop category. The diagnoses reported may not necessarily reflect the major problems encountered during the season in the field, but rather those most prevalent within the samples submitted.

The planting season started late due to excessive rainfall in April. However the remainder of the 2015 growing season was unusually dry. There were no laboratory-confirmed incidences of potato late blight. In the previous 19 years late blight has been identified annually in potato and tomato samples. A number of factors played a role in the reduction of potato late blight this year. Environmental conditions were not conducive for the development and spread of *Phytophthora* and potato producers carried out a stringent, preventive program. The US23 late blight genotype initially came to the Province in 2014 on greenhouse tomato and as a result, a campaign was implemented to prevent the spread of the fungus from greenhouse tomato seedlings or home garden tomato seed. The acreage of soybean has increased due to new markets and as a result, the number of soybean samples received at the laboratory increased. Anthracnose (*Colletorichum* sp.) was identified for the first time in sweet lupin. The number of elm samples submitted for Dutch elm disease (DED) diagnoses was lower than in previous years as the City of Charlottetown implemented a massive effort to remove diseased trees.

Table 1: Summary of diseases diagnosed on commercial crop samples submitted to the Plant Disease Diagnostic laboratory, Prince Edward Island Department of Agriculture in 2015

CROP	DISEASE	CAUSAL AGENT / PLANT PATHOGEN	FREQUENCY OF IDENTIFICATION
VEGETABLES:			
Beet	Common scab	*Streptomyces scabies*	1
	Root rot	*Fusarium* sp.	1
		Pythium sp.	1
		Rhizoctonia sp.	1
Cabbage	Leaf spot	*Alternaria* sp.	2
Cauliflower	Leaf spot	*Alternaria* sp.	3
	Clubroot	*Plasmodiophora brassicae*	1
	Rhizoctonia canker	*Rhizoctonia* sp.	1
	Rhizoctonia stem girdling	*Rhizoctonia solani*	1
	White mould	*Sclerotinia sclerotiorum*	1
Corn	Seed rot and damping-off	*Fusarium oxysporum*	1
		Pythium sp.	1
Cucumber	Damping-off	*Pythium* sp.	2
Potato	Abiotic disease	Heat stress	1
		Sunscald	1
	Bacterial soft rot	*Clostridium* sp.	1
		Erwinia sp. (*Pectobacterium* sp.)	3
		Pseudomonas sp.	3
	Black dot	*Colletotrichum coccodes*	2
	Black scurf	*Rhizoctonia solani*	6
	Botrytis grey mould	*Botrytis cinerea*	5
	Brown spot	*Alternaria alternata*	4
	Common scab	*Streptomyces scabies*	3
	Early dying syndrome	*Botrytis cinerea*	1
		Colletotrichum coccodes	3
		Colletotrichum sp.	1
		Fusarium sp.	5
		Pythium sp.	2
		Rhizoctonia solani	7

Table 1 (contd.)

Potato	Early dying syndrome	*Verticillium dahliae*	5
		Verticillium sp.	1
	Fusarium dry rot	*Fusarium oxysporum*	1
		Fusarium sp.	2
	Fusarium wilt	*Fusarium* sp.	3
	Nematode	Nematode	2
	Leak	*Pythium* sp.	7
	Physiological disorders	Blackheart	1
		Chilling	1
		Little tuber	1
		Undetermined	2
	Pinkeye	*Pseudomonas* sp.	4
		Undetermined	5
	Rhizoctonia canker	*Rhizoctonia solani*	1
	Rhizoctonia skin cracking	*Rhizoctonia solani*	13
	Seed piece decay	Inconclusive	2
		Pythium sp.	1
		Rhizopus sp.	1
	Silver scurf	*Helminthosporium solani*	5
	Verticillium wilt	*Verticillium dahliae*	3
		Verticillium sp.	7
Rutabaga	Rhizoctonia root rot	*Rhizoctonia* sp.	1
Tomato	Anthracnose	*Colletotrichum coccodes*	1
	Leaf spot	*Septoria* sp.	4

CEREAL / FIELD CROPS:

Barley	Common root rot	*Alternaria* sp.	1
		Fusarium sp.	1
	Insect	Thrips	1
	Net blotch	*Pyrenophora sp.*	5
	Physiological disorder	Nutritional imbalance	1
	Powdery mildew	*Erysiphe* sp.	1
	Rust	*Puccinia* sp.	1
	Smut	*Ustilago* sp.	1
	Scald	*Rhynchosporium sp.*	2
	Spot blotch	*Cochliobolus* sp.	4

Table 1 (contd.)

Faba bean	Anthracnose	*Colletotrichum* sp.	1
	Black root rot	*Fusarium* sp.	1
		Rhizoctonia sp.	1
	Damping-off	*Fusarium* oxysporum	1
		Pythium sp.	1
		Rhizoctonia sp.	1
	Fusarium wilt	*Fusarium oxysporum*	1
	Root rot	*Fusarium oxysporum*	1
Lupin	Anthracnose	*Colletotrichum* sp.	2
Oat	Leaf blotch	*Septoria sp. (Stagonospora* sp.)	1
	Smut	*Ustilago sp.*	2
Soybean	Abiotic disease	Nutritional imbalance	1
	Brown spot	*Septoria* sp.	9
	Damping-off	*Fusarium oxysporum*	1
		Fusarium sp.	1
		Pythium sp.	1
		Rhizoctonia solani	1
	Frog-eye leaf spot	*Cercospora* sp.	1
	Pod and stem blight	*Diaporthe* sp.	2
	Rhizoctonia foliar blight	*Rhizoctonia solani*	2
	Rhizoctonia root rot	*Rhizoctonia* sp.	7
	Root and stem rot	*Colletotrichum* sp.	2
		Fusarium avenaceum	1
		Fusarium sp.	4
		Phytophthora sp.	4
	Rust	*Phakospora* sp.	1
Wheat	Fusarium head blight	*Fusarium graminearum*	1
		Fusarium sp.	1
	Glume blotch	*Septoria* sp.(*Stagonospora* sp.)	2
	Rust	*Puccinia* sp.	1
	Septoria leaf spot	*Septoria nodorum*	1
	Sooty mould	*Alternaria* sp.	2
		Aspergillus sp.	1
		Cladosporium sp.	2
		Cochliobolus sp.	2
		Fusarium sp.	1

Table 1 (contd.)

SMALL FRUIT:			
Blueberry (lowbush)	Red leaf	*Exobasidium* sp.	1
	Rust	*Pucciniastrum vaccinii*	2
	Twig blight	*Phomopsis* sp.	1
Grape	Downy mildew	*Plasmopara viticola*	1
Strawberry	Abiotic disease	Tip burn	1
	Leaf blight	*Phomopsis* sp.	2
	Powdery mildew	*Sphaerotheca* sp.	3
OTHER CROPS:			
Elm		DED not detected	1
Peach	Twig blight	*Phomopsis* sp.	1
Tobacco	Abiotic disease	Nutritional imbalance	1
	Leaf spot	*Rhizoctonia solani*	1
	Root rot	*Rhizoctonia solani*	1

CULTURES : Cultures commerciales reçues en 2015 au Laboratoire de diagnostic en phytoprotection

RÉGION : Québec

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TITRE : MALADIES DIAGNOSTIQUÉES SUR LES ÉCHANTILLONS DE CULTURES COMMERCIALES EN 2015 AU LABORATOIRE DE DIAGNOSTIC EN PHYTOPROTECTION DU MAPAQ

RÉSUMÉ : Du 1er janvier au 31 décembre 2015, 999 maladies ont été identifiées parmi 2313 échantillons traités par la section phytopathologie du laboratoire; une proportion importante d'échantillons (51%) étant soumise pour la détection d'un agent pathogène spécifique. La proportion des maladies chez les plantes maraîchères représentait 49% de toutes les maladies identifiées, les petits fruits 22%, les espèces ornementales 9%. Des maladies d'origine parasitaire ont été rapportées dans 956 diagnostics soit 94% de toutes les maladies identifiées, ce qui est supérieur à la moyenne des cinq dernières années (82%). Parmi ces diagnostics, 744 sont attribuables aux champignons, 122 aux bactéries, 45 aux virus, 24 aux nématodes et 21 aux phytoplasmes. Les stress culturaux et climatiques représentaient 6% des diagnostics effectués.

MÉTHODES : Le Laboratoire de diagnostic en phytoprotection du ministère de l'Agriculture, des Pêcheries 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 et 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* », 1e édition (2004).

RÉSULTATS ET DISCUSSIONS : Les tableaux 1 à 12 présentent le sommaire des maladies parasitaires et non parasitaires identifiées sur les cultures commerciales. Au tableau 1, les plantes maraîchères de plein champ regroupent aussi les transplants provenant des serres et des pépinières. Les 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 (serriculture) sont essentiellement des espèces herbacées annuelles ou vivaces.

Le nombre de maladies rapportées ne correspond 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 incertains ou dont le niveau de certitude est insuffisant, ni des résultats négatifs provenant des demandes de détection. 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 d'eau; les orages violents, les vents forts et la grêle.

Les infections fongiques racinaires représentaient 55% de toutes les maladies fongiques. Les fusarioses racinaires étaient les infections fongiques qui affectaient le plus grand nombre d'espèces cultivées (50/ 117), la tomate de serre et les allium étant les plus affectés. Quelques infections fongiques plutôt rares identifiées en 2015 :*Phytophthora rosacearum* et *P. sansomeana* causant un pourridié chez la pomme de terre et le soya respectivement.

Les infections bactériennes les plus diversifiées se retrouvent parmi les *Allium*; cependant les pommes de terre, les tomates et les pommiers montraient les fréquences les plus importantes. *Dickeya chrysanthemi* sur la pomme de terre est une seconde observation. *Xanthomonas arboricola* sur le cerisier serait un nouveau diagnostic de même qu'une espèce encore indéterminée de *Pseudomonas* pectinolytique causant des pourritures molles sur les tiges annuelles du framboisier. *Acidovorax valeriannellae* causant des taches foliaires sur le basilic serait une première observation au laboratoire.

Parmi les 17 types de virus détectés, celui de la tache nécrotique de l'impatiente (INSV) a été le plus souvent identifié, et ce, uniquement sur les plantes ornementales.

Comme l'an dernier, *Ditylenchus dipsaci* causait chez l'ail, la plupart des maladies à nématodes rencontrées.

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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 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail	*Botrytis allii / Botrytis* spp.	Pourriture du col/ dépérissement	17
	Burkholderia gladioli	Pourriture brune	1
	Ditylenchus dipsaci	Maladie vermiculaire de l'oignon	9
	Embellisia allii	Tache et pourriture du bulbe	6
	Fusarium acuminatum / F. moniliforme / F. oxysporum / F. proliferatum / Fusarium sp.	Pourriture des bulbes	44
	Pantoea agglomerans	Pourriture des feuilles	3
	Phytoplasmes	Malformation des fleurs	1
	Potyvirus	Dépérissement foliaire	1
	Pseudomonas marginalis	Pourriture des feuilles	3
	Pseudomonas syringae	Dépérissement foliaire	1
	Pythium sylvaticum / P. ultimum / Pythium spp.	Pourridié pythien/ malformation et pourriture foliaire	3
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Rhizoctonia solani	Rhizoctone	7
Aneth	*Cylindrocarpon* sp.	Pourriture racinaire	1
	Fusarium oxysporum / F. solani	Pourridié fusarien	3
	Pythium sp.	Pourridié pythien	1
Betterave, poirée	*Fusarium oxysporum*	Fusariose	4
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pseudomonas syringae	Tache foliaire	1
	Pythium ultimum	Pourridié pythien	3
Brocoli	*Alternaria brassicae*	Tache alternarienne / tache	2
	Fusarium sp.	noire	1
	Pythium sp.	Fusariose vasculaire	1
	Rhizoctonia solani	Pourridié pythien	1
	Xanthomonas campestris pv. *campestris*	Rhizoctone	1
	Granulée brune	Nervation noire	1
	Phytotoxicité atrazine	Anomalie de coloration florale	1
Carotte, panais	*Cylindrocarpon* sp.	Chancre d'entrepôt	1
	Fusarium sp.	Pourriture racinaire	1
	Geotrichum candidum	Pourriture caoutchou	1
	Meloidogyne sp.	Nodosité des racines	3
	Rhizoctonia solani	Rhizoctone	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	2
	Phytotoxicité glyphosate		1
Céleri	*Cercospora* sp.	Cercosporose	1
	Colletotrichum apii	Anthracnose	3
	Fusarium oxysporum	Fusariose	1
	Rhizoctonia solani	Rhizoctone	1
	Septoria apii	Septoriose	1

Tableau 1. **(suite)** Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Chou, Chou de Bruxelles	*Alternaria brassicicola*	Tache noire	2
	Fusarium oxysporum	Fusariose	1
	Pythium sylvaticum / Pythium sp.	Pourridié pythien	2
	Conductivité électrique du sol élevée		1
Chou-fleur	*Fusarium oxysporum*	Fusariose	1
	Pythium sp.	Pourridié pythien	1
	Xanthomonas campestris pv. *campestris*	Nervation noire	1
	Phytotoxicité gramoxone		1
Citrouille	*Colletotrichum* sp.	Anthracnose	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pythium irregulare	Pourridié pythien	1
	Phytophthora sp.	Pourriture du fruit	1
Concombre	*Pectobacterium carotovorum*	Pourriture molle bactérienne	1
	Phytophthora capsici	Pourriture du fruit et du collet	3
	Pseudoperonospora cubensis	Mildiou	2
	Rhizoctonia solani	Rhizoctone	1
	Ulocladium sp.	Tache foliaire	1
	Xanthomonas campestris	Tache bactérienne	1
Courge	*Alternaria alternata*	Alternariose	1
	Cladosporium sp.	Tache foliaire	1
	Colletotrichum sp.	Anthracnose	2
	Fusarium culmorum / F. graminearum / Fusarium spp.	Brûlure foliaire, chancre au collet	6
	Geotrichum candidum	Pourriture aqueuse	3
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Phytophthora capsici	Pourridié phytophthoréen	6
	Pseudomonas syringae pv. *lacrymans*	Tache angulaire	3
	Blessure mécanique		2
	Carence d'éléments majeurs		1
Courgette	*Erwinia tracheiphila*	Flétrissement bactérien	1
	Pseudomonas syringae	Tache angulaire	1
Épinard	*Cladosporium* sp.	Tache foliaire	1
	Pythium sp.	Pourridié pythien	1
Gourgane, haricot	*Ascochyta* sp.	Ascochytose	2
	Botrytis sp.	Tache chocolat	3
	Cladosporium sp.	Tache sur fleur et gousse	1
	Colletotrichum sp.	Anthracnose	2
	Fusarium spp.	Fusariose	2
	Pythium sp.	Pourridié pythien	2
	Rhizoctonia solani	Rhizoctone	4
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Pseudomonas savastanoi	Tache de gousses	2

Tableau 1. **(suite)** Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Maïs sucré	*Fusarium graminearum*	Fusariose de l'épi	1
	Helminthosporium sp.	Tache helminthosporéenne	1
Melon, pastèque, cantaloup	*Alternaria alternata*	Alternariose	1
	Fusarium oxysporum	Fusariose	2
	Papaya Ringspot Virus (PRSV)	Tache sur fruit	1
	Phomopsis sp.	Flétrissement	1
	Phytophthora capsici	Pourriture du fruit	1
	Plectosporium tabacinum	Tache plectosporienne	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium sp.	Pourridié pythien	1
	Xanthomonas axonopodis	Tache bactérienne	1
Oignon, échalote, poireau, ciboulette	*Enterobacter cloacae*	Pourriture du bulbe et du feuillage	3
	Fusarium oxysporum / F. proliferatum / Fusarium spp.	Pourriture des racines et du bulbe	12
	Levures	Pourriture du bulbe	1
	Pythium sp.	Pourridié pythien	2
	Rhizoctonia sp.	Rhizoctone	1
	Sclerotinia sp.	Sclérotiniose	1
	Stemphylium botryosum	Moisissure noire des feuilles	1
	pH inadéquat		1
Okra	*Fusarium* sp.	Pourridié fusarien	2
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium sp.	Pourridié pythien	1
Piment, poivron	*Colletotrichum* sp.	Anthracnose	1
	Fusarium oxysporum	Pourridié fusarien	2
	Meloidogyne sp.	Nodosité racinaire	1
	Phytophthora capsici	Pourriture de fruits, de collets et de racines	2
Pois vert	*Aphanomyces euteiches*	Nécrose racinaire	1
	Fusarium spp.	Pourridié fusarien	3
	Pythium sylvaticum	Pourridié pythien	2
	Rhizoctonia solani	Rhizoctone commun	2
	Phytotoxicité atrazine		2
Pomme de terre	*Alternaria alternata / A. solani*	Alternariose	4
	Alfalfa Mosaic Virus (AMV)	Anomalie de coloration foliaire	1
	Botrytis cinerea	Moisissure grise	1
	Colletotrichum coccodes	Dartrose	12
	Dickeya chrysanthemi	Jambe noire	2
	Fusarium sambucinum / Fusarium spp.	Pourriture fusarienne	5
	Geotrichum candidum	Pourriture caoutchouc	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	21

Tableau 1. (suite) Sommaire des maladies diagnostiquées parmi les **cultures maraîchères** de champs reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Pomme de terre	*Phytophthora erythroseptica*	Pourriture rose	1
	Phytophthora infestans	Mildiou	2
	Phytophthora rosacearum	Pourriture du collet et tubercule	1
	Phytoplasmes	Malformation foliaire	1
	Potyvirus	Anomalie de coloration foliaire	1
	Pratylenchus sp.	Nanisme	1
	Pseudomonas corrugata / P. fluorescens / P. marginalis	Pourriture molle bactérienne	4
	Potato Virus Y (PVY)	Mosaïque / nanisme	
	Pythium dissotocum / P. irregulare /		3
	P. ultimum / Pythium sp.	Pourriture aqueuse	8
	Rhizoctonia solani	Rhizoctonie	2
	Sclerotinia sclerotiorum	Sclérotiniose	3
	Streptomyces sp.	Gale bactérienne	1
	Verticillium albo-atrum / V. dahliae	Verticilliose	10
	Cœur brun / cœur creux / cœur noir		3
	Croissance secondaire		1
	Œdème foliaire		1
	Phytotoxicité chlorpropham		1
	Phytotoxicité Dicamba		1
	Phytotoxicité glyphosate		2
	Phytotoxicité métribuzine		1
	Phytotoxicité huile minérale		1
	Tache de rouille		1
Radis, daïkon	*Pythium sp.*	Pourridié pythien	1
Rutabaga	*Fusarium sp.*	Pourriture du collet	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pythium sp.	Pourridié pythien	1
Rhubarbe	*Phoma herbarum*	Tache phoméenne	1
Tomate	*Clavibacter michiganensis* subsp. *michiganensis*	Chancre bactérien	1
	Colletotrichum coccodes	Anthracnose racinaire	1
	Fusarium oxysporum / Fusarium spp.	Pourridié fusarien	3
	Geotrichum candidum	Pourriture laiteuse	3
	Phytophthora capsici	Pourriture du fruit	1
	Phytophthora infestans	Mildiou	1
	Pythium ultimum	Pourridié pythien	2
	Sclerotinia sclerotiorum	Sclérotiniose	4
	Verticillium sp.	Verticilliose	1
Total			**386**

Tableau 2. Sommaire des maladies diagnostiquées parmi les **légumes d'entrepôt** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Ail	*Rhizopus* sp.	Pourriture du bulbe	4
Carotte	*Botrytis cinerea*	Moisissure grise	1
	Pseudomonas marginalis	Tache racinaire	1
Chou	*Geotrichum candidum*	Pourriture aqueuse	1
Courge	*Geotrichum candidum*	Pourriture aqueuse	1
	Fusarium graminearum	Pourriture du fruit	1
	Phoma cucurbitacearum	Pourriture noire	1
Échalote	*Aspergillus flavus*	Tache des bulbes	1
	Penicillium sp.	Tache des bulbes	1
Endive	*Botrytis cinerea*	Moisissure grise	1
	Fusarium solani	Chancre racinaire	1
	Phoma sp.	Pourriture racinaire	1
	Pseudomonas fluorescens	Pourriture molle racinaire	1
	Pseudomonas marginalis	Pourriture molle racinaire	1
	Sclerotinia sclerotiorum	Sclérotiniose	1
Physalis	Froid		1
	Conductivité électrique du sol élevée		1
Pomme de terre	*Alternaria* sp.	Alternariose	1
	Fusarium spp.	Fusariose	4
	Geotrichum sp.	Pourriture caoutchouc	1
	Helminthosporium solani	Tache argentée	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	3
	Potato Mop Top Virus (PMTV)	Anneaux bruns dans le tubercule	1
	Rhizoctonia solani	Rhizoctonie	2
Total			**33**

Tableau 3. Sommaire des maladies diagnostiquées parmi les **plantes maraîchères de serres** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
	Rhizopus sp.	Pourriture des fleurs	1
	Verticillium sp.	Verticilliose	2
	Botrytis cinerea	Moisissure grise	1
	Didymella bryoniae	Pourriture noire	1
	Fusarium oxysporum	Fusariose vasculaire	1
	Pseudomonas syringae	Tache angulaire	1
	Pseudoperonospora cubensis	Mildiou	1
	Pythium irregulare / P. sylvaticum / Pythium spp.	Pourridié pythien	5
Laitue	*Sclerotinia* sp.	Sclérotiniose	1
Poivron, piment	*Botrytis cinerea*	Moisissure grise	1
	Colletotrichum sp.	Anthracnose	1
	Fusarium sp.	Pourridié fusarien	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium sp.	Pourridié pythien	1
Tomate	*Acremonium strictum*	Chancre sec	2
	Clavibacter michiganensis subsp. *michiganensis*	Chancre bactérien	9
	Fulvia fulva	Moisisissure olive	1
	Fusarium oxysporum / Fusarium spp.	Pourridié fusarien	20
	F. sporotrichioides / Fusarium striatum	Chancre sur tige	2
	Meloidogyne sp.	Nodosité racinaire	1
	Pectobacterium carotovorum	Pourriture molle bactérienne	1
	Pepino Mosaic Virus (PepMV)	Mosaïque foliaire	6
	Plectosporium tabacinum	Chancre de tige	2
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium irregulare / P. torulosum / Pythium spp.	Pourridié pythien	6
	Sclerotinia sclerotiorum	Sclérotiniose	1
	Tomato Spotted Wilt Virus (TSWV)	Anomalie de coloration foliaire	2
	Verticillium dahliae	Verticilliose	1
Total			**74**

Tableau 4. Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Amélanchier	Conductivité électrique du sol élevée		1
Argousier	*Alternaria* sp.	Brûlure foliaire	1
	Aureobasidium sp. / levures	Pourriture des fruits	2
	Colletotrichum sp.	Anthracnose	1
	Fusarium oxysporum / *Fusarium* spp.	Pourridié fusarien	6
	Phomopsis sp.	Brûlure phomopsienne	6
	Phytophthora cactorum	Pourridié phytophthoréen	2
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1
	Scutellonema sp.	Dépérissement	1
	Septoria sp.	Tache septorienne	1
	Verticillium dahliae	Verticilliose	2
	Zythia sp.	Tache et brûlure foliaire	1
Aronie	*Cytospora* sp.	Chancre cytosporéen	2
Bleuetier en corymbe	*Botrytis cinerea*	Moisissure grise	4
	Blueberry Scorch Virus (BlScV)	Anomalie de coloration foliaire	4
	Colletotrichum acutatum	Anthracnose sur tige	2
	Fusarium sambucinum	Dépérissement foliaire et de tige	1
	Microsphaera sp.	Blanc	1
	Monilia vaccinii-corymbosi	Moniliniose	1
	Phomopsis vaccinii	Brûlure phomopsienne	1
	Phytoplasmes	Anomalie de coloration, nanisme, malformation	10
	pH inadéquat		1
	Sol inadéquat		1
Bleuetier nain	Blueberry Scorch Virus (BlScV)	Malformation foliaire	1
	Cytospora sp.	Chancre cytosporéen	1
	Pestalotiopsis sp.	Chancre de tige	1
	Septoria sp.	Septoriose	2
	Phytotoxicité glyphosate		1
Camerisier	*Botrytis cinerea*	Moisissure grise	1
	Fusarium sp.	Dépérissement	1
	Microsphaera sp. / *Oidium* sp.	Blanc	2
	Phoma sp.	Brûlure foliaire	1
	Pythium sylvaticum	Dépérissement	1
Canneberge	Blueberry Shock Virus (BlShV)	Anomalie de coloration des baies	1
	Botrytis cinerea	Moisissure grise	1
	Fusicoccum sp.	Anomalie de coloration foliaire	1
	Levures	Pourriture des baies	1
	Phyllosticta vaccinii	Dépérissement	2
	Physalospora vaccinii	Pourriture tachetée	1
	Protoventuria myrtilli	Tache foliaire et des baies	4
	Tobacco Streak Virus (TSV)	Anomalie de coloration des baies	1

Tableau 4. (suite) Sommaire des maladies diagnostiquées parmi les **petits fruits** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Cassissier,	*Pseudomonas syringae*	Moucheture bactérienne	1
groseillier	*Septoria ribis*	Tache septorienne	2
Fraisier	*Botrytis cinerea*	Moisissure grise	3
	Colletotrichum acutatum	Anthracnose	1
	Longidorus sp.	Noircissement des racines	1
	Meloidogyne sp.	Nodosité racinaire	2
	Phytophthora cactorum	Pourriture des fruits et collets	5
	Phytophthora spp.	Pourriture des racines et des collets	9
	Phytoplasmes		1
	Pratylenchus sp.	Lésions des racines	3
	Pythium spp. / *Rhizoctonia* spp. / *Cylindrocarpon* spp. / *Fusarium* spp. / *Thielaviopsis* spp.	Pourriture noire des racines	45
	Strawberry Mottle Virus (SMoV)		3
	Strawberry Mild Yellow Edge Virus (SMYEV)		2
	Strawberry Pallidosis Virus (SPaV)		1
	Strawberry vein banding virus (SVBV)		2
	Sphaerotheca macularis	Blanc	2
	Verticillium dahliae	Verticilliose	7
	Phytotoxicité atrazine / métribuzine		2
	Phytotoxicité glyphosate		2
	Phytotoxicité mésotrione / terbacil		2
Framboisier	*Agrobacterium tumefaciens*	Tumeur du collet	7
rouge / noir	*Botrytis cinerea*	Moisissure grise	3
	Phytophthora spp.	Pourridié phytophthoréen	1
	Pseudomonas sp.	Pourriture foliaire et de tige	1
	Pratylenchus sp.	Lésion racinaire	1
	Cylindrocarpon sp. / *Fusarium* spp. / *Pythium* spp. / *Rhizoctonia* spp.	Pourriture noire des racines	5
	Pucciniastrum americanum	Rouille jaune tardive	1
	Rhizoctonia solani	Rhizoctone	2
	Pythium sylvaticum / *Pythium* sp.	Pourridié pythien	1
	Septoria rubi	Septoriose	1
	Sphaerotheca macularis	Blanc	1
	Blessure par le vent		1
	Gel hivernal		1
Sureau	*Armillaria* sp.	Pourridié-agaric	1
	Phytotoxicité pesticide		1
Vigne	*Colletotrichum truncatum*	Anthracnose	3
	Cytospora chrysosperma	Chancre cytosporéen	2
	Fusarium acuminatum / *F. oxysporum*	Chancre de tige	2
	Phoma glomerata	Tache foliaire/ chancre	2
Vigne	*Phomopsis amygdali*	Excoriose	2
	Phytoplasmes	Jaunissement foliaire, malformation	1
	Pseudopezicula sp.	Rougeot	1
Total			**215**

Tableau 5. Sommaire des maladies diagnostiquées parmi les **céréales et cultures associées** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Avoine	*Fusarium oxysporum*	Pourridié fusarien	2
	Pseudomonas syringae	Moucheture bactérienne	1
	Puccinia sp.	Rouille	1
	Pythium spp.	Piétin brun	2
	Ustilago spp.	Charbon	3
Blé, épeautre	*Bipolaris* sp.	Tache helminthosporienne	1
	Blumeria sp.	Blanc	2
	Colletotrichum graminicola	Anthracnose	1
	Fusarium oxysporum / Fusarium sp.	Piétin fusarien	2
	Puccinia sp.	Rouille	1
	Pythium heterothallicum / P. irregulare / P. sylvaticum	Piétin brun	3
	Rhizoctonia sp.	Rhizoctone	1
Quinoa	*Peronospora* sp.	Mildiou	1
Seigle	*Fusarium* sp	Pourridié fusarien	2
	Pythium sp.	Pourridié pythien	1
Total			**24**

Tableau 6. Sommaire des maladies diagnostiquées parmi les **grandes cultures** (**protéagineuses, oléagineuses, textiles et autres cultures associées**) reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Cameline	*Peronospora parasitica*	Mildiou	1
Chanvre	*Fusarium acuminatum*	Pourriture des feuilles	1
Maïs grain,	*Cladosporium* sp.	Moisissure noire	1
maïs ensilage	*Colletotrichum graminicola*	Anthracnose	2
	Fusarium culmorum / F. gramimearum / F.		
	oxysporum / F. poae / F. solani / Fusarium	Piétin fusarien	8
	spp.	Rouille	3
	Puccinia sorghi		
	P. heterothallicum / P. sylvaticum /	Pourridié pythien	5
	Pythium spp.		1
	Sol inadéquat		
Soya	*Alternaria alternata*	Tache alternarienne	1
	Cercospora sojina	Cercosporose	1
	Colletotrichum sp.	Anthracnose	2
	Corynespora cassiicola	Pourriture des racines; tache concentrique	4
	Fusarium acuminatum / F. equiseti / F. graminearum / F. oxysporum / Fusarium spp.	Fusariose	15
	Peronospora manshurica	Mildiou	1
	Phomopsis sp.	Brûlure phomopsienne	3
	Phytophthora sansomeana / P. sojae / Phytophthora spp.	Pourridié phytophthoréen	3
	Pseudomonas syringae	Moucheture bactérienne	2
	Pythium attrantheridium / P. intermedium / P. irregulare / P. sylvaticum / Pythium spp.	Pourridié pythien	12
	Rhizoctonia solani	Rhizoctone commun	2
	Sclerotinia sclerotiorum	Sclérotiniose	2
	Septoria glycines	Tache septorienne	6
	Xanthomonas campestris	Tache bactérienne	1
	Phytotoxicité herbicides (dicamba, mésotrione, métribuzine)		4
	Sol inadéquat		1
Total			**82**

Tableau 7. Sommaire des maladies diagnostiquées parmi les **plantes fourragères** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE / CAUSE	MALADIE / SYMPTÔME	NOMBRE
Luzerne	*Colletotrichum trifolii*	Anthracnose	1
	Fusarium sp.	Anomalie de coloration foliaire	1
	Leptosphaerulina sp.	Tache lepto	1
	Pythium sp.	Pourridié pythien	1
	Rhizoctonia solani	Rhizoctone	1
Raygrass	*Puccinia coronata*	Rouille couronnée	1
Trèfle	*Uromyces trifolii*	Rouille commune	1
Total			**7**

Tableau 8. Sommaire des maladies diagnostiquées parmi les **arbres et arbustes fruitiers** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Cerisier	*Blumeriella jaapii (Phloeosporella padi)*	Brûlure foliaire	3
	Monilia sp.	Pourriture brune	1
	Phoma sp.	Pourriture du fruit	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Wilsonomyces carpophilus	Criblure	1
	Xanthomonas arboricola	Tache bactérienne	1
Poirier	*Pseudomonas syringae*	Chancre bactérien	1
	Venturia pirina	Tavelure	1
Pommier	*Cytospora* sp.	Chancre cytosporéen	1
	Erwinia amylovora	Feu bactérien	11
	Pseudomonas syringae	Chancre bactérien	2
	Sphaeropsis malorum	Pourriture noire	1
	Spilocaea pomi	Tavelure	8
	Tubercularia vulgaris	Maladie du corail	3
Prunier domestique	*Pseudomonas syringae*	Chancre bactérien	1
Total			**37**

Tableau 9. Sommaire des maladies diagnostiquées parmi les **graminées à gazon** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Agrostis tenuis	*Microdochium nivale*	Moisissure nivéale rosée	2
	Pythium torulosum / Pythium sp.	Piétin brun	3
Poa annua,	*Colletotrichum graminicola*	Anthracnose	1
P. pratensis	*Curvularia* sp.	Tache foliaire	3
	Fusarium acuminatum / *Fusarium* spp.	Fusariose	3
	Magnaporthe sp.	Dépérissement	1
	Microdochium nivale	Moisissure nivéale rosée	6
	Pythium rostratum / P. torulosum / Pythium spp.	Piétin brun	11
	Sclerotinia sp.	Sclérotiniose	1
	Gel hivernal		1
Total			**33**

Tableau 10. Sommaire des maladies diagnostiquées parmi les **arbres** et **arbustes ornementaux** reçus au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Abies balsamea	*Phomopsis* sp.	Brûlure phomopsienne	1
Acer sp.	*Phomopsis* sp.	Brûlure phomopsienne	1
	Phytotoxicité atrazine		1
Catalpa sp.	*Fusarium proliferatum*	Dépérissement	1
Cornus sp.	*Pseudomomas syringae*	Moucheture bactérienne	1
	Xanthomonas axonopodis	Tache bactérienne	1
Cotoneaster sp.	*Phomopsis* sp.	Brûlure phomopsienne	1
	Septoria sp.	Tache septorienne	1
	Sphaeropsis sp.	Brûlure foliaire	1
Ginko biloba	Insolation		1
Hydrangea spp.	*Fusarium graminearum*	Brunissement racinaire	1
	Phytotoxicité glyphosate		1
Malus sp.	*Erwinia amylovora*	Brûlure bactérienne	1
Picea glauca	*Cylindrocarpon destructans*	Pourriture racinaire des plantules	1
	Phoma sp.	Dépérissement des plantules	1
Rhododendron sp.	*Pestalotiopsis* sp.	Tache pestalotienne	1
Rhus typhina	*Fusarium* sp.	Pourriture racinaire	1
	Pythium sp.	Pourriture racinaire	1
	Rhizoctonia solani	Pourriture racinaire	1
Sambucus sp.	*Cytospora* sp.	Chancre cytosporéen	1
	Gel hivernal	Brûlure de la tige	1
Spiraea sp.	*Fusarium* sp.	Pourriture racinaire	1
Thuja occidentalis	*Phyllosticta thuyae*	Brûlure phylostictienne	1
Ulmus sp.	*Microsphaeropsis* sp.	Dépérissement	1
	Phoma sp.	Dépérissement	1
Total			**25**

Tableau 11. Sommaire des maladies diagnostiquées parmi les **plantes ornementales herbacées** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Abutilon sp.	*Fusarium* spp.	Coloration anormale des graines	3
Amaranthus spp.	*Fusarium* spp.	Pourridié fusarien	1
	Rhizoctonia solani	Rhizoctone	1
Asclepias sp.	*Alternaria* sp.	Tache foliaire	1
	Cercospora sp.	Cercosporose	1
	Colletotrichum sp.	Anthracnose	3
Begonia spp.	*Botrytis cinerea*	Moisissure grise	1
	Impatiens Necrotic Spot Virus (INSV)	Anomalie de coloration foliaire	5
	Tomato Spotted Wilt Virus (TSWV)	Anomalie de coloration foliaire	1
	Xanthomonas axonopodis	Tache bactérienne	1
Bergenia cordata	*Aphelenchoides* sp.	Brûlure foliaire	1
	Colletotrichum sp.	Anthracnose	1
Brugmansia sp.	Impatiens Necrotic Spot Virus (INSV)	Anomalie de coloration foliaire	1
	Potyvirus	Anomalie de coloration foliaire	1
Calamagrostis sp.	*Colletotrichum* sp.	Anthracnose	1
Calibrachoa sp.	*Pythium* sp.	Pourridié pythien	2
Chysanthemum sp.	*Botrytis cinerea*	Moisissure grise	1
Dianthus sp.	*Fusarium moniliforme / Fusarium* sp.	Fusariose	2
Dracaena sp.	*Colletotrichum* sp.	Anthracnose	1
Gerbera sp.	*Pythium sylvaticum*	Pourridié pythien	1
Hellebore sp.	*Microsphaeropsis* sp.	Tache foliaire	1
Hibiscus sp.	*Botrytis cinerea*	Anomalie de coloration foliaire	2
	Fusarium sp.	Fusariose	1
Hydrangea sp.	*Fusarium graminearum*	Brunissement racinaire	1
	Phytotoxicité glyphosate		1
Impatiens, New Guinea	*Botrytis cinerea*	Moisissure grise	1
	Phytoplasmes	Malformation foliaire	1
	Tomato spotted wilt virus (TSWV)		1
Jasminum sp.	*Nectria* sp.	Chancre nectrien	1
Lobelia sp.	Fumagine	Anomalie de coloration foliaire	1
Mandevilla sp.	Broad bean Wilt Virus (BBWV)	Anomalie de coloration	1
Maranta sp.	*Fusarium* sp.	Pourridié fusarien	1
Nicotiana	Alfalfa Mosaic Virus (AMV)	Mosaïque foliaire	2
Paeonia sp.	*Xanthomonas arboricola*	Tache bactérienne	1

Tableau 11. (suite) Sommaire des maladies diagnostiquées parmi les **plantes ornementales herbacées** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Pelargonium sp.	*Fusarium solani*	Pourridié fusarien	1
	Pythium sp.	Pourridié pythien	1
Penstemon sp.	Impatiens Necrotic Spot Virus (INSV)	Anomalie de coloration foliaire	1
Peperomia sp	Impatiens Necrotic spot Virus (INSV)	Anomalie de coloration foliaire	1
Petunia sp.	*Pectobacterium* sp.	Tache foliaire	1
	Plectosporium sp.	Anomalie de coloration foliaire	1
Santolina sp.	*Colletotrichum* sp.	Anthracnose	1
	Fusarium sp.	Pourridié fusarien	1
	Phoma sp.	Pourriture racinaire	1
	Pythium sp.	Pourrridié pythien	1
Sedum sp.	*Fusarium* sp.	Pourridié fusarien	1
	Pythium sp.	Pourridié pythien	1
Schlumbergera sp.	*Fusarium oxysporum*	Pourridié fusarien	2
Stachys sp.	*Aphelenchoides* sp.	Tache foliaire	1
Tradescanthia	Cucumber Mosaic virus (CMV)	Mosaïque foliaire	1
Verbena sp.	*Pseudomonas cichorii*	Tache foliaire bactérienne	1
Vinca sp.	*Oidium* sp.	Blanc	1
Total			**64**

Tableau 12. Sommaire des maladies diagnostiquées parmi les **plantes aromatiques et médicinales** reçues au Laboratoire de diagnostic en phytoprotection du MAPAQ en 2015.

CULTURE	AGENT PATHOGÈNE ou CAUSE	MALADIE ou SYMPTÔME	NOMBRE
Basilic	*Acidovorax valerianellae*	Tache foliaire	1
Coriandre	*Meloidogyne* sp.	Nodosité racinaire	1
	Pseudomonas syringae	Moucheture bactérienne	1
Houblon	*Fusarium* sp.	Pourridié fusarien	1
	Pseudoperonospora sp.	Mildiou	1
Lavande	*Botrytis cinerea*	Moisissure grise	1
Origan	*Phoma* sp.	Pourriture de tige	1
	Pseudomonas syringae	Moucheture bactérienne	1
	Pythium irregulare	Pourridié pythien	1
Persil	*Rhizoctonia solani*	Rhizoctone	1
	Septoria petroselini	Septoriose	1
	Pythium irregulare / Pythium sp.	Pourridié pythien	3
	Xanthomonas axonopodis	Tache bactérienne	1
Safran	*Penicillium* sp.	Pourriture du corme	1
	Pseudomonas marginalis	Pourriture du corme	1
Sauge	*Oidium* sp.	Blanc	1
Thym	*Acidovorax valerianellae*	Tache foliaire	1
Total			**19**

GRAND TOTAL	**999**

CEREALS / CÉRÉALES

CROP / CULTURE : Barley

LOCATION / RÉGION: Central Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT :
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TITLE / TITRE: 2015 BARLEY DISEASE SURVEY IN CENTRAL ALBERTA

ABSTRACT: In 2015, 20 random commercial barley crops were surveyed for disease levels in central Alberta. Leaf disease severity levels were generally low, and lower than found in previous years, while common root rot was found at light to moderate levels, similar to previous years.

INTRODUCTION AND METHODS: A survey to document diseases of barley was conducted in 20 fields in Central Alberta from July 28-30, 2015. 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. Leaf diseases were rated for percentage leaf area diseased (PLAD) for scald, netted net blotch and other leaf spots. Common root rot (CRR) presence and severity were 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 a percent of the plants affected. Following the survey, a representative tissue sub-sample of diseased plant parts collected at each location was cultured in the laboratory for pathogen isolation and identification.

RESULTS AND COMMENTS: Survey results are presented in Table 1. Growing conditions in Central Alberta were poor in May and June with much lower than normal levels of precipitation, but with near average temperatures. In July and August conditions were near average for both precipitation and temperature. Disease development throughout the surveyed region was lower than found in previous years (Rauhala and Turkington 2015). Scald (*Rhynchosporium secalis*) severity ranged from 0.1 to 5 % in 6 fields, while 2 fields had a PLAD rating of between 6% and 11%, with all remaining fields having no evidence of scald. Netted net blotch (*Pyrenophora teres* f. *teres*) was found in 6 of the 20 surveyed fields and ranged in severity from 0.1% to only 1%. Spot blotch (*Cochliobolus sativus*), was isolated from 55 % of the 'other leaf spot' symptoms at severities ranging from 1 % to 17%. In 2015, no spotted net blotch (*P. teres* f. *maculata*) was found in the surveyed fields. Al*ternaria spp*. were also isolated from sub-samples of leaf tissues exhibiting 'other' leaf spot symptoms.

Common root rot of barley (*Cochliobolus sativus* and *Fusarium* spp.) occurred in all the surveyed fields, at light to moderate severity levels, similar to the light to moderate levels in previous years (Rauhala and Turkington 2015).

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

REFERENCE:

Rauhala, N.E, and Turkington, T.K. 2015 2014 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, 2015.

Disease (severity rating scale)	**% of fields affected**	**Overall average severity**	**Range in average severity per field**
Scald (PLAD*)	40	1.4	0 –11
Netted net blotch (PLAD)	30	<1	0 – 1
Other leaf spots (PLAD)	100	3.5	1 – 16
Total leaf area diseased (PLAD)	100	5	1 – 17
Common root rot (0-4)	100	2	1 - 3

*Percentage leaf area diseased

CROP / CULTURE: Wheat and Barley

LOCATION / RÉGION: Alberta

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE/TITRE: WHEAT AND BARLEY LEAF DISEASE SURVEY IN CENTRAL ALBERTA, 2015

ABSTRACT: During 2014 and 2015, 24 barley, 24 spring wheat, and 37 winter wheat fields in central Alberta were surveyed to document leaf disease occurrence. In the barley fields surveyed, spotted net blotch and spot blotch were more evident compared to scald and netted net blotch. Stripe rust was widespread, with a few fields of winter wheat having moderate to high levels of disease incidence at the seedling stage.

INTRODUCTION AND METHODS: Leaf diseases were surveyed in 24 barley fields and 24 spring wheat fields in central Alberta from July to August 2015. The fields surveyed were located at locations near Blackfalds, Calmar, Pipestone, Ponoka, Wetaskiwin, Nevis, Olds, Stettler and Lacombe. Leaf diseases were also surveyed in 37 winter wheat fields at locations near Stony Plain, Stettler, Camrose, Trochu, Ponoka and Westlock during mid-October 2014, and also early-November 2015. Surveys for stripe rust of winter wheat were made in the breeding nurseries located at Lacombe, Olds, Morrin and Trochu during October 2014 and April 2015. Each commercial field was assessed at 3 to 5 five points, starting at least 20 m from the field edge. Each visual assessment was made on plants within a 1 m^2 sample at the site. Leaf diseases, including scald, netted and spotted net blotch and spot blotch of barley, and tan spot and the stagonospora/septoria leaf spotting complex of wheat were rated using a 0-9 severity scale. Stripe rust incidence was assessed as the percentage of diseased plants when these were at the seedling stage. Stripe rust severity was assessed as the percentage of diseased leaf area when the plants were at the adult stage. A mean of the disease severity, based on the 0-9 scale, or a mean of the percentage incidence or severity was calculated based on the 3 to 5 sites sampled in each field.

RESULTS AND COMMENTS: The 2015 growing season was mostly dry in central Alberta. Precipitation was adequate in the early fall and mild temperatures extended into early November. The environmental conditions in 2015 had a major influence on the development of foliar diseases in cereal crops. Spotted net blotch and spot blotch were more prominent compared to scald and netted net blotch in the barley fields surveyed. Stripe rust was widespread, and a few fields of winter wheat showed moderate to high levels of disease incidence at the seedling stage. The results of the barley and wheat leaf disease surveys are presented in Tables 1 and 2, respectively. The various diseases occurring in the crops were categorized into three classes, light, intermediate or severe, based on the 0-9 scale and/or incidence and severity estimations.

Two-row barley was grown in the majority of barley fields surveyed. Leaf diseases, including scald, netted net blotch, spotted net blotch and spot blotch were light in severity in most fields surveyed (Table 1). More than one disease, such as scald and net blotch, was sometimes present in the same field, resulting in the total number of diseased fields exceeding the number of fields surveyed (Table 1).

The wheat leaf spotting complex involving tan spot and stagonospora /septoria leaf blight was observed in the majority of spring wheat fields surveyed, with disease severity being light to intermediate (Table 2). Light levels of stripe rust were observed in 6 spring wheat fields across central Alberta and high disease severity (30% or higher) was observed in the 2 fields in the Olds area. More than one disease syndrome, such as the leaf spotting complex and stripe rust, was present in the same spring wheat field, resulting in the total number of diseased fields exceeding the number of fields surveyed (Table 2).

Stripe rust was observed in 28 of 37 winter wheat fields at the seedling stage when surveys were conducted during mid-October 2014 or early-November 2015. The majority (18 of 28) of diseased fields exhibited light levels of stripe rust, but 10 fields had incidence disease levels from 15 to 90%. Fields with an intermediate to severe level of stripe rust were located in regions near Stony Plain, Paintearth and Camrose County. Stripe rust development was monitored in 5 of the 37 winter wheat fields surveyed. Trace levels of stripe rust were observed in all 5 fields in the fall of 2014 but no disease was evident in early 2015 in 4 of these. No stripe rust was observed in the other field during the entire 2014/2015 period.

A light to intermediate level of stripe rust incidence was recorder at 21 of 23 tests (germplasm, yield, cooperative tests) surveyed for winter wheat at Olds, Trochu and Lacombe in late October 2014 (data not shown). No stripe rust was observed in the other two tests. Variable levels of stripe rust incidence, ranging from trace to 30% were found in 3 of 6 winter wheat tests surveyed in Olds and Lacombe in April 2015. No stripe rust was observed in the remaining three tests. In conclusion, stripe rust was more widespread in winter wheat compared to spring wheat. Disease development, especially in winter wheat fields with moderate to high levels of stripe rust incidence, needs to be monitored in future.

ACKNOWLEDGEMENTS:
The financial support of the Barley Cluster is greatly appreciated.

Table1. Severity of foliar diseases in 24 fields of barley surveyed in central Alberta, 2015.

Disease	Light*	Intermediate*	Severe*	Fields affected
Scald (*Rhynchosporium secalis*)	9	0	1	10
Netted net blotch (*Pyrenophora teres* f. *teres)*	7	3	0	10
Spotted net blotch (*Pyrenophora teres* f. *maculata*) and spot blotch *(Cochliobolus sativus*)	11	2	0	13

* For the 0-9 severity scale, light = 0.1 to 3.9; intermediate = 4 to 5.9; and severe = 6 to 9.

Table 2. Foliar disease incidence and severity in 24 spring and 37 winter wheat fields surveyed in central Alberta in 2014 and 2015.

Disease	Light*	Intermediate*	Severe*	Fields affected
Leaf spot complex (*P. tritici-repentis* and *Stagonospora* and *Septoria* spp.) in spring wheat	12	6	0	18
Stripe rust *(Puccinia striiformis* f.sp*. tritici)* in spring wheat	6	0	2	8
Stripe rust *(Puccinia striiformis* f.sp*. tritici)* in winter wheat	18	4	6	28

* For the leaf spot complex 0-9 severity scale, light = 0.1 to 3.9; intermediate = 4 to 5.9; and severe = 6 to 9.

* For the stripe rust disease severity scale, light = 1 - 10%; intermediate = 11 - 29%; and severe = 30% or higher.

CROP / CULTURE : Barley

LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN BARLEY IN SASKATCHEWAN IN 2015

ABSTRACT: In 2015, Fusarium head blight (FHB) incidence and severity were assessed in 37 two-row barley crops in Saskatchewan. FHB occurred in 30% of the surveyed crops at a mean provincial severity (FHB Index) of 0.06%, similar to that in 2014 but considerably lower than that recorded for 2013 and 2012. Most FHB-positive crops were affected by *F. poae* and (or) *F. avenaceum*.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity in Saskatchewan in 2015 were assessed in 37 two-row barley crops. Field location and results were grouped according to soil zone: Zone 1 = Brown; Zone 2 = Dark Brown; Zone 3 = Black.

Crop adjustors with Saskatchewan Crop Insurance Corporation and irrigation agrologists with the Saskatchewan Ministry of Agriculture randomly collected 50 spikes from barley crops at late milk to early dough stages. Two barley samples were obtained from the Cereal & Flax Pathology Laboratory of the University of Saskatchewan. Spikes were analyzed for visual FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike, as a proportion of the total, were recorded. An FHB disease severity rating, also referred to as the FHB Index (Stack and McMullen, 2011), was determined for each crop surveyed with FHB severity (%) = [% of spikes affected x mean proportion (%) 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, rinsed three times in sterile distilled water 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 promote *Fusarium* sporulation. A maximum of 20 kernels per sample were used for this purpose.

RESULTS AND COMMENTS: Approximately 0.7 million hectares (1.8 million acres) of barley were seeded in Saskatchewan in 2015. The average barley yield of 2.62 metric tonnes per hectare (59.0 bu/acre) in 2015 was lower than 2013's record-breaking yields, but slightly higher than the 10-year average of 2.85 tonnes (53.7 bu/acre) (Saskatchewan Ministry of Agriculture 2015; Statistics Canada 2015).

In 2015, FHB occurred in 30% of the barley crops surveyed (Table 1). The provincial mean FHB severity (0.06%) was lower than found in 2012 (3.0%) or 2013 (1.7%), but similar to 2014 (0.13%) (Dokken-Bouchard et al. 2014; Dokken-Bouchard et al. 2015). No six-row barley crop samples were received in 2015. Similar to previous years, severity of FHB in barley was highest in soil Zone 3 (Table 1).

Of the 37 barley spike samples collected, 9 showed putative FHB symptoms and a total of 19 isolations were made from these to confirm the presence and identification of *Fusarium* (Table 2). The most frequently isolated causal pathogen, *F. poae*, occurred in five (14%) of the surveyed fields, and accounted for 26% of *Fusarium* isolations. Unlike 2014, *F. acuminatum* and *F. sporotrichoides* were not detected in 2015. *Fusarium graminearum* was detected in two (5%) of the barley crops, a similar level to its prevalence in 2013 (Dokken-Bouchard et al. 2014). This species accounted for 11% of isolations, significantly higher than detected in previous years (e.g. 5% in 2013), except for 2014 when it was isolated from 21% of samples. Other barley pathogens detected infrequently included *Cochliobolus* and *Septoria* spp.

Based on the survey results, FHB caused little to no damage to Saskatchewan barley crops in 2015.

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

REFERENCES:
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Dokken-Bouchard, F.L., Stephens, D., Aryal, B., Peluola, C., Sliva, T. and Fernandez, M.R. 2015. Fusarium head blight in barley in Saskatchewan in 2014. Can. Plant Dis. Surv. 95:70-71. (www.phytopath.ca/publication/cpds)

Saskatchewan Ministry of Agriculture. 2014. Factsheet: November Estimate of 2014 Crop Production. (www.agriculture.gov.sk.ca/Estimate_Crop_Production)

Stack, R.W., and McMullen, M.P. 2011. A visual scale to estimate severity of Fusarium head blight in wheat. PP-1095, NDSU Extension Services. North Dakota State University, Fargo, ND, USA.

Table 1. Prevalence and severity of fusarium head blight (FHB) in two-row barley crops grouped by soil zone in Saskatchewan, 2015.

	Prevalence[1] (No. of crops affected)	**Mean FHB Severity[2] (range)**
Zone 1 Brown	33% (6)	0.03% (0.07-0.08)
Zone 2 Dark Brown	40% (10)	0.03% (0.07-0.17%)
Zone 3 Black/Grey-wooded	24% (21)	0.08% (0.2-0.7%)
Overall Total/Mean	30% (37)	0.06%

[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. isolated from fusarium head blight affected two-row barley crops in Saskatchewan in 2015.

	Fc[1]	*Fa*[2]	*Fe*[3]	*Fg*[4]	*Fp*[5]	*Other Fusarium spp.*
Prevalence[6]	8%	11%	3%	5%	14%	11%

[1]*F. culmorum*; ;[2].*avenaceum*; [3]*F. equiseti*; [4]*F. graminearum*; [5]*F. poae*.
[6]Prevalence (%) = Number of crops with each *Fusarium* sp. detected / total crops surveyed.

CROP / CULTURE: Barley

LOCATION / REGION: Saskatchewan

NAMES AND AGENCY / NOMS ET ETABLISSEMENT:
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TITLE / TITRE: LEAF SPOT DISEASES OF BARLEY IN SASKATCHEWAN IN 2015

ABSTRACT: In 2015, a total of 39 barley crops were examined for leaf spot diseases in Saskatchewan. Disease severity was found at trace to severe levels, with the majority of surveyed crops having trace to slight levels of disease. The casual agents were found to be *Cochliobolus sativus* (spot blotch), *Pyrenophora teres* (net blotch) and *Septoria passerinii* (speckled leaf blotch).

INTRODUCTION AND METHODS: Leaf spot diseases of barley were assessed throughout Saskatchewan in crop districts 1A, 1B, 2A, 2B, 3AS, 3BN, 3BS, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A and 9B. The survey was conducted from the end of July to mid-August, 2015, when most crops were at the late milk to soft dough growth stages. In each crop, more than 10 leaves were collected, placed in paper envelops and dried. The leaves were rated for leaf spot severity using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). In the laboratory, one piece from each infected leaf was surface sterilized and placed on wet filter paper for approximately 7 days to promote pathogen sporulation. Pathogens were identified based on shape, size and colour of their spores.

RESULTS AND COMMENTS: Dry weather in spring of 2015 across Saskatchewan allowed famers to complete seeding quickly. However, little precipitation and cool conditions in many areas of the province delayed seed germination and the development of some crops. Rain in the last week of July significantly improved yield potential across the province. However, wet and cool conditions during August and September delayed harvest (Saskatchewan Ministry of Agriculture 2015). Growing season crop damage was caused mainly by episodes of drought, hail, wind and insects.

Leaf spot disease severity in barley was lower than in 2014 (Liu et al. 2015). In 2015, leaf spots were found on 61% of the crops surveyed at trace to slight severity. Leaf spot severity was moderate in 36% of crops and severe in only 3% (Table 1). The three fungal pathogens found on infected barley leaf tissues included: *Cochliobolus sativus* Ito & Kuribayashi Drechs. ex Dast., *Pyrenophora teres* Drechsler and *Septoria passerinii* Sacc. Among these, *C. sativus* was the most prevalent pathogen, present in 83% of crops, and at an incidence of 42% on infected leaf pieces (Table 2). The second most common pathogen was *S. passerinii*, detected in 63% of crops, but isolated from only 12% of leaf pieces. The prevalence of the third pathogen, *P. teres,* was 55%, at 16% incidence (Table 2). The 2015 field survey indicated that *P. teres* was less prevalent than in 2014; however, there was a slight increase in the proportion of crops affected by *S.passerinii* (Liu et al. 2015). There was no change between 2014 and 2015 in the prevalence of *C. sativus*. In addition, the incidence of all three pathogens isolated from leaf tissues was lower in 2015 than 2014.

ACKNOWLEDGEMENTS:
We thank the Saskatchewan Crop Insurance Corporation staff for collecting many of the barley leaf samples for this survey. We thank Paulina Cholango Martinez for suggesting the appropriate time to identify *S. passerinii* during the laboratory analyses.

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Saskatchewan Ministry of Agriculture. 2015. Final crop report. (http://www.agriculture.gov.sk.ca).

Table 1. Leaf spot disease severity in 39 barley crops surveyed in Saskatchewan in 2015.

Disease severity	Number of crops	Proportion of crops in each category (%)
None	2	5
Very slight (1-5%)	9	23
Slight (6-15%)	13	33
Moderate (16-40%)	14	36
Severe (41-100%)	1	3

Table 2. Pathogen prevalence and incidence from infected barley leaf tissue in Saskatchewan in 2015.

Pathogen	Prevalence (% of crops)	Incidence† (%)
Cochliobolus sativus	83	42
Pyrenophora teres	55	16
Septoria passerinii	63	12

† incidence – percentage of leaf tissue pieces from which each pathogen was isolated; indicative of the relative amount of foliar damage observed

CROP / CULTURE: Barley

LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA – 2015

ABSTRACT: Forty nine barley fields in Manitoba were surveyed for fusarium head blight (FHB) in 2015 to assess disease severity and the causal *Fusarium* species. FHB severity in 2015 was higher than 2014 with a mean FHB index of 0.84%. *Fusarium poae* was the predominant *Fusarium* species isolated, followed by *F. sporotrichioides*, *F. graminearum*, *and F. equiseti*.

INTRODUCTION AND METHODS: Barley fields 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 79-82) stages of growth. A total of 49 (35 two-row, 14 six-row) fields 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 field by sampling 80-120 spikes at three locations and averaging the scores. The mean spike proportion infected (SPI) was estimated for each field. Forty to sixty 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 minutes, air-dried, and plated onto potato dextrose agar in Petri plates (10 kernels per plate) to quantify and identify the *Fusarium* spp. present, based on culture morphology as described in standard taxonomic keys.

RESULTS AND COMMENTS: Barley was grown on 365,848 acres in Manitoba in 2015, an increase of 18% compared to 2014 (MASC, Yield Manitoba 2016). Similar to 2014, the 2-row cultivar ‘Conlon’ was the most widely planted barley in 2015, occupying 24.4% of the total barley acreage. The acreage of ‘CDC Austenson’ increased slightly from 14.2% in 2014 to 16.6% in 2015. ‘Newdale’ was the third most widely planted cultivar, occupying 11% of the area sown to barley. These three cultivars made up half of the barley acreage in Manitoba in 2015 (MASC, Yield Manitoba 2016).

Putative symptoms of FHB were detected in all fields surveyed. The mean incidence of FHB in 2-row barley was 13.5% (range 1.9 – 47.8%) and SPI was 5.9 % (range 2.0 – 20.0%). In six-row barley, the incidence was 5.5% (range 1.70 – 13.7%) and SPI 4.2% (range 3 - 10%). The resulting mean *Fusarium* Head Blight Index (FHB-I) [%incidence X %SPI / 100] for two-row barley was 1.1% (range 0.03 – 6.7%), and that for six-row barley 0.24% (range 0.04 – 0.8%).

The somewhat lower FHB-I in 6-row vs. 2-row barley in 2015 was also reported for 2009, 2010, 2013 and 2014 (Tekauz et al, 2010, Tekauz et al 2011, Banik et al. 2014, Wang et al. 2015). This result is somewhat surprising since 2-row cultivars are generally rated as more resistant to FHB than 6-row cultivars (Seed Manitoba 2015). It is possible that the 2015 results may be a reflection of the relatively lower number (14%) of 6-row barley crops surveyed. The mean FHB-I for all barley fields was 0.84%, which is higher than that reported for 2012 and 2013 (Tekauz et al. 2013, Banik et al. 2014), but still below the 11-year average of 1.1% (2004 to 2014).

The individual *Fusarium* species identified on infected kernels are listed in Table 1. As found in 2011 (Tekauz et al. 2012), 2012 (Tekauz et al. 2013), 2013 (Banik et al. 2014) and 2014 (Wang et al. 2015), *F. poae* was the most common *Fusarium* species found in 2015, present in 98% of fields and isolated from 56.9% of *Fusarium*-infected kernels. *Fusarium sporotrichioides* was found in 84% of fields and isolated from 18.5% of infected kernel in 2015, a higher level than reported in 2013 and 2014 (Banik et al. 2014, Wang et al. 2015). *Fusarium graminearum* was detected in 53% of fields and isolated from 20.2% of infected kernels collected during the survey. This is in contrast to 2010, when *F. graminearum* either dominated or was found at a similar level to *F. poae* (Tekauz et al. 2011). *Fusarium. equiseti, F. culmorum and F. avenaceum* were also detected but only occurred at low levels (Table 1).

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Table 1: *Fusarium* spp.isolated from FHB-affected kernels from 49 barley fields in Manitoba in 2015.

***Fusarium* spp.**	**Percent of fields**	**Percent of kernels**
F. avenaceum	14.0	0.8
F. culmorum	8.2	1.5
F. equiseti	12.2	2.2
F. graminearum	53.1	20.2
F. poae	98.0	56.9
F. sporotrichioides	84.0	18.5

CROP / CULTURE: Barley and Oat

LOCATION / RÉGION: Manitoba

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TITLE / TITRE: BARLEY AND OAT LEAF SPOT DISEASES IN 2015 IN MANITOBA

ABSTRACT: In 2015, ninety commercial barley and oat fields were surveyed for leaf spot diseases in Manitoba. The levels of leaf spot diseases in 2015 were lower than previous years. *Cochliobolus sativus* (spot blotch) and *Pyrenophora teres* (net blotch) were the principal pathogens isolated from barley fields whereas *Pyrenophora avenae* was the most common pathogen causing damage in oat fields.

INTRODUCTION AND METHODS: In 2015, barley and oat leaf spot diseases in Manitoba were assessed by surveying 90 farm fields (47 barley, 43 oat fields) from August 1-8, when most crops were at the early- to early-dough stages of growth (ZGS 79-83). Fields were sampled at regular intervals along the survey routes, depending on crop availability. The area sampled was bounded by Highway #s 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 occurrence 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 incubated on filter paper in moist chambers for 3-5 days to promote sporulation to identify the causal agent(s) and disease(s).

RESULTS AND COMMENTS:
Barley - Visible leaf spots symptoms were observed in both upper and lower leaf canopies in most of the barley fields. In upper canopies, 13% of fields showed no visible symptoms, trace and very slight/slight leaf spot symptoms were observed in 47% and 36% of the fields, respectively. Two barley fields were rated as moderate to severe for leaf spot disease severity. In lower leaf canopies, 4% of fields showed no visible symptoms. A trace of leaf spot symptoms were found in 6% of fields, very slight or slight in 19% of the fields, moderate in 13% of the fields. These severity levels are somewhat lower than those reported in 2012 and 2013 (Tekauz et al. 2013, Banik et al. 2014). The typically low leaf spot levels in recent years were likely due the widespread use of foliar fungicides, and the reduced inoculum carry-over from previous year(s). Overall, yield losses in both barley and oat resulting from leaf spots were nil to very slight in 2015.
Cochliobolus sativus (causal agent of spot blotch) and *Pyrenophora teres* (net blotch) were the principal pathogens isolated from infected leaf tissues (Table1). *Cochliobolus sativus* was isolated from 17 and *Pyrenophora teres* from 12 fields. *Rhynchosporium secalis* (scald) was isolated from one field located near Shortdale, MB, an unusual report for Manitoba.
Oat - In upper leaf canopies, 25% of fields showed no visible leaf spot symptoms, a trace was seen in 49%, very slight or slight in 21%, and moderate in 5%. In lower canopies, 9% of the fields showed no visible symptoms, a trace was seen in 19%, very slight or slight in 28%, and moderate in 16%.
Pyrenophora avenae (causal agent of Pyrenophora leaf blotch) was the principal pathogen and caused most of the damage seen in oat fields (Table 2). *Cochliobolus sativus* (spot blotch) was also detected in one field.

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Table1. Incidence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2015.

Pathogen	**Incidence (% of fields)**	**Frequency (% of isolations)**
Cochliobolus sativus	36.2	66.1
Pyrenophora teres	25.5	32.1
Rhychosporium secalis	2.1	0.9

Table2. Incidence and isolation frequency of leaf spot pathogens of oat in Manitoba in 2015.

Pathogen	**Incidence (% of fields)**	**Frequency (% of isolations)**
Pyrenophora avenae	9.3	63.2
Cochliobolus sativus	2.3	36.8

CROP / CULTURE: Barley

LOCATION / RÉGION: Central and Eastern Ontario

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TITLE / TITRE: DISEASES OF BARLEY IN CENTRAL AND EASTERN ONTARIO IN 2015

ABSTRACT: Thirty-five barley crops in central and eastern Ontario were surveyed for diseases in 2015. Of 14 the diseases observed, loose smut, take-all and fusarium head blight (FHB) were the most prevalent and severe levels of these were found in 3, 3 and 8 fields, respectively. *Fusarium graminearum* and *F. poae* were identified as the predominant species causing FHB.

INTRODUCTION AND METHODS: A survey for barley diseases was made in central and eastern Ontario, in areas where spring barley is grown, in the third week of July 2015. Thirty-five crops were sampled when plants were at the soft-dough stage of growth. Foliar disease severity was determined on 10 flag and penultimate leaves sampled at three random sites per field, using a rating scale of 0 (no disease) to 9 (severely diseased). Diagnosis was based on visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered as trace, slight, moderate, and severe infection levels, respectively. Severity of covered smut, ergot, leaf stripe, loose smut, and take-all was based on the percent of plants infected. 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. The percentage of infected plants or FHB index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of the causal species of FHB was based on 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 (PDA) (10 g PDA per litre amended with 50 ppm of streptomycin sulphate). The plates were incubated for 10-14 days at 22-25ºC and a 14-hour photoperiod using fluorescent and long wavelength light. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: The survey included 7 two-row and 28 six-row barley fields. A total of 14 diseases or disease complexes was observed (Table 1). Net blotch (normally associated with the pathogen *Pyrenophora teres*), barley yellow dwarf (BYDV), septoria complex [including speckled leaf blotch (*Septoria tritici*) and leaf blotch (*Stagonospora nodorum*)] and spot blotch (*Cochliobolus sativus*) were the most common, and were found in 33, 26, 21 and 18 fields at average severities of 2.2, 2.3, 2.2, and 2.4, respectively. Severe disease levels from net blotch, septoria complex and spot blotch were observed in 3, 1, and 2 fields, respectively, but not from BYD. Yield reductions due to these disease were estimated to have averaged <5% in affected fields. Other foliar diseases observed included leaf rust (*Puccinia hordei*), powdery mildew *(Blumaria graminis*), scald (*Rhynchosporium secalis*), and stem rust (*Puccinia graminis* f. sp. *tritici* or f. sp. *secalis*); they were observed in 9, 14, 7, and 1 fields at mean severities of 1.7, 1.9, 1.1, and 1.0, respectively. Although one field had a severe level (7.0) of powdery mildew (Table 1), none of these diseases would have resulted in substantive damage to the crop.

Covered smut (*U. hordei*), ergot (*Claviceps purpurea*), leaf stripe (*Pyrenophora graminea*), loose smut (*Ustilago nuda*) and the root disease take-all (*Gaeumannomyces graminis*) were observed in all fields at mean incidences of 0.1, 0.3, 0.1, 1.2, and 2.0%, respectively (Table 1). Severe infection by cover smut, ergot and leaf stripe was not observed, but did occur from loose smut and take-all, each found in three fields. Yield reductions by loose smut and take-all were estimated as 5% in affected fields.

FHB was observed in all surveyed fields at a mean FHB Index of 11.2% (range 0.04% to 90.0%) (Table 1). A severe level of FHB was observed in 8 crops. Overall, the disease resulted in a significant loss in barley grain yield or quality in 2015. Six *Fusarium* species were isolated from putatively infected kernels (Table 2). *Fusarium graminearum* and *F. poae* predominated and occurred in 97 and 80% of surveyed fields and on 33.8 and 13.2% of infected kernels, respectively. *Fusarium avenaceum*, *F. avenaceum, F. equiseti*, and *F. sporotrichioides* were less common, occurring in 6-34% of fields and 0.2-2.0% of kernels.

The 14 diseases observed on barley in Ontario in 2015 were the same as those recorded in 2014 (Xue and Chen 2015). Overall, the incidence and severity of the diseases were generally greater in 2015 than in 2014. FHB occurred in all surveyed fields and caused significant reductions in grain yield and quality. The more frequent rain events in June and higher temperatures in July compared with the previous year in central and eastern Ontario, were likely responsible for the increased disease severities observed in 2015.

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Table 1. Prevalence and severity of barley diseases in central and eastern Ontario in 2015.

Disease	No. crops affected (n=35)	Disease severity in affected crops*	
		Mean	Range
Barley yellow dwarf	26	2.3	1.0-5.0
Leaf rust	9	1.7	1.0-4.0
Net blotch	33	2.2	1.0-7.0
Powdery mildew	14	1.9	1.0-7.0
Scald	7	1.1	1.0-2.0
Septoria complex	21	2.2	1.0-6.0
Spot blotch	18	2.4	1.0-6.0
Stem rust	1	1.0	1.0-1.0
Covered smut (%)	35	0.1	0.1-0.1
Ergot (%)	35	0.3	0.1-5.0
Leaf stripe (%)	35	0.1	0.1-0.1
Loose smut (%)	35	1.2	0.1-20.0
Take-all (%)	35	2.0	0.1-20.0
Fusarium head blight (FHB)**	35		
Incidence (%)		39.7	2.0-100.0
Severity (%)		20.1	2.0-100.0
Index (%)		11.2	0.04-90.0

*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 was 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 2015.

***Fusarium* spp.**	**% affected fields**	**% kernels**
Total *Fusarium*	100.0	50.8
F. acuminatum	5.7	0.2
F. avenaceum	34.3	2.0
F. equiseti	20.0	1.4
F. graminearum	97.1	33.8
F. poae	80.0	13.2
F. sporotrichioides	8.6	0.3

CROP / CULTURE: Canaryseed

LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: DISEASES OF CANARYSEED IN SASKATCHEWAN IN 2015

ABSTRACT: Leaf mottle caused by *Septoria triseti* was observed in canaryseed (*Phalaris canariensis*) crops and *Fusarium* spp. detected in seed of these crops in Saskatchewan in 2015. Leaf mottle was observed in 78% of crops, and severity was at a trace level in most of these. Prevalence of *Fusarium* spp. was 88% with three species identified: *Fusarium graminearum*, *F. avenaceum* and *F. poae*. Incidence of *F. graminearum* on seed averaged 3% over the 26 crops, and was lower for *F. avenaceum* and *F. poae*.

INTRODUCTION AND METHODS: Twenty-three canaryseed crops were sampled randomly for leaf mottle in early August and 26 crops for *Fusarium* spp. during growth stages BBCH 65 - 89 (full flower - maturity) (Lancashire et al. 1991). Ten leaves taken from the upper canopy were assessed for leaf mottle on a 0 – 5 severity scale: trace (<1% (of leaf tissue affected), very slight (1-5%), slight (6-15%), moderate (16-40%) and severe (41-100%) (Horsfall and Barratt 1945). Leaves with (or without) leaf mottle symptoms (necrotic tissue with black pycnidia) were collected from each crop and dried in paper envelopes. Subsequently, a piece from each of the 10 leaves was surface-sterilized in a solution of 5% NaOCl for 1 min and then rinsed three times in sterile water. The leaf pieces were plated on sterile filter paper, and after 24 hours the percentage of the leaf pieces that harbored the leaf mottle pathogen was confirmed by visual observation. To test for the presence of *Fusarium* spp., 100 seeds per field (2,600 total) were surface sterilized in 5% NaOCl for 1 min, rinsed three times in sterile water and then dried. Seeds were plated on PDA (potato dextrose agar) and placed under a 12 hour light/dark regime at room temperature for 5 days (Warham at al. 1995). *Fusarium* species present were determined by the shape and size of their macrospores (Gerlach and Nirenberg 1982). Prevalence of *Fusarium* spp. was determined by counting the proportion of crops affected, and incidence by counting the number of seeds affected by each *Fusarium* sp. from the 100 plated for each canaryseed crop.

RESULTS AND CONCLUSIONS: Among the 23 crops surveyed, *Septoria triseti* Speg.was observed in 18, giving a prevalence of 78%. Fifteen of the 18 crops were determined to have a trace of leaf mottle, two had very slight, and one had slight severity (Table 1). The incidence of *S. triseti* on the 10 leaves collected from each crop (230 leaves total) was 16%.
The prevalence of all *Fusarium* spp. on the 2600 canaryseed seeds examined was 88% (Table 2). Only three fields were *Fusarium*-free. Three species were identified: *F. graminearum*, prevalent in 58% of the 26 crops, *F. avenaceum* in 50% and *F. poae* in 35%. Averaged over all 26 crops, the incidence of *F. graminearum* on seed was 3%, *F. avenaceum* 1% and *F. poae* 1%. The incidence of *F. graminearum* on seed varied among crops from 29% in one crop to zero in 11 crops (Table 3). Other fungi were detected on leaf pieces and seed, such as *Alternaria* spp., but were considered to be saprophytes.
In addition, aphids were observed in many canaryseed crops, while lodging was minimal.

ACKNOWLEDGEMENTS:
We thank X.M. Zhang for sample collection and help with identification of *Fusarium* species, and to the CFPATH group for the survey coordination.

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Table 1. Severity of leaf mottle in 23 Saskatchewan canaryseed crops in 2015.

Disease severity	Number of crops	Proportion of crops in each category (%)
None	5	22
Trace	15	65
Very slight	2	9
Slight	1	4
Moderate	0	0
Severe	0	0

Table 2. Prevalence and incidence of *Fusarium* spp. in 26 Saskatchewan canaryseed crops, in 2015.

	Prevalence[1] (%)	**Incidence[2] (%)**
Total *Fusarium* spp.	88	6
Fusarium graminearum	58	3
Fusarium avenaceum	50	1
Fusarium poae	35	1

[1]Proportion of crops with *Fusarium* spp.
[2]Based on a 100 seed sample per crop

Table 3. Incidence (%) of *Fusarium* spp. on 100-seed samples of canaryseed from 26 Saskatchewan crops in 2015.

Field #	Crop District	*F. graminearum* (%)	*F. avenaceum* (%)	*F. poae (%)*
1	2B	2	0	2
2	2B	29	2	0
3	2B	1	0	0
4	2B	0	2	3
5	2B	0	2	1
6	2B	0	0	0
7	4B	0	1	0
8	4B	2	0	0
9	4B	0	0	0
10	4B	1	0	0
11	4B	0	2	3
12	7A	0	0	1
13	7A	0	0	0
14	7A	0	0	0
15	7A	0	0	0
16	7A	18	1	0
17	8B	4	0	2
18	5B	1	2	3
19	5B	3	2	0
20	5B	2	1	0
21	5A	1	3	2
22	2B	2	0	0
23	2B	2	1	0
24	2B	0	0	1
25	2B	1	1	0
26	2B	3	2	0

CROP / CULTURE: Corn

LOCATION/ REGION: Ontario

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TITLE / TITRE: STATUS OF CORN DISEASES IN ONTARIO, 2015 CROP SEASON

ABSTRACT: Northern corn leaf blight (NCLB) and eyespot were the most common and severe leaf diseases found in Ontario corn crops in 2015. Both diseases were found in almost all crops visited in Southern and Western Ontario, with 40% of the affected crops having incidence levels of ≥30%, and 25% of the cros having severities of >20% leaf area affected. Incidence was lower in crops sampled in Eastern Ontario (15%) compared to Southern (32%) and Western Ontario (25%). Common rust also was widespread, but unlike NCLB and eyespot, rust incidence was the same (19%) in both Eastern and Southern Ontario. Grey leaf spot (GLS) was localized primarily in Southern Ontario where it was observed in 46% of the crops sampled. Ear and stalk rot diseases were insignificant at the time of the survey. Neither Stewart's bacterial wilt or Goss's bacterial wilt and blight were detected in Ontario in 2015.

INTRODUCTION AND METHODS: Favourable spring conditions in most of Ontario resulted in many corn fields being planted from late April to mid May. The warm weather during the 2015 growing season in conjunction with early planting led to rapid crop development which resulted in a decrease in the incidence and severity of many foliar diseases, compared to 2014. A total of 181 corn crops were surveyed across Ontario from August 27 to September 09, 2015 to document the occurrence 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], northern corn leaf spot [*Bipolaris zeicola* (G.L. Stout) Shoemaker], southern corn leaf blight [*Bipolaris maydis* (Y. Nisik. & C. Miyake) Shoemaker], 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 2015 corn disease survey provides vital information on endemic pathogen populations, and allows for the scouting of 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 areas of Canada (Manitoba and Alberta) and bordering US Great Lakes States, including Michigan (Mehl et al., 2015).

In addition to disease occurrence, the incidence (percentage of affected plants) and severity of the major leaf diseases (eyespot, GLS, NCLB and common rust) were also recorded in all 181 surveyed crops. Severity of common rust, eyespot, GLS and NCLB was rated on the 1-7 scale of Reid and Zhu (2005). Leaves displaying NCLB symptoms were collected for race identification and study of the distribution patterns in *E. turcicum.* Additional symptomatic plants parts were collected for subsequent laboratory analysis, especially for unidentifiable or suspect samples of Goss's bacterial wilt and Stewart's bacterial wilt.

RESULTS AND DISCUSSION:
Northern corn leaf blight continues to be the most common foliar corn disease in the province. In 2015 the disease was detected in 176 (97.2%) of fields sampled (Table 1). Forty-six of the 176 crops with NCLB had incidences ≥30% and 59 crops had severity ratings ≥4 (Table 2). The most affected crops were found in 15 counties across the province [Chatham Kent (10), Stormont, Dundas and Glengarry (10), Leeds and Grenville (5), Oxford (5), Prescott and Russell (5), Elgin (4), Ottawa (3), Perth (3),

Victoria (3), Wellington (3), Horon (2), Middlesex (2), Dufferin (1), Lanark (1), Grey (1) and Waterloo (1)]. This illustrates 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 the crops sampled in Southern and Western Ontario, and somewhat fewer in Eastern Ontario (92.8%). Mean disease incidence in affected crops was also considerably lower in Eastern Ontario (15%) and Central Ontario (19%) than Southern (32%), and Western Ontario (25%); however, five crops in Eastern Ontario had disease incidences of ≥32%. Mean disease severity in affected crops in Saskatchewan was nearly identical to Central (3.2), Eastern (3.1), Southern (3.3) and Western Ontario (3.1) (Table 2). In addition to favourable environmental conditions, changing agronomic practices in Southern and Western Ontario (shorter crop rotations, increased corn on corn, higher residue levels due to greater conservation tillage adoption) and changes in pathogen population dynamics (new races) which have resulted in increased susceptibility of corn hybrids to the disease, have contributed to the higher NCLB incidence and severity (Wise and Mueller, 2011). Furthermore, all seed corn crops surveyed in Chatham-Kent and Essex counties had a higher mean disease severity (3.5; range 1.5-6) and a higher mean disease incidence (39.7%; range 8-85%) than those recorded in commercial corn crops. The high incidence of NCLB in Ontario is concerning since yield losses are associated with the disease, and this erodes producer profits. As a result, there is a need to implement additional disease management strategies, for example use of foliar fungicides; however, this increases production costs and can be an environmental risk. In future, sustainable and economic corn production will require the development of new NCLB *Ht* gene/inbreds and their incorporation into high yielding commercial corn hybrids.

Variability in commercial corn hybrid reactions to NCLB was evident from inspection of the 17 Ontario Corn Committee (OCC) 2015 performance trials, of which 12 locations (Alma, Belmont, Dundalk, Elora, Exeter, Lindsay, Orangeville, Ridgetown, Waterloo, Winchester, Wingham, and Woodstock) had very high disease severity ratings (≥4) (Table 3).

The sites surveyed can be used to map the geographical distribution of physiological races of *E. turcicum* since it is not uncommon to find both resistant and susceptible NCLB lesion types on the same leaf. Likewise one can observe that the reactions of some hybrids to NCLB differ depending on where they are grown in Ontario, suggesting the presence of different races of *E. turcicum*, as has been reported in previous years (Zhu et al. 2013, Jindal et al. 2015). To verify this, and subsequently to map the distribution of such races in corn growing regions of Ontario, 155 leaf samples with NCLB symptoms were collected during the survey for study.

Eyespot was more prevalent in 2015 compared to 2014. The disease was found in 158 (87%) of the sites sampled (Table 1) at a mean severity of 3.2 and an incidence of 31% of fields visited (Table 2). Thirty-one of 158 affected crops had severity levels of 5 and an incidence of 65-100% of plants affected. As with NCLB, eyespot was less common in Eastern Ontario (69% of fields affected) compared to Southern and Western Ontario (99%). However, four individual crops in Eastern Ontario had high eyespot severity ratings of 5.0, compared to the mean eyespot severity of 3.7 in affected crops in Southern Ontario. The widespread distribution of eyespot in Ontario was demonstrated by the elevated severity ratings of ≥4 in 67 corn crops situated throughout the province. Many of the hybrids included in the OCC trials planted at Blyth, Dundalk, Exeter, Winchester and Wingham, as well as many entries in seed company demonstration plots, exhibited variable levels of resistance to eyespot.

Common Rust was also one of the more common foliar diseases detected in Ontario corn in 2015. By contrast **southern rust,** which has been increasing in southern and mid-central U.S. regions, was found in only 5 fields in Essex, Chatham Kent, Middlesex and Wellington Counties. Common rust was found in 149 (82%) fields (Table 1) at a mean disease severity of 2.3 and an incidence of 18% (Table 2). In contrast to NCLB and eyespot, common rust severity and incidence were similar across the province. High levels of rust (≥4) were recorded in 29 fields in 12 counties [Stormont, Dundas and Glengarry (9), Oxford (6), Leeds and Grenville (3), Middlesex (2), Wellington (2), Chatham Kent (1), Dufferin (1), Elgin (1), Perth (1), Renfrew (1) and Victoria (1)]. At seven OCC sites (Alma, Belmont, Elora, Lindsay, Orangeville, Winchester and Woodstock) some of the commercial and developmental hybrids exhibited moderate to high resistance to common rust (assuming infection was uniform throughout the crops). In seed corn, one of 17 crops visited had female inbreds that were moderately susceptible (severity rating of 3.0) to common rust.

Grey leaf spot was found in only 28 (15.5%) of the crops sampled (Table 1). As in 2014, GLS was not widely spread in Ontario in 2015. The disease was most prevalent (97% of fields) in five counties, Chatham-Kent, Elgin, Essex, Middlesex and Oxford in Southern Ontario. In Eastern Ontario, where 70 crops were sampled, GLS was not detected. GLS severity and incidence were low (≤2.0 and ≤25.0, respectively) in 5 of 14 seed corn crops sampled in the southwest. At the OCC trial in Dresden, some hybrids were highly susceptible to GLS, as was the case for various hybrids in demonstration plots in Chatham-Kent and 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 corn production, and warm and humid conditions through late July and August have favoured GLS development. This is in stark contrast to the U.S. Midwest corn-belt where GLS occurs throughout the region and is the most economically important foliar corn disease (Wise 2012).

Anthracnose leaf blight and dieback was detected in 20 crops (11%). Fourteen of these were in Eastern Ontario and severity and incidence were low with the exception of 10 crops in Stormont, Dundas and Glengarry and Prescott & Russell counties where the incidence was >60%. ALB was not observed in any of the 14 seed corn crops or 17 OCC trial sites visited.

Other leaf spots: Physoderma brown spot was found throughout the province; however, its severity and incidence were low in the majority of crops except a few in Chatham-Kent and Essex where symptoms on sheaths appeared severe. **Phaeosphaeria leaf spot** caused by *Phaeosphaeria maydis* (Henn.) Rane, Payak, & Renfro was found in five crops in Southern Ontario. Holcos leaf spot was observed in five crops in Southern and Western Ontario. **Northern leaf spot** and **Southern corn leaf blight** were found in a few crops in Chatham Kent and Elgin Counties.

Fungal ear and stalk diseases: **Common smut** and **Head smut** were found in only 17 (9%) of sampled crops (Table 1). Overall, the mean common smut and head smut incidence was 9% in affected crops. Incidence levels of ≥10% were found in two crops in Chatham Kent. Common smut and head smut were found in four crops of seed corn with 60% incidence in one crop in Chatham Kent. **Ear rot** was found in eight crops at a low incidence level. Ears with exposed kernels were found to have *Fusarium* spp. infection. **Stalk rot** was found in one crop at a very low incidence. The low incidence and occurrence of ear and stalk diseases at the time of the survey suggests these diseases were less important in 2015 compared to other years; however, the 2015 survey may have been conducted too early to detect high levels of ear and stalk rots. Ear rots (*Diplodia*, *Fusarium* and *Penicillium*) were observed only at very low levels at harvest, as was Gibberella ear rot and its accompanying mycotoxin (DON), in the majority of the province. Only a few corn fields had DON levels above 2 ppm, in contrast to problem years such as 2011 (Stewart and Tenuta, 2014).

One crop in Chatham-Kent was found to have **crazy top** 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 crops sampled in 2015. 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 treatment (Chaky et al. 2013). Likewise, **Goss's bacterial wilt and blight** was not found in Ontario in 2015.

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Table 1. Disease occurrence in Ontario corn crops in 2015 grouped by county and region.

County	No. crops	Disease / number of crops affected (n=181)							
		ALB	Eyespot	GLS	NCLB	Rust	Smut	Ear rot	Stalk rot
Chatham-Kent	34	5	34	19	34	27	6	3	1
Dufferin	4	0	4	0	4	4	0	0	0
Durham	2	0	2	0	2	2	0	0	0
Elgin	12	0	11	1	12	10	3	0	0
Essex	6	0	6	4	6	6	1	1	0
Grey	1	0	1	0	1	1	0	0	0
Huron	7	1	7	0	7	7	1	1	0
Lanark	7	0	1	0	6	1	0	0	0
Leeds & Grenville	10	0	6	0	10	8	0	0	0
Middlesex	6	0	6	4	6	5	2	0	0
Ottawa	12	3	11	0	12	10	0	0	0
Oxford	10	0	10	3	10	10	0	0	0
Perth	14	0	14	1	14	12	2	0	0
Prescott & Russell	11	4	11	0	11	10	0	0	0
Renfrew	15	0	4	0	11	6	0	1	0
Stormont, Dundas & Glengarry	15	7	15	0	15	15	0	0	0
Victoria	3	0	3	0	3	3	0	0	0
Waterloo	5	0	5	0	5	5	2	2	0
Wellington	6	0	6	0	6	6	0	0	0
York	1	0	1	0	1	1	0	0	0
Central Ontario	6	0	6	0	6	6	0	0	0
Eastern Ontario	70	14	48	0	65	50	0	1	0
Southern Ontario	68	5	67	31	68	58	12	3	1
Western Ontario	37	1	37	1	37	35	5	1	0
Ontario total	181	20	158	32	176	149	17	5	1

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 the major diseases in Ontario corn crops in 2015, grouped by county and region

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**
Chatham-Kent	3.5	1.5-5	42.6	8-90	1.5	1-4	8.2	0-40	3.3	1.5-6	34.9	8-90	1.8	1-4	11.2	0-58
Dufferin	3.8	3-4.5	33.8	15-65	-	-	-	-	3.4	1.5-6	31.3	4-80	2.8	1.5-4.5	23.8	4-74
Durham	3.5	2-5	47.5	10-85	-	-	-	-	2.3	1.5-3	13.0	4-22	1.8	1.5-2	7.0	6-8
Elgin	3.6	1-5	37.3	0-88	1.1	1-2	0.8	0-10	3.4	2-6	31.4	9-100	2.2	1-4	15.8	0-62
Essex	3.2	1.5-4.5	29.0	10-48	1.8	1-4	9.8	0-35	2.8	2-3.5	25.0	12-36	1.6	1.5-2	12.7	5-18
Grey	2.5	2.5	8.0	8	-	-	-	-	4.0	4	32.0	32	2.5	2.5	9.0	9
Huron	2.4	2-3.5	7.4	3-15	-	-	-	-	3.4	2.5-5	23.1	15-45	3.0	2.5-3.5	8.4	3-18
Lanark	1.2	1-2.5	0.7	0-5	-	-	-	-	2.1	1-4	5.3	0-15	1.1	1-2	0.6	0-4
Leeds & Grenville	2.0	1-3	9.0	0-22	-	-	-	-	3.8	2-5	19.6	5-32	2.8	1-5	26.9	0-83
Middlesex	3.8	1.5-5	46.3	6-85	1.1	1-2	5.0	0-12	2.9	1.5-4.5	25.3	6-52	2.6	1-5	33.3	0-100
Ottawa	3.4	1-5	28.1	0-100	-	-	-	-	3.1	2-5	12.5	3-26	2.2	1-4	12.3	0-58
Oxford	4.5	3-5	66.1	22-92	1.2	1-2	1.7	0-8	3.9	2.5-5.5	28.0	15-45	3.6	2-4.5	46.9	12-81
Perth	4.0	2-5	51.5	4-100	1.0	1-1.5	0.2	0-3	2.9	1.5-5	20.6	9-45	1.9	1-4	9.9	0-55
Prescott & Russell	2.9	2-5	19.1	6-100	-	-	-	-	3.2	2-4	13.6	6-21	2.1	1-3	11.1	0-40
Renfrew	1.4	1-3	2.3	0-12	-	-	-	-	1.8	1-3	4.8	0-12	1.7	1-4	6.5	0-65
Stormont, Dundas & Glengarry	3.2	2-5	19.1	9-80	-	-	-	-	4.1	2-6	30.1	5-100	3.5	2-5	46.9	9-82
Victoria	4.5	4-5	58.0	24-75	-	-	-	-	4.3	4-5	28.3	24-35	3.7	3.5-4	33.7	15-71
Waterloo	3.7	2.5-5	33.8	9-85	-	-	-	-	3.2	2.5-4	23.2	15-32	2.5	1.5-3.5	9.4	2-18
Wellington	3.8	2.5-5	37.8	6-90	-	-	-	-	3.3	2-5.5	33.2	6-90	2.8	1.5-4	29.7	2-79
York	4.0	4	21.0	21	-	-	-	-	1.5	1.5	5.0	5	3.5	3.5	12.0	12
Central Ontario	4.1	2-5	50.0	10-85	-	-	-	-	3.2	1.5-5	19.3	4-35	3.0	1.5-4	26.2	6-71
Eastern Ontario	2.4	1-5	13.8	0-100	-	-	-	-	3.1	1-6	15.1	0-100	2.3	1-5	19.2	0-83
Southern Ontario	3.7	1-5	44.2	0-90	1.4	1-4	5.4	0-40	3.3	1.5-6	31.5	6-100	2.2	1-5	19.3	0-100
Western Ontario	3.6	2-5	35.5	3-100	1.0	1-1.5	0.1	0-3	3.1	1.5-6	24.9	4-90	2.4	1-4.5	14.2	0-79
All Ontario	**3.2**	**1-5**	**30.8**	**0-100**	**1.2**	**1-4**	**2.0**	**0-40**	**3.2**	**1-6**	**23.4**	**0-100**	**2.3**	**1-5**	**18.4**	**0-100**

[1] Disease severity in affected crop was rated as percentage of leaf area with symptoms; **eyespo**t, GLS (**Grey leaf spot**) and **common rust** were rated on a 1-7 scale (1=no symptoms, 2=<1%, 3=1-5%, 4=6-20%, 5=21-50%, 6=>50 % leaf area with symptoms and 7= most of the leaves dead); N**CLB** (Northern corn leaf blight) on 1-7 scale (1=no symptoms; 2=<1%; 3=1-5%; 4=6-20%; 5=>50% lower leaves and >25% of the centre and upper leaves with symptoms, 6=lower leaves dead, >50 centre leaves and >25% upper leaves with symptoms; 7=most leaves almost dead.

[2] Incidence is number of affected plants/total number of plants observed x 100; A 'hyphen' indicates disease not found in the fields sampled

Table 3. Severity and incidence of major diseases observed at OCC[1] corn trial sites in Ontario, 2015.

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]
Alma	5.0	90.0	0.0	0.0	5.5	45.0	4.0	79.0
Belmont	5.0	85.0	0.0	0.0	4.5	52.0	4.5	81.0
Blyth	2.0	4.0	0.0	0.0	3.0	18.0	3.0	5.0
Dresden	4.5	65.0	4.0	35.0	3.0	24.0	1.5	12.0
Dundalk	2.5	8.0	0.0	0.0	4.0	32.0	2.5	9.0
Elora	5.0	65.0	0.0	0.0	6.0	90.0	4.0	70.0
Exeter	1.5	6.0	1.5	6.0	4.5	48.0	1.5	5.0
Ilderton	5.0	85.0	1.5	4.0	3.0	22.0	1.5	4.0
Lindsay	5.0	75.0	0.0	0.0	5.0	35.0	4.0	71.0
Orangeville	4.0	30.0	0.0	0.0	6.0	80.0	4.5	74.0
Ottawa	4.0	45.0	0.0	0.0	3.5	35.0	2.5	30.0
Ridgetown	5.0	70.0	1.5	5.0	5.0	90.0	1.5	8.0
Tilbury	4.5	40.0	0.0	0.0	2.5	20.0	1.5	10.0
Waterloo	4.0	35.0	0.0	0.0	4.0	32.0	3.0	12.0
Winchester	2.0	80.0	0.0	0.0	5.0	15.0	5.0	78.0
Wingham	2.0	6.0	0.0	0.0	5.0	45.0	3.0	12.0
Woodstock	5.0	90.0	2.0	8.0	5.5	39.0	4.0	60.0

[1]OCC - Ontario Corn Committee

[2] Disease severity in affected crop was rated as percentage of leaf area with symptoms; eyespot, GLS (Grey leaf spot) and **common rust** were rated on a 1-7 scale (1=no symptoms, 2=<1%, 3=1-5%, 4=6-20%, 5=21-50%, 6=>50 % leaf area with symptoms and 7= most leaves dead and NCLB (Northern corn leaf blight) on 1-7 scale (1=no symptoms; 2=<1%; 3=1-5%; 4=6-20%; 5=>50% lower leaves and >25% of the centre and upper leaves with symptoms, 6=lower leaves dead, >50 centre leaves and >25% upper leaves with symptoms; 7=most leaves almost dead.

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

CROP / CULTURE: Oat

LOCATION / REGION: Saskatchewan

NAMES AND AGENCY / NOMS ET ETABLISSEMENT:
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TITLE / TITRE: FUSARIUM INFECTION OF OAT IN SASKATCHEWAN IN 2015

ABSTRACT: The *Fusarium* species present on seed samples of 31 oat crops collected across Saskatchewan in 2015 were identified based on macrospore morphology. Four species were identified: *Fusarium poae*, *F. graminearum*, *F. avenaceum*, and *F. culmorum*. *Fusarium poae* was the most common of these.

INTRODUCTION AND METHODS: In 2015, 31 oat crops in 13 crop districts were surveyed in July and August with approximately 15 panicles collected from each field. Samples were dried, stored in paper bags, and hand threshed. The seeds were then surface sterilized in 5% NaOCl for three minutes, rinsed in sterile water, and air dried. Thirty seeds from each sample were plated on potato dextrose agar for seven days. The fusarium species present in each sample were identified based on macrospore morphology (Zillinsky, 1983; Gerlach and Nirenburg, 1982).

RESULTS AND COMMENTS: Of the 31 crops surveyed, *Fusarium* spp. were identified in 22. The species identified were: *F. poae* (Peck) Wollenweber, *F. graminearum* Schwabe, *F. avenaceum* (Fr.:Fr.) Sacc., and *F. culmorum* (W.G. Smith) Sacc. *Fusarium poae* was the most prevalent species and was found in 16 of the 31 crops surveyed (52%), with an incidence on seed of 8.6% (Table 1). *Fusarium graminaerum* and *F. avenaceum* were the next most common species, detected in ten (32%) and six (19%) of the 31 crops, with an incidence on seed of 1.6% and 1.1%, respectively. *Fusarium culmorum* was the least common species, at 7% prevalence and 0.2% incidence.

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We thank the Saskatchewan Crop Insurance Corporation staff for collecting many of the samples and the Saskatchewan Oat Development Commission for financial support.

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Table 1. Prevalence and incidence of *Fusarium* spp. on oat seed from Saskatchewan in 2015.

Pathogen	**Prevalence (% crops)**	**Incidence† (%)**
Fusarium poae	51.6	8.6
F. graminaerum	32.3	1.6
F. avenaceum	19.4	1.1
F. culmorum	6.5	0.2

† incidence = proportion (%) of seed from which each pathogen was isolated

CROP / CULTURE: Oat

LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: LEAF SPOT DISEASES OF OAT IN SASKATCHEWAN IN 2015

ABSTRACT: Leaf spot disease severity in 28 oat crops in Saskatchewan in 2015 was trace to slight in the majority of surveyed crops with only a few showing moderate levels. *Pyrenophora avenae* (pyrenophora leaf blotch) and *Cochliobolus sativus* (spot blotch) were the common oat pathogens isolated from diseased leaves. *Stagonospora avenae* f. sp. *avenaria* (stagonospora leaf blotch) was not observed in 2015.

INTRODUCTION AND METHODS: In 2015, leaf spotting diseases of oat were surveyed across Saskatchewan in mid-August, when crops were at the milk to soft dough growth stages. Twenty-eight crops were surveyed, and disease severity was assessed on two to four plants at each of five points approximately 20 m apart and 30 m from the field edge. Oat was rated in the field 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 20 leaves were collected from each field, dried and stored in paper envelopes for subsequent analysis. The pathogens involved were identified in the laboratory by cutting and surface sterilizing 10 pieces of infected leaf tissue from 10 different leaves. The leaf tissue pieces were placed on water agar plates for 7 days to promote sporulation of the pathogen(s), and the identity was determined by examining spore size and shape. For confirmation, pathogens were then transferred to V8 Juice Agar (V8A) plates for further growth and sporulation. Single spore technique was used to obtain pure cultures of *P. avenae* and *C. sativus*. The cultures were stored in cryopreservation fluid at -65° C, for future use and (or) distribution.

RESULTS AND COMMENTS: In 2015, growing conditions were relatively dry in the spring and early summer leading to reduced disease development. Leaf spots were observed in the canopies of all 28 crops surveyed, however, disease severity ranged only from trace to slight in 25 fields and was moderate in three. *Pyrenophora avenae* Ito & Kuribayashi and *Cochliobolus sativus* Ito & Kuribayashi Drechs. ex Dast. were identified from the plated oat leaf tissues (Table 1) and their prevalence and incidence was lower compared to 2014 (Taylor et al. 2015). No *Stagonospora avenae* (Frank) Bissett was observed in 2015 leaf samples. These results were different from the field surveys conducted prior to 2014 (Tekauz et al. 2012, Taylor et al. 2014) when *P. avenae* and *S. avenae* were reported as the predominant leaf blotch pathogens. This may have resulted from changes in environmental conditions, with those in 2015 being more favorable to the growth and development of *C. sativus,* but not *S. avenae*.

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CROP / CULTURE: Oat

LOCATION / RÉGION: Manitoba

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

ABSTRACT: Twenty four oat fields in Manitoba were surveyed for Fusarium head blight (FHB) in 2014 to assess FHB severity and the causal *Fusarium* species. Although visual symptoms of FHB in the surveyed fields were scarce, *Fusarium* pathogens were in kernels collected from 17 out of 24 fields. *Fusarium poae* was the predominant species in the fields, followed by *F. graminearum, F. sporotrichioides,* and *F. avenaceum.*

INTRODUCTION AND METHODS: Oat fields 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 24 oat fields were selected at random along the survey routes, depending on 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 by sampling 80-120 panicles at three locations and averaging the scores. Subsequently, kernels removed from 10 randomly selected panicles per field were ground to a powder using liquid nitrogen. DNA was extracted from a one gram ground sample from each field using the CTAB method (Brandfass and Karlovsky 2008). PCR analysis was performed on DNA samples using PCR primers specific to various *Fusarium* species commonly found in cereal crops grown in western Canada (Demeke et al. 2005).

RESULTS AND COMMENTS: Crop growing conditions in Manitoba in 2014 were generally normal, resulting from timely precipitation in June and July. However, in some regions spring seedling was impacted by extreme weather, including excessive rain and hail, resulting in considerable land not being seeded, or if seeded, being subsequently abandoned. In 2014, a total of 341,030 acres of oat were seeded. ‘Souris’, ‘Summit’, ‘Furlong’ and ‘Pinnacle’ were top four cultivars grown and made up to 74.7% of the total oat production area in Manitoba (MASC, Yield Manitoba 2014).

Among 24 oat fields surveyed, the lack of definitive FHB symptoms, such as orange-pink or otherwise discolored spikelets on a panicle, was the norm. Overall, the average incidence of FHB on oat in Manitoba was estimated to be less than 1% based on visual estimation.

Despite the lack of visible FHB symptoms, *Fusarium* infection was detected in 17 out of 24 fields. *Fusarium poae* was the most common *Fusarium* species found fields (in 46%), followed by *F. graminearum* (in 29%), *F. sporotrichioides* (in 16%) and *F. avenaceum* (in 8%) (Table 1).

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Demeke, T., Clear, R. M., Patrick, S. K. and Gaba, D. 2005. Species-specific PCR-based assays for the detection of *Fusarium* species and a comparison with the whole seed agar plate method and trichothecene analysis. Int. J. Food Microbiol. 103(3):271-84 (doi:10.1016/j.ijfoodmicro.2004.12.026)

Table 1. *Fusarium* spp. detected by PCR in kernels collected from 24 oat fields in Manitoba in 2014.

***Fusarium* spp.**	**Percentage of fields positive for *Fusarium* infection**
F. avenaceum	8
F. graminearum	29
F. poae	46
F. sporotrichioides	16

CROP / CULTURE: Oat

LOCATION / RÉGION: Manitoba

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF OAT IN MANITOBA – 2015

ABSTRACT: Forty nine oat fields in Manitoba were surveyed for Fusarium head blight (FHB) in 2015 to assess FHB severity and the causal *Fusarium* species. Visual symptoms of FHB were only observed in 8 of 49 fields surveyed. However, *Fusarium* pathogens were isolated from kernels of all 49 fields. *Fusarium poae* was the predominant species detected (64.2%), followed by *F. graminearum* (17.6%), *F. sporotrichioides* (15.4%), and *F. avenaceum* (3.0%).

INTRODUCTION AND METHODS: Oat fields in Manitoba were monitored for the incidence 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 49 oat fields were selected at random along the survey routes, depending on crop frequency. The areas sampled were 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. Fusarium head blight in each field was assessed by non-destructive sampling of a minimum of 80-100 plants at each of three locations for the percentage of infected panicles (disease incidence), and the average proportion of the panicle (spike) infected (SPI). FHB severity levels were calculated as the 'FHB Index' (% incidence x SPI (%) / 100). Thirty to fifty panicles were collected from each field for laboratory analysis. Subsequently, 50 putatively infected kernels per field were surface-sterilized in 0.3% NaOCl for 3 minutes, air-dried, and plated onto potato dextrose agar to identify *Fusarium* spp. based on morphological traits as described in standard taxonomic keys.

RESULTS AND COMMENTS: In 2015, a total of 451,934 acres of oat were seeded in Manitoba. 'Souris', 'Summit', 'Furlong' and 'Pinnacle' were the top four cultivars based on seeded acreage, and made up to 72.4% of the total oat production area in Manitoba (MASC, Yield Manitoba 2015).

In the 49 oat fields surveyed, visual symptoms of *Fusarium* infection were only observed in 8 fields. The lack of definitive FHB symptoms, such as orange-pink or otherwise discolored spikelets on a panicle, was not uncommon. Overall, the average incidence of FHB on oat in 2015 was estimated to be less than 1% based on the visual estimation.

Fusarium pathogens were isolated from oat kernels in all 49 fields. *Fusarium poae* was the most common *Fusarium* species which was found in 48 out of 49 fields, followed by *F. sporotrichioides* (30 fields), *F. graminearum* (19 fields), and *F. avenaceum* (8 fields) (Table 1). *Fusarium poae* was isolated from 64.2% of putatively FHB infected kernels, followed by *F. graminearum* (17.6%), *F. sporotrichioides* (15.4%) and *F. avenaceum* (3.0%) (Table 1).

REFERENCES:
Manitoba Agricultural Services Corporation (MASC). Yield Manitoba 2015.

Table 1: *Fusarium* spp. isolated from FHB-affected kernels in 49 oat fields in Manitoba in 2015.

***Fusarium* spp.**	**Number of fields / Percent**		**Percent of kernels**
F. avenaceum	8	16.3	3.0
F. equiseti	2	4.1	0.8
F. graminearum	19	38.8	17.6
F. poae	48	98.0	64.2
F. sporotrichioides	30	61.2	15.4

CROP / CULTURE: Oat

LOCATION / RÉGION: Central and eastern Ontario

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TITLE / TITRE: DISEASES OF OAT IN CENTRAL AND EASTERN ONTARIO IN 2015

ABSTRACT: Twenty-one oat crops in central and eastern Ontario were surveyed for diseases in 2015. Of the 10 diseases observed, stagonospora leaf blotch, crown rust, barley yellow dwarf, and take-all were most the most prevalent, and severe levels of these were found in 6, 3, 1 and 1 fields, respectively. Fusarium head blight (FHB) was found in all fields but only at low visual levels. *Fusarium poae* was the predominant species causing FHB.

INTRODUCTION AND METHODS: A survey to document diseases in central and eastern Ontario oat crops was conducted in the third week of July 2015 when plants were at the soft dough stage of development. Twenty-one fields were chosen at random in 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 visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe disease levels, respectively. Severity of ergot, loose smut, and take-all was based on the percent of plants infected. FHB was rated for incidence (% infected panicles) and severity (% infected spikelets in the affected panicles) based on approximately 200 panicles at each of three random sites per field. A FHB Index [(% incidence x % severity)/100] was determined for each field. The percentage of infected plants or FHB index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe disease 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% NaOCI for 60 seconds and plated in 9-cm diameter petri dishes on modified potato dextrose agar (PDA) (10 g PDA per liter amended with 50 ppm of streptomycin sulphate). The plates were incubated for 10-14 days at 22-25ºC and a 14-hour photoperiod using fluorescent and long wavelength ultraviolet tubes. 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). Stagonospora leaf blotch (normally associated with the pathogen S*tagonospora avenae* f. sp. *avenaria*), barley yellow dwarf (BYDV), and crown rust (*Puccinia coronata* f. sp. *avenae*) were the most important diseases and were found in 21, 21 and 19 fields at average severities of 4.4, 2.9 and 2.8, respectively. Severe levels of stagonospora leaf blotch, BYD, and crown rust was observed in 6, 1 and 3 fields, respectively. These diseases collectively likely resulted in yield reduction of >5% in affected crops. Other foliar diseases observed were halo blight (*Pseudomonas syringae* pv. *coronafaciens*), pyrenophora leaf blotch (*Pyrenophora avenae*), and spot blotch (*Cochliobolus sativus*). Severe levels of these diseases were not found and none would have resulted in substantive damage to a crop.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago nuda*) and take-all root rot (*Gaeumannomyces graminis* var. *avenae*) were observed in all fields at low mean incidence levels of 0.1, 0.1 and 1.2%, respectively (Table 1). These diseases likely resulted in minimal damage, except in one crop with 10% take-all. .

Fusarium head blight occurred in all fields at a mean FHB Index of 0.4% (range 0.01-1.0%) (Table 1). The disease was recorded at slight to moderate levels in affected crops. Five *Fusarium* species were isolated from discoloured kernels (Table 2). *Fusarium poae* predominated and occurred in 100% of fields and on 36.5% of kernels. *Fusarium graminearum* was less common and was found in 57% of fields and on 4.3% of kernels. *Fusarium avenaceum, F. equiseti* and *F. sporotrichioides* were least common, occurring in 5-29% of fields and on 0.1-0.7% of kernels.

The 10 diseases observed on oat in Ontario in 2015 were the same as those recorded for 2014 (Xue and Chen 2015). Overall, the incidence and severity of the diseases were similar to those recorded in 2014, except for stagonospora leaf blotch, which was more severe in 2015, and FHB, which was more severe in 2014. FHB, although observed in all surveyed fields in 2015, as occurred in 2014, did not cause significant reductions in grain yield and quality.

REFERENCE:

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Table 1: Prevalence and severity of oat diseases in central and eastern Ontario in 2015.

	No. crops affected	**Disease severity in affected crops***	
Disease	**(n=21)**	**Mean**	**Range**
Barley yellow dwarf	21	2.9	1.0-6.0
Crown rust	19	2.8	1.0-7.0
Halo blight	16	2.2	1.0-5.0
Pyrenophora leaf blotch	18	1.4	1.0-3.0
Spot blotch	16	1.5	1.0-3.0
Stagonospora leaf blotch	21	4.4	2.0-7.0
Ergot (%)	21	0.1	0.1-0.5
Loose smut (%)	21	0.1	0.1-0.5
Take-all (%)	21	1.2	0.1-10.0
Fusarium head blight (FHB)**	21		
Incidence (%)		8.5	1.0-30.0
Severity (%)		4.4	1.0-10.0
Index (%)		0.4	0.01-1.0

*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 2015

.***Fusarium* spp.**	**% affected fields**	**% kernels**
Total *Fusarium*	100.0	42.0
F. avenaceum	4.8	0.1
F. equiseti	28.6	0.7
F. graminearum	57.1	4.3
F. poae	100.0	36.5
F. sporotrichioides	14.3	0.4

CROP / CULTURE: Wheat

LOCATION / RÉGION: Saskatchewan

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TITLE / TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2015

ABSTRACT: In 2015, fusarium head blight (FHB) incidence and severity were assessed in 163 wheat crops in Saskatchewan. FHB occurred in 34% and 44% of the common and durum wheat crops serveyed , respectively. The provincial mean FHB severity (FHB Index) for common wheat was 2.2% and for durum wheat 5.2%. These levels were higher, especially for durum wheat, than those recorded for previous years.

INTRODUCTION AND METHODS: Fusarium head blight (FHB) incidence and severity were assessed in 163 wheat crops in Saskatchewan in 2015, 106 common wheat (Canada Western Red Spring and Canada Prairie Spring classes) and 57 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.

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. Additional samples consisting of 50 spikes from 13 crops were obtained from the Cereal and Flax Pathology Laboratory of the University of Saskatchewan. Spikes were analyzed for visual FHB symptoms at the Crop Protection Laboratory in Regina. The number of infected spikes per crop and the number of infected spikelets in each spike were recorded. An FHB disease severity rating, the FHB index (Stack and McMullen, 2011), was determined for each wheat crop surveyed, with FHB severity (%) = [% of spikes affected x mean proportion (%) of kernels infected] / 100. Mean FHB severity values were calculated for each soil/irrigation zone and for the whole province. Glumes or kernels with visible FHB symptoms were surface sterilized in 0.6% NaOCl solution for 1 min and rinsed three times in sterile distilled water and cultured on potato dextrose agar (PDA) and carnation leaf agar (CA) to confirm presence of *Fusarium* spp. on infected kernels. PDA or half strength PDA was used to observe colony morphology; CA was used to promote sporulation and assist with macrospore identification. A maximum of 20 kernels per sample were selected and cultured for this purpose.

RESULTS AND COMMENTS: Approximately 2.4 million hectares (6.0 million acres) of spring wheat (Canada Western Red Spring and Canada Prairie Spring Wheat classes) and 1.6 million hectares (3.9 million acres) of durum wheat were seeded in Saskatchewan in 2015. The spring wheat acreage was lower, but that seeded to durum higher than in 2014. Average spring wheat production in Saskatchewan was 8.2 metric tonnes per ha (lower than in 2013 or 2014, but similar to 2012). Average durum production was 4.6 metric tonnes per ha (similar to 2014, lower than 2013, but higher than 2012). The average yields in 2015 were approximately 1.4 metric tonnes per ha (37.0 bu/ac) for spring wheat and

1.3 metric tonnes (38.0 bu/ac) for durum wheat (Saskatchewan Ministry of Agriculture 2015; Statistics Canada 2015).

FHB was detected in 34% and 44% of the common and durum wheat crops, respectively (Table 1). Prevalence and severities of FHB in common and durum wheat were lowest in soil Zone 3. Prevalence and severity of FHB was similar in soil Zones 1 and 3, where little durum is produced, and highest in Zone 2, where both common and durum wheat are cultivated. Irrigated zones were not surveyed in 2015.

Overall, the 2015 provincial mean FHB severity (2.2%) was higher than in previous years for common wheat, and much higher, (x 3) or 5.2%, than in previous years for durum wheat. FHB severity in common wheat was 0.6% in 2011 (Miller et al. 2012), 1.2% in 2012 (Dokken-Bouchard et al. 2013), and 0.5% in both 2013 and 2014 (Dokken-Bouchard et al. 2014, 2015). In durum wheat this was 0.9% in both 2011 (Miller et al. 2012) and 2012, 1.3% in 2013, and 1.8% in 2014 (Dokken-Bouchard et al. 2013, 2014, 2015).

Of the 163 wheat samples collected, 60 had visible FHB symptoms, which were confirmed by the culturing results. The most frequently isolated species was *F. graminearum* (Table 2). This species, considered to be the most aggressive FHB-causing pathogen, was detected in 24% of surveyed fields and accounted for 34% of total *Fusarium* isolations. *Fusarium graminearum* was detected in 22% of the common wheat and 28% of the durum wheat samples with visible symptoms, a level approximately half that in 2014. It accounted for 20% of the total *Fusarium* isolations from common wheat and 14% from durum wheat. This is a significantly lower level than found in 2014 (Dokken-Bouchard et al. 2015).

Fusarium poae was detected in only 6% of crops and accounted for just 9% of total *Fusarium* isolations in 2015, less than in 2013, when it was detected in 31% of crops and accounted for 24% of *Fusarium* isolations. In previous years, either *F. avenaceum* or *F. poae* were the dominant species in the province (Dokken-Bouchard et al. 2014; Dokken-Bouchard et al. 2015). *Fusarium avenaceum* was detected in 12% of crops and accounted for 18% of total *Fusarium* isolations, a similar level to 2013 and 2014. *Fusarium culmorum* and *F. sporotrichoides* were detected in 6% of crops and accounted for 9% of total *Fusarium* isolations, higher than recorded in 2014 (Dokken-Bouchard et al. 2015).

Other fungal pathogens isolated from wheat spikes collected in 2015 included *Septoria* and *Cochliobolus* spp., along with various secondary saprophytes.

The 2015 cropping season was relatively dry and drought-affected crops were observed throughout the province. Yield per unit area was lower for both spring and durum wheat compared to 2014, which was likely attributable to the weather. Although the overall production for durum was similar to 2014, the area seeded was greater than in 2014 (Saskatchewan Ministry of Agriculture 2014, 2015). Despite lower disease pressure (relatively fewer *Fusarium* isolations than in 2014) due to drier weather, FHB was observed in many fields at much higher severity levels than observed in 2014. This might be attributed to uneven precipitation occurring in the crop samples collected among fields. Similarly, it could have resulted in the greater overall mean FHB severity in spring and durum wheat in 2015 compared to 2014.

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, 2015.

	Common Wheat		**Durum Wheat**	
Soil Zones	**Prevalence[1] (No. of Crops Surveyed)**	**Mean FHB Severity[2] (range)**	**Prevalence[1] (No. of Crops Surveyed)**	**Mean FHB Index[1] (range)**
Zone 1 Brown	33% (9)	2.3% (0 – 19.4%)	35% (23)	4.4% (0 – 100%)
Zone 2 Dark Brown	44% (23)	8.7% (0 – 90%)	58% (26)	7.5% (0 – 80%)
Zone 3 Black/Moist Black/Grey	31% (74)	0.1% (0 – 1.8%)	25% (8)	0.01% (0 – 0.05%)
Overall Total/Mean	34% (106)	2.2% (0 - 90%)	44% (57)	5.2% (0-100%)

[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 fusarium head blight affected wheat crops in Saskatchewan in 2015.

Crop	*Fa*[1]	*Fav*[2]	*Fc*[3]	*Fe*[4]	*Fg*[5]	*Fp*[6]	*Fs*[7]	*Other F. spp.*
Durum	2*	25	7	4	28	11	9	18
Common	2	7	6	3	22	4	4z	7
Wheat Total	2	12	6	3	24	6	6	10

[1]*Fusarium acuminatum*; [2]*Fusarium avenaceum*; [3]F. *culmorum*; [4]*F. equiseti*; [5]*F. graminearum*; [6]*F. poae*; [7]*F. sporotrichoides*.
*Number of crops affected / total crops surveyed (%)

CROP / CULTURE: Common and durum wheat

LOCATION / RÉGION: Saskatchewan

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: **LEAF SPOT DISEASES OF COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2015**

ABSTRACT: The leaf spot (LS) disease complex was evaluated in 145 wheat crops across Saskatchewan in 2015. Disease severity was compared relative to wheat species, soil zone, crop district, and cultivar. Mean LS severity was lower than in 2014 and 2012, but similar to 2013. There was considerable variation in LS severity among and within regions. Overall, there was no difference in LS levels between common and durum wheat. For common wheat, LS was lowest in the Black/Dark Grey soil zone while for durum wheat it was higher in the Brown than Dark Brown soil zone. *Pyrenophora tritici-repentis* was the most prevalent pathogen followed by the septoria leaf complex pathogens.

INTRODUCTION AND METHODS: A survey for leaf spot (LS) diseases of common and durum wheat in Saskatchewan was conducted between the milk and dough growth stages in 2015. A total of 145 common and durum crops were sampled in 20 crop districts (CD) in the various soil zones (Fig. 1, Table 1). There were 33 fields surveyed in the Brown soil zone, 53 in the Dark Brown soil zone, and 59 in the Black/Grey soil zone. Among the crops sampled, 95 were identified as common, and 50 as durum wheat.

Information on the agronomic practices employed was obtained from the producers for most fields sampled. Twenty common and 10 durum wheat cultivars were identified among the samples, the most popular (grown in 5 fields or more) being the durum wheats ‘Strongfield’ (9 fields), ‘Transcend’ (8), ‘Brigade’ (5), and the common wheats ‘CDC Utmost’ (15), ‘Carberry (7)’, ‘Lillian’ (5) and’ Shaw’ (5), ‘Unity’ (5), and ‘Vesper’ (5). Information on whether the sampled fields had been sprayed with fungicide(s), and when, was obtained from about half of the producers. There was a similar number of crops sprayed with fungicides (35) as nonsprayed (37). Information on the crops grown in 2014 and 2013 (or if summerfallow), and tillage method was also obtained from producers for most of the fields surveyed. For common wheat, the most frequent previous crop was an oilseed (56 fields), fewer wheat crops were preceded by a pulse (11) or a cereal (7) crop, while the most frequently grown crop two years previously was a cereal (61), or an oilseed (7). For durum wheat, the most frequent previous crop was also an oilseed (19) or a pulse (13), while the most frequently grown crop two years previously was a cereal (15), followed by a pulse (5) or oilseed (4). Summerfallow was the least common practice, with only three common, and two durum, wheat fields having been left fallow the previous year or two years previously. Tillage system was classified as conventional, minimum, or zero-till, while previous crop in 2014 or 2013 was classified as a cereal, a non-cereal (oilseed or pulse), or summerfallow. Most of the common wheat crops for which agronomic information was provided were under zero-till (43), followed by fields under minimum-till (11), with only four fields being managed conventionally; by contrast, all durum wheat fields surveyed were under zero-till (14). Due to the low number of fields for some of the tillage and previous crop(s) categories, and the higher than average variability in disease levels, comparison of LS severity and fungal frequency among tillage systems and previous crops was not done in 2015.

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 a mean percentage leaf area with LS was calculated for each crop and CD. For crops with the greatest LS severities and which had not been sprayed with a fungicide at any growth stage (total of 37 crops), 1 cm^2 surface-disinfested leaf pieces were plated on water agar for identification and quantification of causal LS pathogens.

Climate data were obtained from a total of 419 climate stations (134 in Alberta, 215 in Saskatchewan, and 70 in Manitoba) (Environment Canada, 2015) and used for temperature and precipitation analyses. The climate data were split into two separate periods, i.e. May 1st to July 15th and July 16th to August 31st, in order to differentiate the different rainfall patterns occurring in Saskatchewan during the 2015 growing season. In order to better be able to understand the climate conditions near the fields sampled which did not have a climate station nearby, a spatial analysis technique called ‘nearest neighbor’, that uses a 10 km x 10 km grid, was used to create a seamless raster dataset for the entire province. To present the massive amount of data into a condensed format, another spatial analysis called ‘zonal statistics’ was used to calculate the daily average temperature and total daily precipitation within each CD. Relative humidity (RH) was obtained from only a proportion of the Environment Canada climate stations (50 of the 419 used for temperature and precipitation). Besides analyzing the RH at 6 a.m., the hourly RH data were also rolled up to a daily format which resulted in average daily values. The same nearest neighbor interpolation method employed above was then used to create a seamless raster dataset (10 km x 10 km grid cell).

RESULTS AND COMMENTS: Leaf spots were observed in all crops surveyed in 2015 (Table 1). In individual crops, percentage flag leaf area affected ranged from trace to 25%. The overall mean LS severity on flag leaves of 7.6%, was lower than recorded for 2014 and 2012, but similar to that in 2013 (Fernandez et al. 2013, 2014, 2015). Overall, for all crops sampled in 2015, there was no difference in LS severity between common and durum wheat. There was a rather large variation in disease severity among and within regions that could be attributed to the particular weather conditions throughout the summer.

Influence of soil zone and crop district on LS severity

For all common wheat fields sampled, mean LS severity was greater in the Brown and Dark Brown soil zones than in the Black/Grey soil zone, while for durum wheat disease severity was greater for the Brown than the Dark Brown soil zone (Table 1, Fig. 1). A higher overall disease level for common than durum wheat in the Dark Brown soil zone was also observed in 2014 (Fernandez et al. 2015). For common wheat, the lower disease severity in the Black/Grey than in the other soil zones does not accord with results from 2014 when the greatest mean LS severity was observed in the Black/Grey soil zone. For durum wheat, the higher LS level in the Brown vs. the Dark Brown soil zone does match observations made in 2014.

When grouped by CDs, common wheat crops grown in 3A/3B (south-west/south-central), 5A/5B (east), 6A/6B (central) and 7A/7B (west-central) had the greatest mean LS severity, while those in 4A/4B (south-west), 8A/8B (north-east), and 9A/9B (north-west) had the lowest (Table 1, Fig. 1). For durum wheat, CDs 3A/3B had the greatest mean disease severity, followed by 2A/2B (south-east), 4A/4B (south-west) and 6A/6B (central). The remainder of CDs had less than five durum wheat crops sampled.

Influence of cultivar on LS severity

Overall, for the most frequently-grown common wheat cultivars, ‘Carberry’ (mean LS of 10%), ‘Lillian’ (10%), ‘Shaw’ (13%), and ‘Vesper’ (11%) had the highest disease severities, with ‘CDC Utmost’ (3%) and ‘Unity’ (6%) having the lowest LS levels. Among the durum wheat cultivars grown in five or more fields, the greatest disease severities were observed in ‘Strongfield’ (10%) and ‘Transcend’ (11%), followed by ‘Brigade’ (6%). In 2014, ‘Carberry’, ‘CDC Utmost’, ‘Strongfield’ and ‘CDC Verona had the greatest, and ‘Transcend’ and Unity’ the lowest mean LS severities among all the identified common and durum wheat cultivars (Fernandez et al. 2015).

<u>Influence of climate</u>
The climate data for May 1st to July 15th, and for July 16th to August 31st, are presented in Figs. 2 to 5. In 2015, there was a pronounced variability in total precipitation among and within regions, and throughout the growing season. In both time periods, total precipitation was positively correlated with average RH (not presented). For many fields, a clear correspondence between precipitation/RH levels and LS severity was difficult to detect. One of the possible explanations for the latter might be differences in microclimate not captured in the climate analyses. Although there were differences in seeding dates across and within crop districts, most of the LS infections on the flag leaves would have developed by mid-July. Much of the province experienced drought conditions in the spring and early-summer (Fig. 2), with uneven precipitation in many regions. More precipitation occurred in many of the affected regions after mid-July (Fig. 3), which helped to promote crop development. The early-season drought was reflected in low LS severity in areas with low precipitation/RH, such as fields in CDs 2B, 4B, 6A/6B, and 9B. There were also fields with low LS levels in CDs that appeared not to be much affected by drought, such as those in CDs 1A, 1B, 5B, 8A, and 9A. This might be attributed to fungicide application in those fields; however, in most cases there was no information on whether such fields had been sprayed, except for 8A/8B where producers reported that most fields surveyed had received a foliar fungicide application. Some of those fields, such as in CD 1A, appeared to have had low precipitation after mid-July which might have contributed to the low LS levels. In some cases, lower LS severity than expected based on precipitation levels might be explained by temperatures lower than the provincial average, especially in CD 5B and the northern CDs (Figs. 4 and 5).

Fields with greater LS severity were mostly in CDs 3AS, 3BS and 5A, which were apparently not affected by drought to the same extent as other regions, although some fields with high LS levels were also observed in drought-affected areas such as 7A (Figs. 2 and 3). Fields with relatively higher disease levels in some of the western CDs were planted to durum wheat which is known to be more susceptible to LS than common wheat. Periodic smoke ‘cloud’ cover from the forest fires in northern Alberta and Saskatchewan over the summer in 2015 was another factor that may have contributed to some areas having higher than expected LS severity based on the low amounts of precipitation. However, this did not appear to be reflected in higher RH levels given the significant positive correlation between precipitation and average RH. In addition, some of the crops in the drier areas had multiple growth stages because of early dry conditions followed by wet weather. Later emerging plants and slower developing crops in these areas would have been exposed to higher disease pressure thus resulting in greater LS severity.

Additionally, seeding date might have also played a role in LS development given that in most of the province the drought primarily impacted only the first part of the growing season. A significant positive correlation between seeding date and LS severity in common wheat was observed in 5A/5B (r=0.776, $P < 0.01$, n=11) and 7A/7B (r=0.912, $P < 0.05$, n=5), suggesting that the later seeded crops in those regions developed more LS than the earlier seeded crops.

<u>Causal pathogens</u>
Similar to previous years, tan spot (*Pyrenophora tritici-repentis*) was the most prevalent and widespread LS pathogen, and was more frequently isolated in common than in durum wheat (Fernandez et al., 2013, 2014, 2015) (Table 1). The remainder of infections were caused primarily by the septoria leaf complex, the most prevalent pathogen being *Stagonospora nodorum,* which was more frequently isolated from common than from durum wheat. In 2014, *S. nodorum* was more frequent in durum than common wheat (Fernandez et al. 2015). In 2015, spot blotch (*Cochliobolus sativus*) was present at low frequencies and in number of fields, which could be attributed to the low levels of precipitation in the spring and early summer in most of the province. This contrasts with 2014 when this pathogen was isolated from 51% of the common and 91% of the durum wheat crops sampled. There were few apparent differences in fungal isolations among soil zones in 2015. For durum wheat, *P. tritici-repentis* was most frequent in the Brown soil zone, while *S. nodorum* was most frequent in the Dark Brown soil zone.

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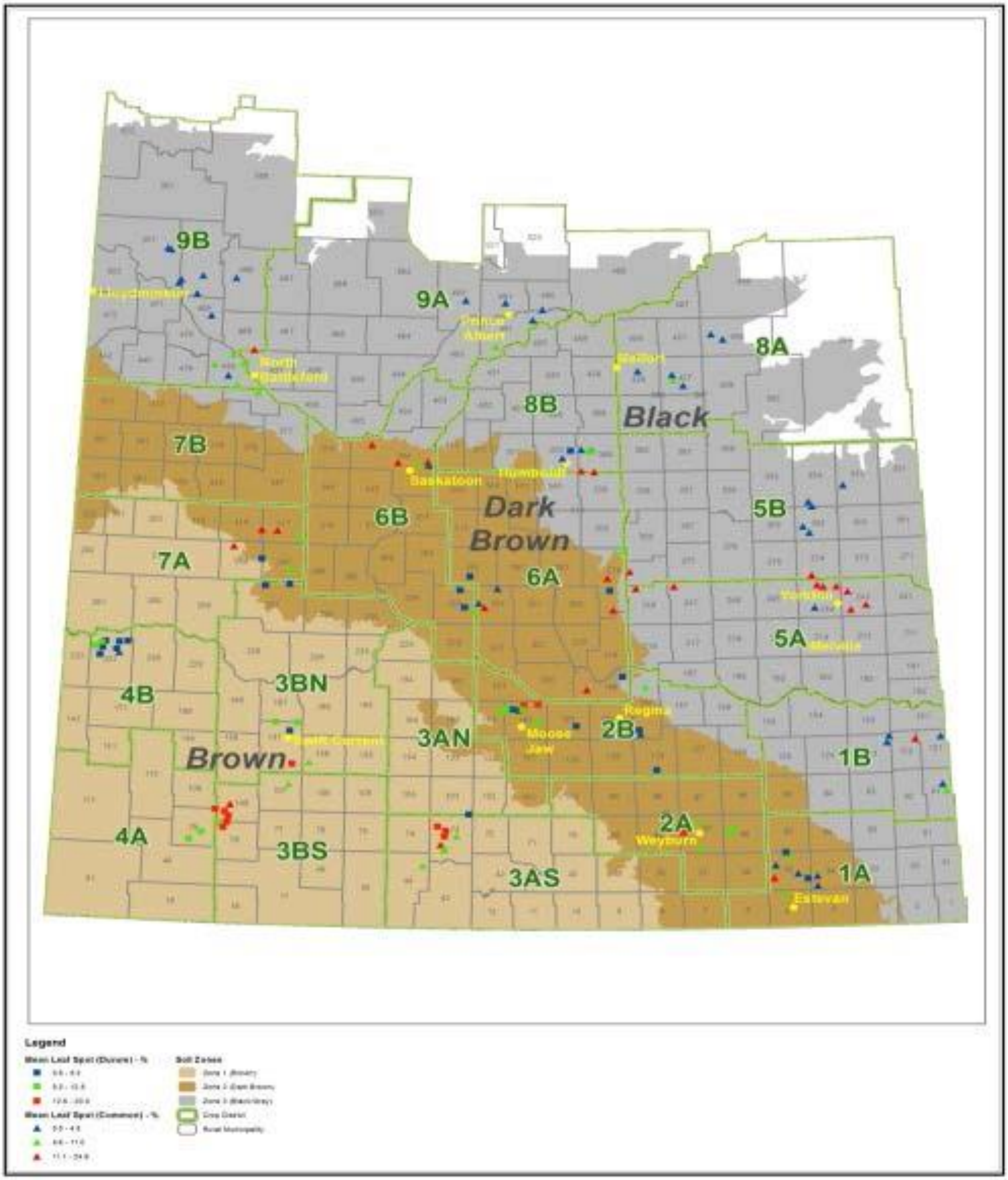

_**Fig. 1.** Location of common and durum wheat fields surveyed across Saskatchewan in 2015, and their recorded leaf spot disease severity.

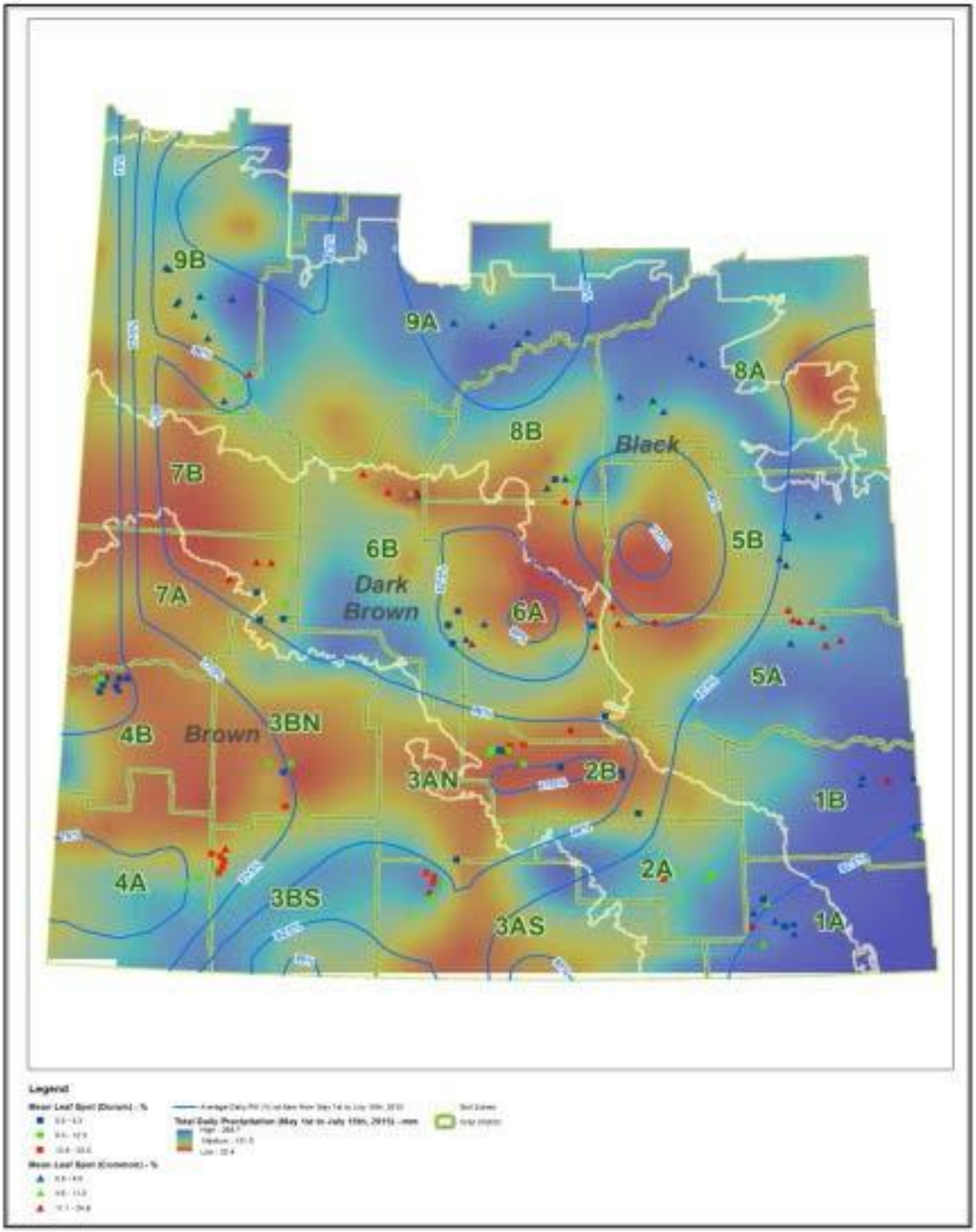

Fig. 2. Total daily precipitation (mm) and mean relative humidity (%) at 6 a.m. for May 1st to July 15th, 2015 across Saskatchewan.

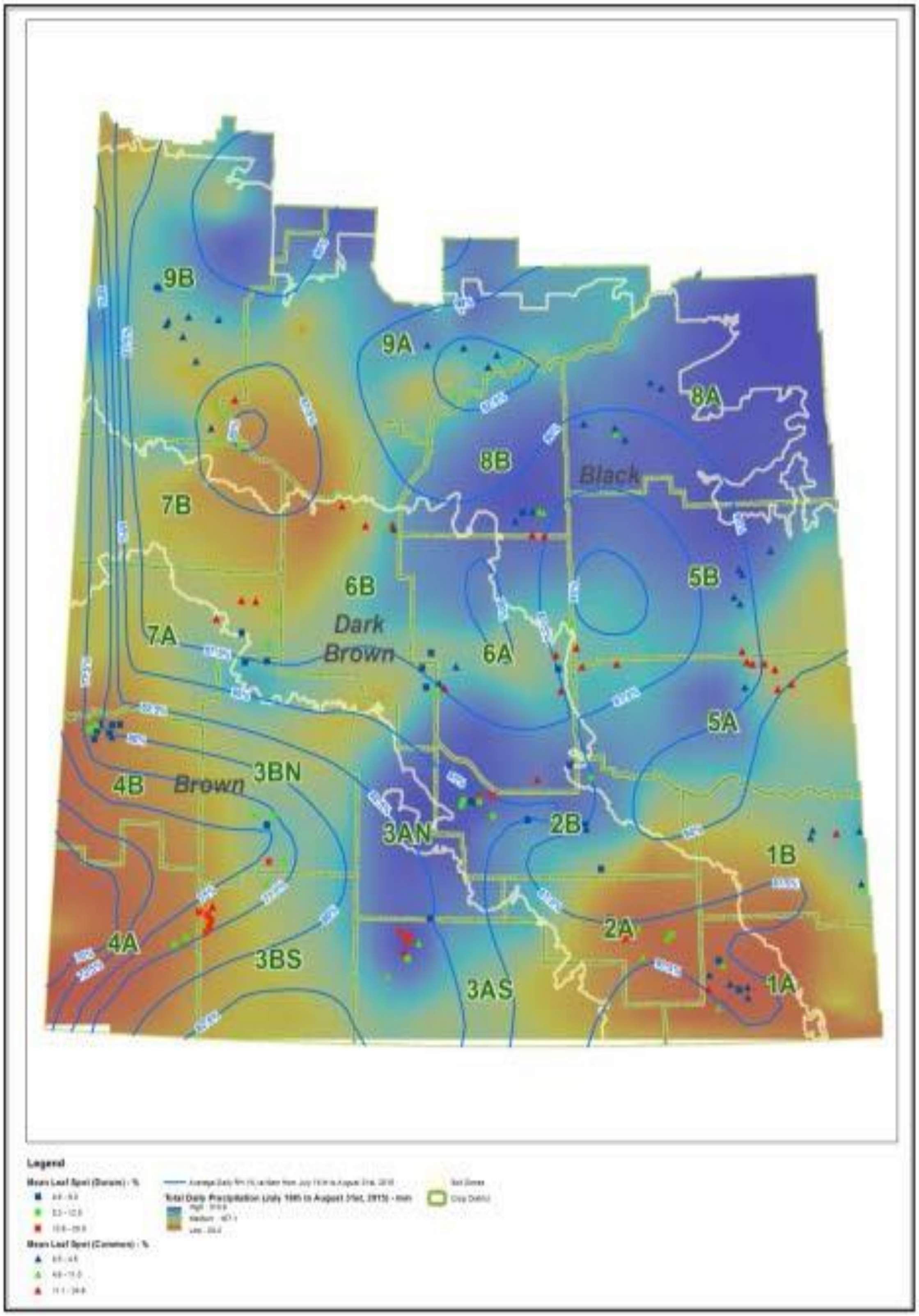

Fig. 3. Total daily precipitation (mm) and mean relative humidity (%) at 6 a.m. for July 16th to August 31st, 2015 across Saskatchewan.

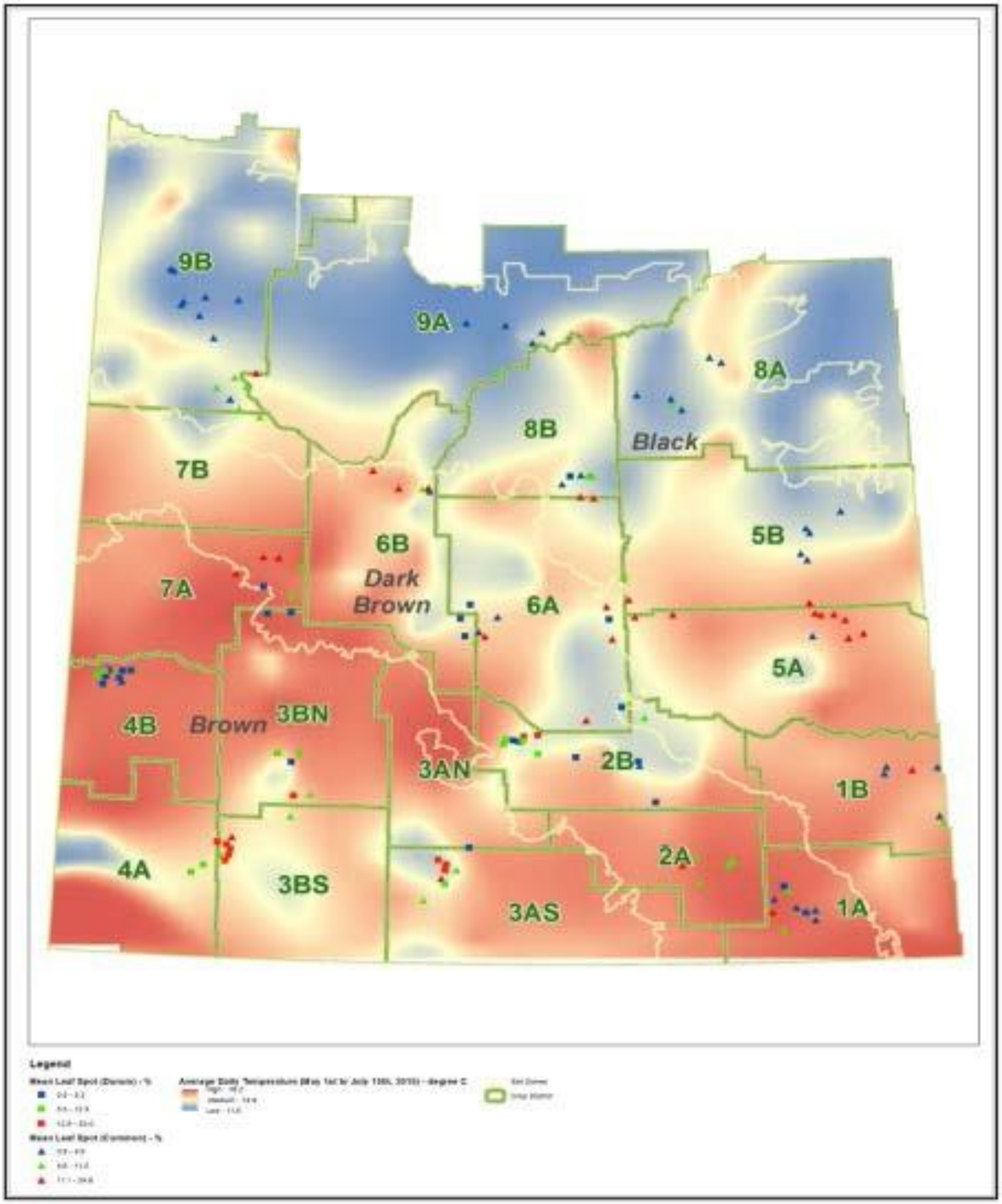

Fig. 4. Average daily temperature (°C) for May 1st to July 15th, 2015 across Saskatchewan.

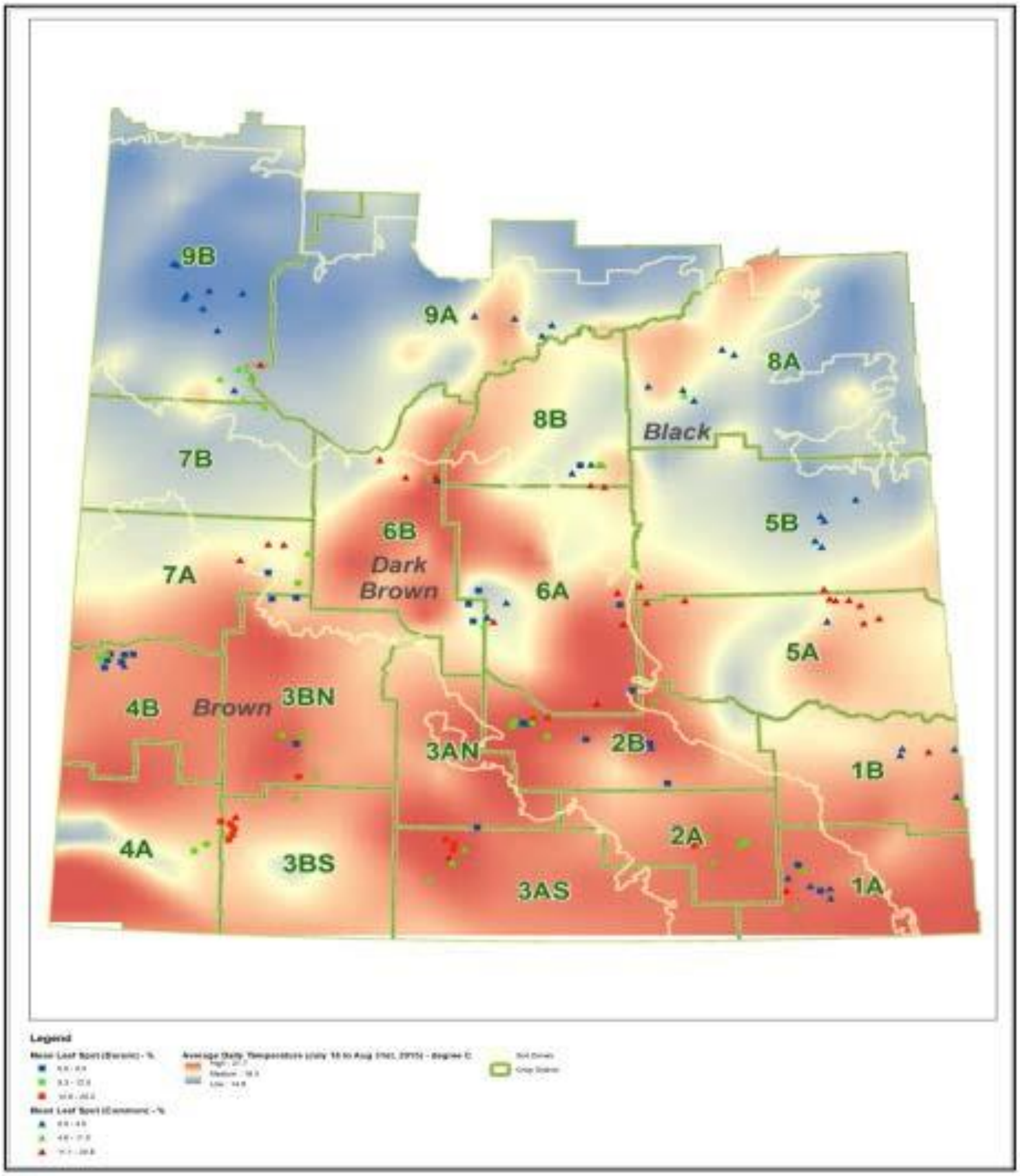

Fig. 5. Average daily temperature (°C) for July 16th to August 31st, 2015 across Saskatchewan.

CROP / CULTURE: Spring Wheat

LOCATION / RÉGION: Manitoba

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: LEAF SPOT DISEASES OF SPRING WHEAT IN MANITOBA IN 2015

ABSTRACT: In 2015, leaf spot diseases were assessed in 61 spring wheat crops in Manitoba. Prevalence and isolation frequency of leaf spot pathogens showed that *Pyrenophora tritici-repentis* was the most prevalent and widespread pathogen, followed by *Stagonospora nodorum*.

INTRODUCTION AND METHODS: A survey for leaf spot (LS) diseases of spring wheat was conducted between the milk and dough growth stages in 2015 (ZGS 73 – 85). A total of 61 spring wheat crops were sampled. In contrast to other disease surveys conducted in Manitoba, the fields were not surveyed at random. Instead, information on their location was obtained from producers. In each field, 50 flag leaves were collected at random and percentage of leaf area affected by LS (severity) was recorded using a scale from 1 (slightly affected) to 50 (leaves dead) (Fernandez, 1998).

From each field, 1 cm^2 surface-disinfested leaf pieces from 10 leaves were plated on water agar to promote pathogen sporulation for disease identification. Identification of LS pathogens involved microscopic examination and morphological characterization.

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share Report (MASC 2015), there were approximately 2.5 million acres (1million ha) of spring wheat seeded in Manitoba in 2015. The top five cultivars, based on their area, were 'Carberry' (21.8%), 'Cardale' (20.7%), 'Harvest' (13.4%), 'AAC Brandon' (10.4%) and 'Glenn' (9.9%). 'Carberry', 'Cardale' and 'AAC Brandon' were the predominant spring wheat cultivars grown in the crops sampled in this survey.

Leaf spot diseases were observed in almost all of the fields surveyed (Table 1). The provincial mean LS severity was 15.7%. The range in severity varied widely from a minimum of zero to a maximum of 45.0%. LS severity was lowest in the Interlake region (3.8%) and highest in the Eastern (30.7%) and Northwest regions (25.2%). The sample with the highest LS severity was from the Eastern region (45.0%).

As reported for previous years (Gilbert et al., 2012, 2013) *Pyrenophora tritici-repentis* (tan spot) was the most prevalent and widespread LS pathogen in Manitoba (Table 2). The results of 610 samples of leaf tissue analyzed showed that *Pyrenophora tritici-repentis*, causal agent of tan spot, was the most frequently isolated species, accounting for 72.7% of isolations. This species was detected in 69.4% of surveyed fields. This was followed by *Stagonospora nodorum* (23.8%) (stagonospora blotch) and *Cochiobolus sativus* (3.5%) (spot blotch), detected in 35.5% and 11.3% of surveyed fields, respectively.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Manitoba Agriculture, Food and Rural Development Farm Production Extension Specialists for the collection of a portion of the cereal samples for this survey.

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Table 1. Leaf spot (LS) severity in spring wheat fields in Manitoba in 2015.

Region	No. Fields[1]	LS Prevalence[2] %	Mean LS Severity[3] %	LS Severity % (Range)
Central	27	96	10.8	0.0 – 45.0
Eastern	11	100	30.7	0.1 – 45.0
Interlake	6	100	3.8	0.5 – 10.0
Northwest	9	100	25.2	5.0 – 40.0
Southwest	8	100	9.9	4.0 – 25.0
Mean/Total	61	98	15.7	0.0 – 45.0

[1]Number of fields sampled.
[2]Prevalence (%) = Number of fields affected / total fields surveyed
[3]Mean percentage flag leaf affected. Rated on a scale of 1 (slightly affected) to 50 (leaves dead)

Table 2. Prevalence and isolation frequency of leaf spot pathogens in spring wheat fields in Manitoba in 2015.

	Prevalence %	Frequency %
Pyrenophora tritici repentis	69.4	72.7
Cochiobolus sativus	11.3	3.5
Stagonospora nodorum	35.5	23.8

[1]Prevalence = % of spring wheat fields from which the pathogen was isolated
[2]Frequency = % of leaf spot pathogen (as the % of the total pathogen isolations)

CROP / CULTURE: Spring Wheat

LOCATION / RÉGION: Manitoba

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF SPRING WHEAT IN MANITOBA IN 2015

ABSTRACT: In 2015, Fusarium head blight incidence and severity were assessed in 66 spring wheat crops in Manitoba. The disease occurred in 77.3% of the wheat crops surveyed at a provincial mean FHB severity (FHB Index) of 0.3 %. The most prevalent *Fusarium* species was *F. graminearum*, followed by *F. sporotrichioides* and *F. poae*.

INTRODUCTION AND METHODS: Spring wheat in Manitoba was surveyed for fusarium head blight (FHB) at 66 field locations. The survey for FHB was conducted from late July to early August when most of the crops were at growth stage ZGS 73 – 85. In contrast to other disease surveys conducted in Manitoba, the crops were not surveyed at random. Instead, information on their location was obtained from the producers. The proportion of infected spikes per field (incidence) and the proportion of infected spikelets in each spike (severity) were recorded in 10 spikes from ten random sites in each crop surveyed. The FHB index (overall severity) was determined for each crop surveyed: [Average % incidence X Average % severity] / 100.

From each crop, at least 50 spikes were processed for pathogen isolation and identification in the laboratory. Ten kernels from each crop surveyed were surface-sterilized in a laminar flow bench and 5 kernels were placed on potato dextrose agar plates amended with 0.02% streptomycin sulfate (PDA-Strep) and 5 kernels were placed on Spezieller Nährstoffarmer Agar (SNA) media. Identification of *Fusarium* species involved microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006).

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation’s Variety Market Share Report (MASC 2015), there were approximately 2.5 million acres (1 million ha) of spring wheat seeded in Manitoba in 2015. The top five cultivars, based on seeded acreage, were ‘Carberry’ (21.8%), ‘Cardale’ (20.7%), ‘Harvest’ (13.4%), ‘AAC Brandon’ (10.4%) and ‘Glenn’ (9.9%). ‘Carberry’, ‘Cardale’ and ‘AAC Brandon’ were the predominant spring wheat cultivars grown in the fields sampled in this survey.

FHB occurred in 77% of the surveyed spring wheat fields in Manitoba (Table 1). The provincial mean FHB severity (FHB Index) was 0.3 %. The range in severity varied from a minimum of zero to a maximum of 2.6%. Prevalence and severity of FHB in spring wheat were lowest in the Northwest region and most prevalent in the Southwest (100%) and Eastern regions (91%). The highest mean severity was in the Eastern region. The sample with the highest FHB severity (2.6%) was from a spring wheat crop in the Eastern region.

Overall, the 2015 provincial mean FHB index was lower than in previous years, i.e. 1.7% in 2010, 2.1% in 2011, 1.1% in 2012, and 1% in 2014 (Gilbert et al. 2011, 2012, 2013; Derksen and de Rocquigny 2015). Based on the survey results, FHB caused zero to minimal damage in Manitoba spring wheat crops in 2015.

The results from 660 kernels plated on PDA-Strep and SNA media showed that *Fusarium graminearum* was the most frequently isolated pathogen species, accounting for 72.9% of isolations (Table 2). It was detected in 59.1% of surveyed crops. Six other species were found at lower levels, including *F.poae* (detected in 7.6% of crops and consisting of 5.3% of total *Fusarium* isolations) and *F. sporotrichioides* (detected in 9.1% of crops and 4.8% of total *Fusarium* isolations). Unidentified *Fusarium* spp. are also listed.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Manitoba Agriculture, Food and Rural Development Farm Production Extension Specialists for the collection of a portion of the cereal samples for this survey and for the respective incidence and severity ratings.

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MASC. 2015. Variety Market Share Report.

Table 1. Fusarium head blight incidence and severity (FHB index) in spring wheat crops in Manitoba in 2015.

Region	No. Crops[1]	FHB Prevalence[2] %	Mean FHB Index[3] %	FHB Index % (Range)
Central	27	85	0.3	0.0 - 2.2
Eastern	11	91	0.6	0.0 - 2.6
Interlake	11	64	0.0	0.0 - 0.0
Northwest	9	33	0.0	0.0 - 0.0
Southwest	8	100	0.3	0.0 - 1.0
Mean/Total	66	77	0.3	0.0 - 2.6

[1]Number of crops sampled.
[2]Prevalence (%) = Number of crops affected / total crops surveyed.
[3]Mean FHB Index: [Average % incidence X Average % severity] / 100.

Table 2. *Fusarium* species isolated from kernels in FHB-affected spring wheat crops in Manitoba in 2015.

	Prevalence[1] %	**Frequency[2] %**
F. graminearum	59.1	72.9
F. poae	7.6	5.3
F. avenaceum	3.0	3.2
F. culmorum	4.5	1.6
F. acuminatum	3.0	1.6
F. equiseti	1.5	1.1
F. sporotrichioides	9.1	4.8
Fusarium spp.	18.2	9.6

[1]Prevalence = % of spring wheat crops from which the pathogen was isolated.
[2]Frequency = % of *Fusarium* species as the % of the total *Fusarium* isolations.

CROP / CULTURE: Spring wheat

LOCATION / RÉGION: Central and eastern Ontario

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:

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TITLE / TITRE: DISEASES OF SPRING WHEAT IN CENTRAL AND EASTERN ONTARIO IN 2015

ABSTRACT: Thirty-three spring wheat crops in central and eastern Ontario were surveyed for diseases in 2015. Of the 12 diseases observed, septoria/stagonospora leaf blotch, ergot, take-all and fusarium head blight (FHB) were most prevalent, and severe levels of infection were found in 9, 1, 1 and 3 fields, respectively. *Fusarium graminearum* was the predominant species causing FHB.

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-three fields 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 visual symptoms. Average severity scores of <1, <3, <6, and ≥6 were considered trace, slight, moderate, and severe levels, respectively. Severity of ergot, loose smut, and take-all was based on the percent plants infected. 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. The percentage of infected plants or FHB index values of <1, <10, <20, and ≥20% were considered as slight, moderate, severe, and very severe infection levels, respectively. Determination of the causal species of FHB was based on 30 infected spikes collected from each field. The spikes were air-dried at room temperature and subsequently threshed. Thirty discolored kernels per sample were chosen at random, surface sterilized in 1% NaOCl for 60 seconds and plated in 9-cm diameter petri dishes on modified potato dextrose agar (PDA) (10 g PDA per liter amended with 50 ppm of streptomycin sulphate). The plates were incubated for 10-14 days at 22-25ºC and a 14-hour photoperiod provided by fluorescent and long wavelength ultraviolet tubes. *Fusarium* species isolated from kernels were identified by microscopic examination using standard taxonomic keys.

RESULTS AND COMMENTS: Twelve diseases or disease complexes were observed in the crops surveyed (Table 1). Septoria/stagonospora leaf blotch (normally associated with the pathogens *Septoria tritici* and *Stagonospora* spp.), stagonospora glume blotch (*Stagonospora nodorum*), spot blotch (*Cochliobolus sativus*), and leaf rust (*Puccinia triticina*), were the most common diseases identified, and were found in 33, 32, 32, and 23 surveyed fields at average severities of 4.5, 2.7, 1.7, and 2.6, respectively. Severe infection levels by septoria/stagonospora leaf blotch, stagonospora glume blotch, spot blotch, and leaf rust was observed in 9, 3, 1, and 3 fields, respectively. Yield reductions due to these four diseases were estimated to have averaged >5% in affected fields. Other foliar diseases observed included bacterial leaf blight (*Pseudomonas syringae* pv. *syringae*), powdery mildew (*Blumaria graminis* f.sp. *tritici*), stem rust (*Puccinia graminis*), and tan spot (*Pyrenophora tritici-repentis*). These diseases were found in 31, 17, 2, and 32 fields at average severities of 1.8, 2.2, 1.5 and 1.6, respectively. No several levels were observed and these diseases likely caused little or no reduction in yield.

Ergot (*Claviceps purpurea*), loose smut (*Ustilago tritici*) and take-all root rot (*Gaeumannomyces graminis* var*. tritici*) were observed in all fields at incidence levels of 0.8, 0.3 and 1.1%, respectively (Table 1). These diseases likely resulted in minimal damage, except for one crop with 15% ergot and one crop with 10% take-all. .

FHB was observed in all fields at a mean FHB index of 8.1% (range 0.1-56.0%) (Table 1). A severe level of FHB was observed in three crops. Overall, FHB resulted in a significant loss of grain yield and quality in 2015. Six *Fusarium* species were isolated from putative fusarium-damaged kernels (Table 2). *Fusarium graminearum* predominated and occurred in all fields and on 63.1% of kernels. *Fusarium avenaceum, F. equiseti* and *F. poae* were less common and found in 42, 21, and 21% of fields and on 7.2, 1.3, and 1.1% of kernels, respectively. *Fusarium aucuminatum* and *F. sporotrichioides* were least common, occurring in 3-15% of fields and 0.1-0.9% of kernels.

The 12 diseases observed on spring wheat in Ontario in 2015 were the same as those recorded for 2014 (Xue and Chen 2015). Overall, their incidence and severity were generally greater in 2015 than 2014. FHB occurred in all surveyed fields and caused significant reductions in grain yield and quality. The more frequent rainfall events in June and higher temperatures in July compared with the previous year in central and eastern Ontario were likely responsible for the increased disease severities observed in 2015.

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Table 1. Prevalence and severity of spring wheat diseases in central and eastern Ontario in 2015.

Disease	No. crops affected (n=33)	Disease severity in affected crops*	
		Mean	Range
Bacterial blight	31	1.8	1.0-3.0
Leaf rust	23	2.6	1.0-7.0
Powdery mildew	17	2.2	1.0-4.0
Stagonospora glume blotch	32	2.7	1.0-7.0
Septoria/Stagonospora leaf blotch	33	4.5	1.0-7.0
Spot blotch	32	1.7	1.0-7.0
Stem rust	2	1.5	1.0-2.0
Tan spot	32	1.6	1.0-4.0
Ergot (%)	33	0.8	0.1-15.0
Loose smut (%)	33	0.3	0.1-5.0
Take-all (%)	33	1.1	0.1-10.0
Fusarium head blight (FHB)**	33		
Incidence (%)		27.0	5.0-70.0
Severity (%)		22.5	2.0-80.0
Index (%)		8.1	0.1-56.0

*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 fusarium-damaged wheat kernels in central and eastern Ontario in 2015.

***Fusarium* spp.**	**% affected fields**	**% kernels**
Total *Fusarium*	100.0	73.6
F. acuminatum	3.0	0.1
F. avenaceum	42.4	7.2
F. equiseti	21.2	1.3
F. graminearum	100.0	63.1
F. poae	21.2	1.1
F. sporotrichioides	15.2	0.8

CROP / CULTURE: Winter Wheat

LOCATION / RÉGION: Manitoba

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:

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TITLE / TITRE: LEAF SPOT DISEASES OF WINTER WHEAT IN MANITOBA IN 2015

ABSTRACT: In 2015, Leaf spot diseases were assessed in 46 winter wheat crops in Manitoba. Prevalence and isolation frequency of leaf spot pathogens showed that *Pyrenophora tritici-repentis* was the most prevalent and widespread pathogen followed by *Stagonospora nodorum*.

INTRODUCTION AND METHODS: A survey for leaf spot (LS) diseases of winter wheat was conducted between the milk and dough growth stages in 2015 (ZGS 73 – 85). A total of 46 winter wheat crops were sampled. In contrast to other disease surveys conducted in Manitoba, the crops were not surveyed at random. Instead, information on their location was obtained from producers. In each crop, 50 flag leaves were collected at random and percentage of leaf area affected by LS (severity) was recorded using a scale from 1 (slightly affected) to 50 (leaves dead) (Fernandez, 1998).

From each crop, 1 cm^2 surface-disinfested leaf pieces from 10 leaves were plated on water agar to promote pathogen sporulation for disease identification. Identification of LS pathogens involved microscopic examination and morphological characterization.

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share Report (MASC 2015), there were approximately 159,000 acres (64,000 ha) of commercial winter wheat seeded in Manitoba for 2015. The top five cultivars grown, based on their area were 'Emerson' (54.2%), 'CDC Falcon' (20.7%), 'Flourish' (9.8%), 'CDC Buteo' (8.4%) and 'Peregrine' (1.5%). 'Emerson' was the predominant winter wheat cultivar grown of the crops sampled in this survey.

Leaf spot diseases were observed in 100% of crops surveyed (Table 1). The provincial mean LS severity was 9.5%. The range in severity varied widely from a minimum of 0.1% to a maximum of 37.5%. LS severity was lowest in the Interlake region (4.6%) and highest in the Eastern region (18.8%). The sample with the highest LS severity (37.5%) was from the Eastern region.

As reported for previous years (Tekauz et al., 2011, 2013) *Pyrenophora tritici-repentis* (tan spot) was the most prevalent and widespread LS pathogen in Manitoba (Table 2). The results of 460 samples of leaf tissue analyzed showed that *Pyrenophora tritici-repentis* was the most frequently isolated species, accounting for 77.5% of isolations. This species was detected in 76.6% of surveyed fields. It was followed by *Stagonospora nodorum* (18.3%) (stagonospora blotch) and *Cochiobolus sativus* (4.2%) (spot blotch), detected in 31.9% and 6.4% of surveyed fields, respectively.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Manitoba Agriculture, Food and Rural Development Farm Production Extension Specialists for the collection of a portion of the cereal samples for this survey.

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Tekauz, A., Stulzer, M., Beyene, M. and Gompf, J. 2013. Leaf spot diseases of Manitoba winter wheat crops in 2012. Can. Plant Dis. Surv. 93:137-138. (www.phytopath.ca/publication/cpds)

MASC. 2015. Variety Market Share Report.

Table 1. Leaf spot (LS) severity in winter wheat crops in Manitoba in 2015.

Region	No. crops[1]	LS Prevalence[2] %	Mean LS Severity[3] %	LS Severity % (Range)
Central	27	100	5.9	0.1 - 20.0
Eastern	9	100	18.8	4.0 - 37.5
Interlake	5	100	4.6	1.0 - 10.0
Southwest	5	100	17.5	5.0 - 30.0
Mean/Total	46	100	9.5	0.1 - 37.5

[1]Number of crops sampled.
[2]Prevalence (%) = Number of crops affected / total crops surveyed.
[3]Mean percentage flag leaf affected; rated on a scale of 1 (slightly affected) to 50 (leaves dead).

Table 2. Prevalence and isolation frequency of leaf spot pathogens in winter wheat crops in Manitoba in 2015.

	Prevalence %	Frequency %
Pyrenophora tritici-repentis	76.6	77.5
Cochiobolus sativus	6.4	4.2
Stagonospora nodorum	31.9	18.3

[1]Prevalence = % of winter wheat crops from which the pathogen was isolated.
[2]Frequency = % of leaf spot pathogen (as the % of the total pathogen isolations).

CROP / CULTURE: Winter Wheat

LOCATION / RÉGION: Manitoba

NAMES AND AGENCIES / NOMS ET ÉTABLISSEMENTS:
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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA IN 2015

ABSTRACT: 2015, Fusarium head blight incidence and severity were assessed in 54 winter wheat crops in Manitoba. FHB occurred in 80% of the surveyed crops. The provincial mean FHB severity (FHB Index) was 1.1 %. The most prevalent pathogen species was *Fusarium graminearum*, followed by *F. poae*.

INTRODUCTION AND METHODS: Winter wheat in Manitoba was surveyed for fusarium head blight (FHB) incidence and severity at 54 field locations. The survey was conducted during mid- to late July when most of the crops were at growth stage ZGS 73 – 85. In contrast to other disease surveys conducted in Manitoba, the crops were not surveyed at random. Instead, information on their location was obtained from producers. The proportion of infected spikes per crop (incidence) and the proportion of infected spikelets in each spike (severity) were recorded in 10 spikes from ten random sites in each field surveyed. The FHB index (overall severity) was determined for each crop surveyed: [Average % incidence X Average % severity] / 100.

From each crop, at least 50 spikes were processed for pathogen isolation and identification in the laboratory. Ten kernels from the field surveyed were surface-sterilized in a laminar flow bench and five kernels were placed on potato dextrose agar plates amended with 0.02% streptomycin sulfate (PDA-Strep) and five kernels were placed on Spezieller Nährstoffarmer Agar (SNA) media. Identification of *Fusarium* species involved microscopic examination and morphological characterization using the criteria of Leslie and Summerell (2006).

RESULTS AND COMMENTS: According to Manitoba Agricultural Services Corporation's Variety Market Share Report (MASC 2015), there were approximately 159,000 acres (63,600 ha) of commercial winter wheat seeded in Manitoba for 2015. The top five cultivars, based on their seeded area, were 'Emerson' (54.2%), 'CDC Falcon' (20.7%), 'Flourish' (9.8%), 'CDC Buteo' (8.4%) and 'Peregrine' (1.5%). 'Emerson' was the predominant winter wheat cultivar grown in the fields sampled in this survey.

FHB occurred in 80% of the surveyed winter wheat crops in Manitoba (Table 1). The provincial mean FHB severity (FHB Index) was 1.1%. The range in severity varied widely from a minimum of zero to a maximum of 14.0%. Prevalence and severity of FHB in winter wheat were lowest in the Interlake region and most prevalent in the Eastern (90%) and Central regions (89%). The highest mean severity was in the Eastern region but the sample with the highest FHB severity (14.0%) was from a crop in the Central region.

Overall, the 2015 provincial mean FHB index of 1.1% was considerably lower than in 2014 (11.6%) (Derksen and de Rocquigny 2015). Based on the survey results, FHB likely caused zero to minimal damage in Manitoba winter wheat crops in 2015.

The results from kernels plated on PDA-Strep and SNA media showed that *Fusarium graminearum* was the most frequently isolated species, accounting for 59% of isolations (Table 2). This species was detected in 52% of surveyed fields and six other species were found at low levels. The identities of the remaining 27.6% of isolates were *Fusarium* spp.

ACKNOWLEDGEMENTS:
We gratefully acknowledge the participation of Manitoba Agriculture, Food and Rural Development Farm Production Extension Specialists for collecting a portion of the cereal samples for this survey and for the respective incidence and severity ratings.

REFERENCES:

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Leslie, J.F. and Summerell, B.A. 2006. The Fusarium Laboratory Manual. Blackwell Publishing Ltd, Iowa. 388 p.

MASC. 2015. Variety Market Share Report.

Table 1. Fusarium head blight (FHB) index in winter wheat fields in Manitoba in 2015.

Region	No. Fields[1]	FHB Prevalence[2] %	Mean FHB Index[3] %	FHB Index % (Range)
Central	28	89	0.8	0.0 - 14.0
Eastern	10	90	2.7	0.0 - 13.6
Interlake	9	33	0.0	0.0 - 0.0
Southwest	7	86	1.3	0.0 - 5.7
Mean/Total	54	80	1.1	0.0 - 14.0

[1]Number of fields sampled.
[2]Prevalence (%) = Number of crops affected / total crops surveyed.
[3]Mean FHB Index: [Average % incidence X Average % severity] / 100

Table 2. *Fusarium* species isolated from kernels in FHB- affected winter wheat crops in Manitoba in 2015.

	Prevalence %	Frequency %
F. graminearum	51.9	58.9
F. poae	7.7	2.5
F. avenaceum	3.8	3.1
F. culmorum	1.9	1.8
F. acuminatum	5.8	3.7
F. equiseti	1.9	0.6
F. sporotrichioides	3.8	1.8
Fusarium spp.	28.8	27.6

[1]Prevalence = % of winter wheat crops from which the pathogen was isolated
[2]Frequency = % of *Fusarium* species (as the % of total *Fusarium* isolations)

CROP / CULTURE: Winter wheat

LOCATION / RÉGION: Ontario

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TITLE / TITRE: 2015 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 up to five test locations in Ontario in 2015. Septoria leaf blotch and powdery mildew were detected at all locations at moderate and low severity levels, respectively. Leaf rust was recorded at two test locations at moderate levels. Disease severities among locations and genotypes varied somewhat.

INTRODUCTION AND METHODS: A survey to document the relative levels for 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 2015. Four genotypes, UGRC GL133, UGRC GL119, 'Emmit' and 'Ava', planted at five locations, Ottawa, Palmerston, Elora, Nairn and Ridgetown 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, other than Ridgetown where levels were very light (Table 1). 'Ava' soft red winter wheat had a slightly lower mean level of septoria leaf blotch.

Powdery mildew was observed at all locations, at a moderate level in Ottawa and a low level at the other locations. No powdery mildew developed on 'Emmit' and 'Ava' genotypes at Nairn (Table 2).

Moderate levels of leaf rust was recorded at Ottawa (5.9) and Nairn (4.0). Genotype UGRC GL133 had the lowest (3.1) mean leaf rust score (Table 3).

Table 1. Septoria leaf blotch severity (0-9 scale) in soft red winter wheat in Ontario in 2015.

		Genotype			
Location	UGRC GL133	UGRC GL119	'Emmit'	'Ava'	Mean (SD)
Ottawa	5.0	6.0	7.0	5.0	5.8 (1.0)
Palmerston	3.7	3.3	4.0	3.7	3.7 (0.3)
Elora	4.5	4.5	4.5	4.5	4.5 (0.0)
Nairn	6.5	7.0	7.0	5.8	6.6 (0.6)
Ridgetown	0.8	0.8	1.0	0.8	0.9 (0.1)
Mean (SD)	4.1 (2.1)	4.3 (2.4)	4.7 (2.5)	4.0 (1.9)	

Table 2. Powdery mildew severity (0-9 scale) in soft red winter wheat in Ontario in 2015.

	Genotype				
Location	UGRC GL133	UGRC GL119	'Emmit'	'Ava'	Mean (SD)
Ottawa	2.0	6.0	6.0	3.0	4.2 (1.9)
Palmerston	2.7	2.7	3.0	3.3	2.9 (0.3)
Elora	2.0	2.5	3.5	2.5	2.6 (0.6)
Nairn	0.8	0.5	0.0	0.0	0.3 (0.4)
Ridgetown	0.3	0.5	1.0	0.3	0.5 (0.3)
Mean (SD)	1.1 (1.0)	1.2 (1.2)	1.7 (2.3	1.6 (1.6)	

Table 3. Leaf rust severity (0-9 scale) in soft red winter wheat in Ontario in 2015.

	Genotype				
Location	UGRC GL133	UGRC GL119	'Emmit'	'Ava'	Mean (SD)
Ottawa	4.0	5.0	8.0	7.0	5.9 (1.8)
Nairn	2.3	4.3	4.8	4.8	4.0 (1,2)
Mean (SD)	3.1 (1.2)	4.6 (0.5)	6.4 (2.3)	5.6 (1.2)	

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

RÉGION / LOCATION : Québec

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TITRE: MALADIES DES CÉRÉALES OBSERVÉES AU QUÉBEC EN 2015

RÉSUMÉ: En 2015, la rouille jaune du blé s'est manifestée pour une troisième année consécutive. Elle a été détectée dans toutes les régions des essais blé et a affecté plus fortement le blé d'hiver. La rouille couronnée de l'avoine, bien que de faible intensité, a été observée aux stations situées au sud du Saint-Laurent sauf celle de la vallée de la Matapédia. La rouille des feuilles et l'oïdium du blé ont été notés dans les régions centrales, alors que l'oïdium de l'orge a été décelé au sud. Comme à l'habitude, les taches foliaires étaient présentes sur tout le territoire. Quant à la fusariose de l'épi, elle a été un problème pour certaines régions.

ABSTRACT: In 2015, stripe rust occurred on wheat for the third year in a row. It was present in all regions with wheat trials, and symptoms were more severe on winter wheat. Crown rust in oat was not severe but was observed at test locations south of the St. Lawrence river except the one in the Matapédia Valley. Leaf rust and powdery mildew on wheat were observed in central regions, while powdery mildew on barley was noted in the south. As usual, leaf spots were widespread at all test locations. Overall, fusarium head blight was not a major problem, but was more pronounced in some regions.

MÉTHODES: Sept à neuf essais d'enregistrement et de performance de céréales de printemps ainsi que trois essais de blé d'hiver réalisés dans différentes régions du Québec (CÉROM 2015) ont été visités une fois durant la saison afin d'y noter les maladies foliaires présentes. Le stade de développement de la céréale lors des visites se situait entre laiteux moyen et pâteux moyen. Les maladies ont été identifiées sur la base des symptômes visuels. Le nom des agents pathogènes normalement associés à ces maladies est mentionné dans le texte à titre indicatif. Les symptômes des maladies foliaires ont été notés selon une échelle de 0 à 9 (0 = plante saine; 9 = feuille étendard présentant des symptômes sur plus de 50 % de sa surface). L'intensité des symptômes est considérée faible pour les valeurs situées entre 0 et 4; moyenne pour les valeurs de 4 à 7; et élevée pour les valeurs de 7 à 9. La Financière agricole du Québec (FADQ 2015) a fourni le nombre d'avis de dommages qu'elle a reçus pour le blé et l'orge et ayant comme cause principale la fusariose de l'épi (Michel Malo, FADQ, communication personnelle).

RÉSULTATS ET COMMENTAIRES: En 2015 (FADQ, 2015), le printemps tardif a retardé le début des semis d'environ une semaine et ce, dans toutes les régions du Québec. Pour les régions du sud de la province, les conditions climatiques de la fin avril à la mi-mai ont été propices à la réalisation de la presque totalité des semis. Pour les autres régions, la période des semis s'est avérée plus longue à cause de pluies fréquentes et parfois abondantes, d'un faible ensoleillement et de températures sous les normales saisonnières. En juin, les températures fraîches ont retardé la levée et la croissance des cultures sur l'ensemble du territoire. Quant aux précipitations, elles ont été peu abondantes dans les régions plus au nord comme le Saguenay–Lac-Saint-Jean et normales dans les régions du sud et du centre avec, cependant, des épisodes de pluie abondante dans certains secteurs de l'Estrie et de la rive-nord de la région de Québec. En juillet, les températures plus fraîches que la normale ont été favorables à la croissance des céréales.

Chez l'avoine, la tache ovoïde (*Stagonospora avenae*) était présente dans tous les essais et l'intensité des symptômes a varié de moyenne à élevée. La rouille couronnée (*Puccinia coronata*) a été observée en Montérégie (Saint-Hugues et Saint-Hyacinthe), à Princeville (Centre-du-Québec), à Saint-Étienne-de-Lauzon (région de Québec) et à La Pocatière (Bas-Saint-Laurent). En 2015 cependant l'intensité des symptômes a été faible partout, même à La Pocatière qui a l'habitude d'être plus fortement touché par la rouille couronnée.

La rouille jaune du blé (*Puccinia striiformis*) a été observée en 2015 pour une troisième année consécutive. Elle s'est manifestée sur le blé d'hiver à Saint-Augustin-de-Desmaures (région de Québec) et à Saint-Mathieu-de-Beloeil (Montérégie), puis sur le blé de printemps à Saint-Augustin-de-Desmaures, à Saint-Étienne-de-Lauzon et à La Pocatière. Tout comme en 2014, l'intensité de rouille jaune de certaines lignées/cultivars de blé d'hiver était élevée, alors que pour le blé de printemps les lignées/cultivars les plus sensibles étaient moyennement affectées. La rouille des feuilles (*Puccinia triticina*), quant à elle, a été notée sur le blé d'hiver à Saint-Augustin-de-Desmaures et sur le blé de printemps à Saint-Étienne-de-Lauzon où toutes les lignées/cultivars ont été moyennement touchées. Les taches foliaires (*Drechslera tritici-repentis*, *Stagonospora nodorum* et *Cochliobolus sativus*) ont été notées dans tous les essais et présentaient des symptômes d'intensité moyenne. L'oïdium (*Blumeria graminis* f. sp*. tritici*, syn. *Erysiphe graminis*), d'intensité faible à moyenne, était présent sur le blé d'hiver à Saint-Augustin-de-Desmaures et Princeville, et sur le blé de printemps à Princeville, Saint-Augustin-de-Desmaures et Saint-Étienne-de-Lauzon. Globalement la fusariose de l'épi du blé n'a pas été un grave problème en 2015 alors que 5,5 % des producteurs assurés (78 sur 1293) ont signalé des dommages à leur culture attribuables à cette maladie. Certaines régions ont cependant été plus touchées que d'autres, notamment la région de Québec, le Saguenay-Lac-Saint-Jean, le Bas-Saint-Laurent et la Montérégie-Est.

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 faible à moyenne à Saint-Hugues et de moyenne à élevée pour les autres essais. En 2015, l'oïdium (*Blumeria graminis* f.sp*. hordei*, syn. *Erysiphe graminis*) était présent, quoique faiblement, à Saint-Hyacinthe, alors que la rouille des feuilles (*Puccinia hordei*) ne s'est pas manifestée. Tout comme pour le blé, les mêmes régions ont été plus fortement affectées que d'autres par la fusariose de l'épi. Cependant, lorsque qu'on considère l'ensemble du territoire la fusariose ne semble pas avoir été un grave problème chez l'orge en 2015 puisque 3,4 % des producteurs assurés (20 sur 582) à la FADQ ont rapporté des dommages dus à la maladie, un ratio comparable à celui obtenu en 2013.

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CROPS / CULTURES: Spring Wheat, Winter Wheat, Barley, Oat

LOCATION / RÉGION: Manitoba, Saskatchewan

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TITLE / TITRE: **CEREAL SMUT SURVEYS, 2015**

ABSTRACT: In 2015, 76 spring wheat fields, 20 barley fields, and 15 oat fields were surveyed for the smut diseases caused by *Ustilago* spp. in Manitoba. Three wheat fields were infested with *U. tritici* infected plants, at severities ranging from 0.1 to 3%. No barley or oat fields were observed to have smutted plants. In Saskatchewan, 22 fields of spring wheat, 4 fields of winter wheat and 2 fields of durum wheat were surveyed. Three spring wheat fields were infested with *U. tritici* infected plants at trace levels. Smut infected plants were not observed in the winter wheat or durum wheat fields.

INTRODUCTION AND METHODS: Two surveys, one in Manitoba and one in Saskatchewan, were conducted during July in 2015 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 7, 8, 9 and 11, and in Saskatchewan, crop districts 2B, 3A, 3B, 6A, 6B, and 7A. 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 heads and those infected Fields with <0.05% infections were considered as trace in Saskatchewan.

An isolate of smut was collected from each field positive for smutted plants and compared with a carboxin-sensitive isolate, '72-66', of *U. nuda* from Canada, and a carboxin-resistant isolate, 'Viva', of *U. nuda* (Newcombe and Thomas 1991) from France, using the teliospore germination assay of Leroux (1986) and Leroux and Berthier (1988) to determine if resistance to the fungicide carboxin may be present. Teliospores of each isolate were streaked onto half-strength potato dextrose agar amended with 0 or 1.0 $\mu g\ ml^{-1}$ 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: Seventy six fields of spring what were assessed, of which 64 were of awned wheat and 12 were of awnless wheat. Three (5%) fields of awned wheat were infested with smut (*U. tritici*); two fields at 0.1% infection and one at a 3% infection level. No fields of awnless wheat were infested with smut. Fifteen fields of 2-row barley, 5 fields of 6-row barley, and 15 fields of oat were assessed; no smut infection was observed in any of these.

Saskatchewan: Twenty two fields of spring wheat, four fields of winter wheat and two fields of durum wheat were assessed. Three (14%) spring wheat fields were infested with smut (*U. tritici*) infected plants at trace levels. Smutted plants were not observed in the fields of winter wheat or durum wheat.

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

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CROP / CULTURE: Oat

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

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TITLE / TITRE: CROWN RUST OF OAT IN MANITOBA, SASKATCHEWAN AND EASTERN CANADA IN 2014

ABSTRACT: In 2014, 71 fields with wild oat and 20 fields of common oats were surveyed for the incidence and severity of *Puccinia coronata* f.sp. *avenae* in Manitoba and Saskatchewan. Plants with crown rust were found in 92 and 60% of all wild and common oat fields at mean incidences of 43% and 25%, and mean severities of 16 MS and 6 MR to MS, respectively. No virulence was detected to resistance gene *Pc94* in collections from Manitoba and Saskatchewan, No virulence was detected to the resistance genes *Pc45*, *Pc50*, *Pc58, Pc94, PC96, Pc98*, and *Pc101* in collections from Ontario, Quebec and 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 12 to 22 in 2014. The areas surveyed were in crop districts 1, 2, 3, 7, 8, 9 and 11 in Manitoba and crop districts 1, 2, and 5 in Saskatchewan. 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.), 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 and Quebec were collected between July 16 and August 7, and samples from infected oat plants in Prince Edward Island were submitted by R. Martin. 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*, *Pc96*, *temp_pc97*, *temp_Pc98*, *Pc101*, *Pc103-1*, and *Pc104* were used as supplemental differentials.

RESULTS AND COMMENTS: Seventy one fields with wild oats and 20 fields of common oat lines were surveyed in Manitoba and Saskatchewan. Wild oat plants infected with *P. coronata* f, sp, *avenae* were found in 65 (92%) of the fields, and infected common oat plants were found in 12 (60%) of the fields.

Crown rust incidence on wild oats ranged from 0 to 100%, with a mean incidence of 43%. The severity of crown rust on wild oats ranged from 0 to 60S with a mean severity of 16 MS. The incidence and severity of crown rust infection on wild oats was higher in areas near the Manitoba-Saskatchewan border.

Crown rust incidence on commercial oats ranged from 0 to 100%, with a mean incidence of 25%. The severity of crown rust on common oats ranged from 0 to 30S with a mean severity of 6 MR to MS. The incidence and severity of crown rust infection on common oats was generally higher in areas near the Manitoba-Saskatchewan border, as found for wild oats.

Seventy four spi were made from wild oats and 62 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 three. Only a single spi was found for 54 of the races. No spi from wild oats were identified with virulence to the resistance gene *Pc94*.

Eleven spi were made from common oat collections with 11 races identified from these. None of the spi had virulence to the resistance genes *Pc40*. *Pc50*, *Pc54, Pc58*, *Pc64*, *Pc94*, and *Pc96* from common oat fields.

Four spi were made from collections from the Uniform Rust Nursery with four races identified. With so few spi from uniform rust nursery isolates, virulence was not detected to a large number of resistance genes.

Twenty one spi were made from the collections from eastern Canada, with only one spi for 17 of the races. In 2014, none of the spi from the eastern prairie region was virulent to *Pc45*, *Pc50*, *Pc58*, *Pc94*, *Pc96*, *Pc98*, and *Pc101* (Table 1). Fifty percent or more of the spi possessed virulence to the resistance genes *Pc38, Pc39, Pc48, Pc56* and *Pc68*.

Greater than 50% of all spi from 2014 collections possessed virulence to resistance genes *Pc38* and *Pc39*. 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 North Dakota and Minnesota since the 1980s.

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Table 1. Frequencies (%) of virulence of *Puccinia coronata* f. sp. *avenae* isolates from the eastern Canadian Prairie region and eastern Canada on 16 standard and eight supplemental crown rust differential oat lines in 2014.

Oat lines and *Pc* gene present	**Wild Oat**		**Commercial Oat Field**		**Uniform Rust Nursery**		**Eastern Canada**	
	# isolates	**Percent**	**# isolates**	**Percent**	**# isolates**	**Percent**	**# isolates**	**Percent**
Standard								
Pc38	69	93	11	100	4	100	20	95
Pc39	72	97	7	64	2	50	14	67
Pc40	24	32	0	0	0	0	4	19
Pc45	35	47	6	55	0	0	0	0
Pc46	50	68	8	73	1	25	8	38
Pc48	27	36	6	55	4	100	19	90
Pc50	6	8	0	0	0	0	0	0
Pc51	63	85	9	82	1	25	3	14
Pc52	27	36	7	64	1	25	7	33
Pc54	8	11	0	0	0	0	4	19
Pc56	68	92	9	82	1	25	17	81
Pc58[a]	3	4	0	0	0	0	0	0
Pc59[a]	4	5	1	9	0	0	1	5
Pc62	5	7	2	18	1	25	4	19
Pc64	2	3	0	0	1	25	3	14
Pc68	42	57	5	45	4	100	20	95
Supplemental								
Pc91	32	43	8	73	0	0	1	5
Pc94	0	0	0	0	0	0	0	0
Pc96	2	3	0	0	0	0	0	0
Temp_Pc97	5	7	1	9	0	0	2	10
Temp_Pc98	3	4	1	9	0	0	0	0
Pc101	3	4	1	9	0	0	0	0
Pc103-1	13	18	4	36	0	0	2	10
Pc104	27	36	4	36	1	25	3	14
Total	74		11		4		21	

[a]The *Pc58*-differential was shown to carry three linked genes, and the *Pc59*-differential three unlinked genes (Chong et al. 2008).

CROP / CULTURE: Spring and winter wheat

LOCATION / RÉGION: Southern Alberta

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TITLE / TITRE: 2015 STRIPE RUST SURVEY IN SOUTHERN ALBERTA

ABSTRACT: Stripe rust incidence and severity was assessed in winter and spring wheat fields in Southern Alberta during the 2014-15 crop season. *Puccinia striiformis* f. sp. *tritici* was observed in early December 2014 and in late April 2015 suggesting that overwintering is Southern Alberta had occurred. Stripe rust remained localized throughout May and June, but in early July stripe rust had become widespread, although severity levels remained relatively low. Dry prevailing condition during the spring and early summer were likely responsible for the limited impact of stripe on wheat yields and quality in Southern Alberta during 2015.

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 in 2014/15. Surveys began in early December 2014 following winter wheat seeding and continue in late April 2015 and at regular intervals from early June to mid-August until spring wheat started to ripen. Fields were traversed in a “V” pattern until 10 sites separated by 25 m were evaluated for disease incidence and severity. The incidence of plants with leaf stripe on plants 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 disease severity, fields were classified as follows: clean (0%), trace (<1%), light (1% to 4%), moderate (5% to 19%) and severe (20% to 100%).

RESULTS AND COMMENTS: There was evidence for overwintering of the stripe rust pathogen in Southern Alberta, based on stripe rust being detected in 30% of the winter wheat fields surveyed in December 2014 and 20% of those surveyed in late April 2015 (Table 1). The dry conditions that prevailed in spring resulted in mainly trace levels being recorded in winter wheat fields in early June. Dry conditions remained widespread until mid-July when normal precipitation patterns resumed. Subsequent rust development was too late to have a significant impact on wheat yield or quality. In general, elevated rust severity levels were observed only in a corridor north and south of Highway 3 that was limited to the Cardston Lethbridge, and Warner areas. In Alberta, the predominant red winter wheat varieties planted were ‘Radiant’ and ‘Moats’ which are susceptible and resistant, respectively. The predominant red spring wheat varieties ‘AC Harvest’, ‘Carberry’, ‘Lillian’ and ‘Stettler’, range from being resistant to highly resistant. In summary, despite the apparent overwintering of stripe rust, the dry conditions that prevailed during the spring and early summer prevented epidemic stripe rust development in 2015, and limited the impact of the disease on yield and quality in winter and spring wheat to only a few fields in Southern Alberta.

Table 1. Number of wheat fields surveyed and the corresponding stripe rust severity levels recorded in southern Alberta during the 2014-2015 crop season.

Crop (Date)	**Clean (0%)**	**Trace (<1%)**	**Light (1% to 4%)**	**Moderate (5% to 19%)**	**Severe (20% to 100%)**
Winter wheat (Dec 2014)	7	1	2	0	0
Winter wheat (Apr 23, 2015)	8	1	1	0	0
Winter wheat (June 03, 2015)	18	1	1	0	0
Winter wheat (Jul 06, 2015)	2	1	0	2	2
Spring wheat (Jul 06, 2015)	2	1	1	2	0
Winter wheat (Jul 15, 2015	1	1	0	0	0
Spring wheat (Jul 15, 2015)	7	1	1	0	0
Spring wheat (Jul 27, 2015)	4	0	6	2	1
Spring wheat (Aug 12, 2015)	2	2	2	0	2

CROP / CULTURE: Spring and Winter Wheat

LOCATION / RÉGION: Manitoba

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TITLE / TITRE: LEAF RUST AND STRIPE RUST OF WHEAT IN MANITOBA IN 2015

ABSTRACT: Field surveys for leaf and stripe rust were conducted from June-September 2015 in Manitoba. Wheat leaf rust was first found in June and developed throughout the growing season. However, levels of infection were relatively low, and as the wheat crop matured early, an epidemic did not develop in farm fields. Most of the latter were also fungicide treated. Stripe rust was rarely found and only isolated pustules were observed.

INTRODUCTION AND METHODS: Trap nurseries and commercial fields of wheat in Manitoba 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 2015.

RESULTS AND COMMENTS: Leaf rust was generally only found at low levels in Manitoba during 2015. Field surveys were conducted both on winter wheat and spring wheat at trap nurseries. Winter wheat leaves infected with leaf rust were collected in mid-July from Carman, Portage, Winnipeg, Morden, Minto and Rosebank, MB. There was approximately 35% severity on the winter wheat cultivars present. Leaf samples of spring wheat infected with leaf rust were collected in mid-August from Thornhill, Portage, Carman, Brandon, Morden and Emerson, MB. Leaf rust severity was lower in spring wheat. Severity at Minto was 0 to trace, and was about 5-10% at Thornhill, 10% at Morden, and 20% at Portage. Crops were seeded early at most locations and leaf rust developed on plants at later growth stages. Leaf rust occurred somewhat later in the season in trap and breeding nurseries. Farm fields had very little rust due to early maturity as a result of lower moisture later in the season, and the widespread use of foliar fungicides.

Stripe rust was only found at trace levels with isolated pustules at most locations. Stripe rust was observed at 5-10% severity in the Carberry area.

CROP / CULTURES: Barley, Oat and Wheat

LOCATION / RÉGION: Manitoba and eastern Saskatchewan

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TITLE / TITRE: STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2015

ABSTRACT: Stem rust in cereal crops in western Canada was nearly absent in 2015. While environmental conditions during the growing season were favorable for rust infection, the low disease severity was attributed to minimal inoculum migrating from the USA. No viable samples were obtained from wild barley in 2015, thus no races of wheat stem rust were pathotyped in 2015. For oat stem rust, race TJS was dominant (88%), followed by race TJJ (7%). Eight other races of oat stem rust were detected at low frequency in 2015.

INTRODUCTION AND METHODS: A total of 234 oat and 72 wheat and barley fields, as well as trap nurseries of barley, oat, and wheat, were monitored in 2015 to assess severity of infection of 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 et al. 2015).

RESULTS AND COMMENTS: Extremely dry (40-60% of normal) conditions from April to May in the prairies delayed seeding of crops and affected stand development. Mean temperature was below normal in May and June (0 to -2C), but normal (-2 to +2°C) over the full growing season. Precipitation was above average (115-200%) across the prairies in July and August when rust infection normally occurs. Overall, environmental conditions for stem rust infection were favourable across the prairies in the 2015 crop season. Nevertheless, infection on stands of wild barley was generally absent, and was as trace levels in wild and commercial oat fields. Stem rust infection in the USA was almost absent in 2015, thus there was little migration of inoculum.

While stem rust pustules were occasionally found on a few plants in some stands of wild barley (*Hordeum jubatum*) in 2015, no viable samples could be recovered for race determination. In the USA, only one sample was pathotyped (to race QFCSC). There was insignificant wheat stem rust infection in 2015, due to lack of inoculum from the USA.

Stem rust in cultivated and wild oat stands was at trace levels in western Canada in 2015. All oat cultivars except 'Stainless' are susceptible to stem rust races TJJ and TJS (Fetch and Jin 2007). Race TJS was dominant (88%) in 2015 and attacks all commonly grown oat cultivars in Canada. This race continues to increase in frequency from the original detection in 2005 (Fetch and Zegeye 2015). The next prevalent race was TJJ (NA67) at 7%, while races TGN and TJN were at 1% in the population. The high prevalence of race TJS may be due to use of the *Pg-a* resistance gene in USA oat cultivars.

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OILSEEDS, PULSES, FORAGES AND SPECIAL CROPS / OLÉAGINEUX, PROTÉAGINEUX, PLANTES FOURRAGÈRES ET CULTURES SPÉCIALES

CROP: Field bean

LOCATION: Manitoba

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TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2015

ABSTRACT: A total of 40 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 widespread foliar disease throughout the province. Diseases of less importance included rhizoctonia root rot, white mould and halo blight. In 2015, anthracnose and rust were not observed in the 40 bean crops.

METHODS: Crops of field bean in Manitoba were surveyed for root and foliar diseases at 40 different locations. The survey for root diseases was conducted in mid-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. When the plants were starting to mature, the foliar survey was carried out on August 17, 18 and 20 on the same fields assessed for root rot, The crops surveyed were selected at random from regions in southern Manitoba where most of the 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 the 40 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 40 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: Favourable weather and field conditions resulted in an early start to the 2015 growing season, followed by cool weather with freezing temperatures late in May and early June (Manitoba Agriculture, Food and Rural Development 2015a; 2015b). Hot, humid weather in July advanced crops quickly, with scattered, isolated showers reported throughout bean growing regions. Later in the summer, warm, dry weather conditions prevailed. However symptoms of excess moisture and crop stress were noted across some regions of the province (Manitoba Agriculture, Food and Rural Development 2015c).

Two root diseases were identified (Table 1). Fusarium root rot was observed in all 40 field bean crops surveyed, with severity ratings ranging from 1.5 to 6.7, with a mean of 3.8. It has remained the most prevalent root disease of dry bean for several years (Conner et al. 2011; Henriquez et al. 2013; 2015). A number of *Fusarium* spp. including *F. redolens, F. acuminatum* and *F. solani* were isolated from symptomatic root tissue. Rhizoctonia root rot (*Rhizoctonia solani*) was detected in 2 of the 40 crops sampled with a mean severity rating of 5.8. Pythium root rot was not detected in any of the crops surveyed. Twelve 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 seven of the crops surveyed, with a mean disease severity of 3% 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 all 40 crops. The incidence of CBB ranged from 5 to 53% with a mean of 17%, while severity ranged from 0.3 to 2.7, with a mean of 1.8. Anthracnose was not detected in 2014 and 2015, unlike many years prior to this period. Rust was not observed in any of the crops surveyed. White mould symptoms were detected in 18 crops with an incidence of tissue infection that ranged from 0.3% to 15%, and an average of 5.6%. This represents an increase from 2014 in the incidence and severity (Henriquez et al. 2015). Seasonal precipitation in some of the bean growing regions of Manitoba in 2015 was above normal, which would have contributed to the increased risk of white mould in these crops (Manitoba Crop Weather Report 2015), while other regions received below normal precipitation thus lowering the risk of sclerotinia disease.

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Table 1. Prevalence and severity of root diseases and halo blight in 40 crops of field bean in Manitoba in 2015.

Disease	No. crops affected	Disease Severity	
		Mean[1]	Range
Fusarium root rot[2]	40	3.8	1.5-6.7
Rhizoctonia root rot[2]	2	5.8	5.1-6.5
Halo blight (%)	7	3%	1-5%

[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 40 crops of field bean in Manitoba in 2015.

Disease	No. crops affected	Disease Severity[1]		Incidence of Leaf Infection	
		Mean[2]	Range	Mean[2]	Range
Common bacterial blight[3]	40	1.8	0.3-2.7	17.0%	5.0-53.3%
Anthracnose (%)	0	0	0		
Rust (%)	0	0	0		
White mould (%)	18	5.6	0.3-15%		

[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) and on the incidence of leaves with symptoms.
[2]Means are based on an average of the crops in which the diseases were observed.

CROP / CULTURE: Field Bean (*Phaseolus vulgaris* L.)

LOCATION / RÉGION: Southern Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: WHITE MOULD ON DRY BEAN IN ALBERTA IN 2015

ABSTRACT: Dry edible bean is produced on approximately 20,000 ha in southern Alberta each year. The main disease affecting production is white mould caused by *Sclerotinia sclerotiorum* (Lib.) de Bary. A survey for white mould in 24 commercial dry bean fields was performed in 2015 in southern Alberta.

INTRODUCTION AND METHODS: Dry edible bean (*Phaseolus vulgaris* L.) is an important pulse crop on many farms with irrigation in southern Alberta. High yielding, early maturing cultivars are required there. Since no genetic resistance to white mould is known in bean, the disease is a major impediment to the dry bean industry. Since 2011, white mould incidence and severity have typically ranged from 18% to 29%, and 0.1 to 0.75, respectively (M.W. Harding, unpublished). There was an exception in 2014 when average incidence in mid-August was 4.1% and severity 0.11 (Chatterton et al., 2015). A survey was conducted in mid-August, 2015 to evaluate white mould prevalence, incidence and severity on dry bean in southern Alberta.

Twenty four irrigated, commercial bean crops in southern Alberta were surveyed on August 14, 2015 for white mould (*S. sclerotiorum*). Each crop was evaluated for white mould level in 2-m of two adjacent rows at three locations. Disease prevalence was calculated as the percent fields showing disease symptoms. Disease incidences were calculated as the percentage of plants with visible disease symptoms. Disease severities were estimated using a 0-4 scale shown in Table 1.

RESULTS AND COMMENTS: White mould was found in 23 of the 24 crops for a prevalence of 96%. The disease incidences ranged from 0 to 67% with an overall mean incidence of 18.2% and severities ranged from 0 to 1.65 with an overall mean severity of 0.30 (Table 2).

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ACKNOWLEDGEMENTS
This survey was supported by Alberta Agriculture and Forestry. Thanks to Viterra’s Alberta Bean Division for assistance, and to the producers for allowing access to their fields.

Table 1. The rating scale used to estimate severity of white mould on dry edible bean.

Rating	**Symptoms**
0	No symptoms
1	<25% plant canopy damaged by white mold; mostly small branches and occasional pods infected; normal pod filling is observed
2	25-50% canopy damaged; several small/large branches and pods infected and/or slight infection of main stem; normal pod filling is observed
3	51-75% canopy damaged; many small/large branches and pods infected and/or moderate infection of main stem; a few pods contain small seed; some plants may be dead
4	>75% canopy damaged; most small/large branches and many pods infected; severe infection of main stem and poor pod filling; many plants dead

Table 2. White mould prevalence, incidence and severity in dry bean fields in southern Alberta in 2015.

No. crops	Disease	Disease Incidence (%)		Disease Severity[2]	
affected	Prevalence (%)	Mean[1]	Range	Mean[1]	Range
23/24	96	18.2	0-67	0.3	0 – 1.7

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

CROP: Field bean

LOCATION: Western Ontario

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TITLE: ROOT DISEASES OF FIELD BEAN IN WESTERN ONTARIO IN 2015

ABSTRACT: A total of 26 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 the crops surveyed.

METHODS: Crops of field bean in western Ontario were surveyed for root diseases at 26 different locations. The survey was conducted from late July to early August with crops ranging from the 4th trifoliolate to the late vegetative growth stages. The crops were selected from the counties of Huron, Perth, Middlesex and Oxford where most field bean crops are grown.

At least 10 plants were sampled at each of two 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. 2011). Ten roots with disease symptoms were chosen from each crop 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). Ten roots from each of the 26 bean crops surveyed were frozen for future PCR detection of root rot pathogens.

RESULTS AND COMMENTS: The 2015 cropping season in southern Ontario began with wet weather affecting a large portion of the crop (Ontario Bean Growers (OBG) 2015). Some crops were replanted due to flooding following heavy rains, while other fields had large sections that were washed out completely. Saturated soil conditions and frequent rains into July contributed to highly variable stands and visible signs of root rot in most fields. In August, drier conditions prevailed and many crops made a good recovery with close to average yields across most market classes (D. Vermey (OBG) and B. Hall, pers.comm.).

Two root diseases were observed (Table 1). Fusarium root rot (*Fusarium* spp.) was detected in all 26 crops surveyed for root diseases. Similar results have been reported previously in Ontario (Henriquez et al. 2014a; 2015a) and elsewhere in Canada (Conner et al. 2011; Henriquez et al. 2014b; 2015b). Crops in which *Fusarium* spp. were isolated had root rot severity ratings that ranged from 2.5 to 6.8 with a mean of 4.9. Rhizoctonia root rot (*Rhizoctonia solani*) and Pythium root rot (*Pythium* spp.) were not detected in any of the 26 crops surveyed. Molecular detection methods to confirm the identity of other fungi isolated from five surveyed crops are currently in progress. Nineteen of 26 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 26 crops of field bean in Ontario in 2015.

	No. crops	**Disease Severity**	
Disease[1]	**affected**	**Mean[2]**	**Range**
Fusarium root rot	26	4.9	2.5-6.8
Rhizoctonia root rot	0	0	0
Pythium root rot	0	0	0
Other	5	4.6	2.7-5.9

[1]Root diseases were rated on a scale of 0 (no disease) to 9 (death of plant).
[2]Means are based on an average of the crops in which the diseases were observed.

CROPS / CULTURES: Canola

LOCATION / RÉGION: Alberta

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TITLE / TITRE: A SURVEY FOR BLACKLEG ON CANOLA IN ALBERTA IN 2015

ABSTRACT: Blackleg is a disease on canola caused by *Leptosphaeria maculans* (Sowerby) P. Karst. It can cause catastrophic losses if not managed. Cultivar resistance and crop rotation are the primary tools for management, and as a result, blackleg severity in Alberta is typically very low even though the pathogen is common throughout the province (Kutcher et al., 2013). A survey for blackleg on canola was undertaken to characterize the prevalence, incidence and severity of the disease in Alberta in 2015.

INTRODUCTION AND METHODS: *Leptosphaeria maculans*, the causal agent of blackleg, can cause disease on all above ground parts of canola plants. In severe cases, vascular colonization and the formation of basal stem cankers can result in major yield reductions and increased crop lodging. The pathogen is a declared pest in Alberta's *Agricultural Pests Act and Regulation*. The most recent survey for blackleg on canola in Alberta was performed in 2012. Since it is important to understand the distribution, prevalence and severity of this pathogen, a new survey for blackleg in Alberta was initiated in 2015. Surveyors were encouraged to visit canola fields the week before swathing. Post-swathing ratings were discouraged unless they were taken within a few days of cutting. Surveyors walked a W-shaped pattern, stopping at five locations in the field. Sampling locations were at least 20 m apart and at least 20 m from field margins. Twenty plants were rated at each sampling location (100 plants per field). Ratings were performed by first cutting the canola stem at the soil line and then rating the cross-section for black discoloration. Blackleg prevalence was calculated as the percentage of crops with symptoms of black discoloration visible in stem cross sections. Incidence was calculated as the percent of plants with symptoms, and severity was estimated using a 0-5 scale for rating vascular discoloration (Table 1).

RESULTS AND COMMENTS: The survey results are presented in Table 2 and Figure 1. Symptoms of blackleg were observed in 147 of the 208 fields surveyed making a prevalence of 70.7%. The incidence of disease ranged from 0 to 71% with an overall mean of 13.1%. Disease severity ranged from 0 to 1.76 with an overall mean of 0.39. Results from a canola disease survey in 2012 showed that blackeg prevalence, incidence and severity were 99%; 21%; and 1.26, respectively (R. Lange, unpublished). While many factors can influence disease levels, it is known that environmental conditions such as temperature, humidity and available moisture directly affect disease initiation and development. It is interesting to note that dry spring conditions, which lingered into July throughout much of Alberta in 2015, co-occurred with reduced blackleg levels, while in 2012 there was abundant spring moisture which co-occurred with relatively higher disease levels.

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ACKNOWLEDGEMENTS
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Table 1. A rating scale to estimate blackleg severity on canola (WCC/RCC 2009)

Rating	Symptoms
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
5	Diseased tissue occupies 100% of cross-section with significant constriction; tissue dry and brittle; plant dead

Table 2. Blackleg prevalence, incidence and severity in canola fields in Alberta in 2015.

No. crops	Disease	Disease Incidence (%)		Disease Severity[2]	
affected	Prevalence (%)	Mean[1]	Range	Mean[1]	Range
147/208	70.7	13.1	0 – 71	0.39	0 – 1.76

[1]Means represent an average of all the crops surveyed.
[2]Disease severity was assessed using a 0-5 scale

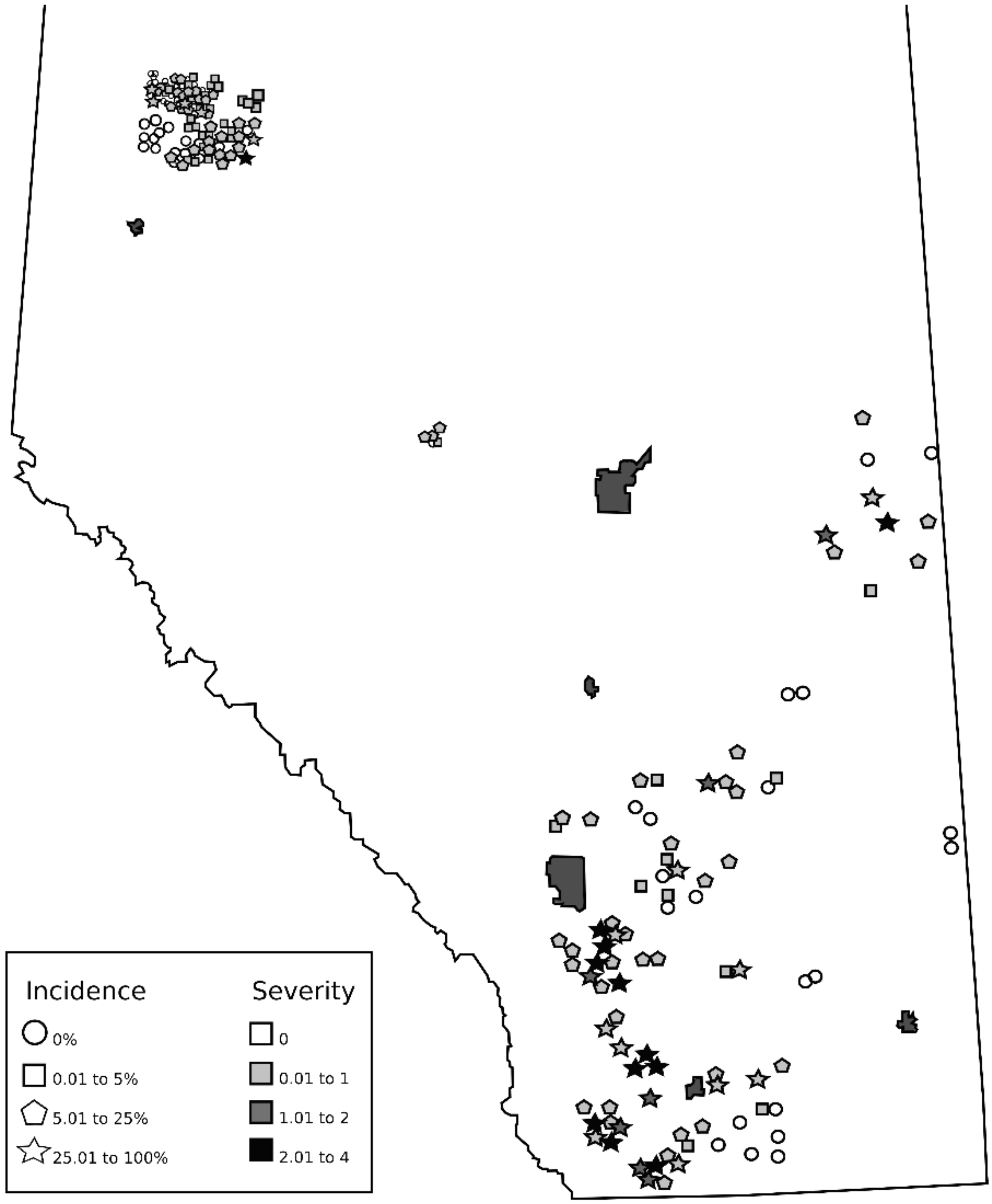

Figure 1. The location, incidence and severity of blackleg on canola in Alberta in 208 fields in 2015.

CROP: Canola

LOCATION: Alberta

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TITLE: OCCURRENCE AND SPREAD OF CLUBROOT ON CANOLA IN ALBERTA IN 2015

ABSTRACT: A survey of 836 commercial canola crops in 38 counties and municipalities in central and southern Alberta revealed 58 new fields with clubroot (*Plasmodiophora brassicae* Woronin) infestation. Further surveillance by county and municipal personnel identified another 229 new records of the disease, for a total of 287 new clubroot-infested fields in 2015. A grand total of 2154 clubroot-infested fields have been confirmed in Alberta since surveys began in 2003.

METHODS: A total of 836 commercial canola (*Brassica napus* L.) crops in 38 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). These included 604 crops that were located in fields that had either not been surveyed previously for clubroot, or had been inspected in earlier surveys and found to be free of the disease. An additional 232 crops were surveyed because they were within a 1.6 km radius of fields where clubroot resistance appeared to have become eroded in 2013 or 2014 (7, 8), or because they were in fields confirmed to have been planted to canola in at least three of the last five years. Most fields were surveyed in late August or 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, then 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 adopted 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. (6). 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 obtain the most complete assessment possible of clubroot infestation in the province.

RESULTS AND COMMENTS: A total of 65 of the 836 canola crops inspected were found to have symptoms of clubroot, 58 of which represented new records of clubroot infestation. Clubroot severity ranged from mild to moderate, but no severe infestations (ID > 60%) were identified in 2015. Symptoms of the disease were observed in a total of 32 fields that had been sown to clubroot-resistant canola cultivars. All of these fields had been planted to canola for at least three of the past five years, and/or were in close proximity to fields where clubroot resistance had been eroded or extinguished in 2013 or 2014. Many of the *P. brassicae* strains recovered from resistant cultivars in 2013 and 2014 have been confirmed to be highly virulent on these cultivars; this suggests shifts in the virulence of pathogen populations are a result of the selection pressure imposed by the planting of resistant hosts in short rotations (S.E. Strelkov, unpublished data). Further evaluation of the virulence of the 2015 pathogen collections is underway in order to better understand changes in the pathotype composition of *P. brassicae* populations.

In addition to the 58 new records of clubroot infestation identified in the pan-Alberta survey, another 229 new field infestations were detected in independent surveys conducted by municipal personnel in the counties of Camrose, Clearwater, Flagstaff, Lacombe, Lac Ste. Anne, Lamont, Leduc, Minburn, Mountain View, Parkland, Red Deer, Smoky Lake, Stettler, St. Paul, Strathcona, Two Hills, Westlock, Wetaskiwin, Woodlands, and Yellowhead (Table 1). Fourteen of those counties were not visited as part of the province-wide survey, and the only data on clubroot occurrence came from the municipal personnel. Collectively, surveillance activities in 2015 revealed 287 new records of clubroot infestation in Alberta. Conditions were very dry over many parts of the province in 2015, with 23 municipalities making official declarations of drought. As clubroot development is heavily influenced by soil moisture levels (4), it is likely that the dry conditions resulted in a lower clubroot incidence and severity than would otherwise have been expected. Indeed, no severe clubroot infestations were observed in 2015, while in most years they represent up to 10-15% of all new cases (5). Despite the generally unfavorable conditions for clubroot, the disease appears to have continued its spread, with the first confirmed infestations in the Municipal District of Bonnyville, and in the counties of Mountain View and Two Hills (Table 1). Clubroot infestations have now been reported from nearly all counties and municipalities in central Alberta, although only isolated cases of the disease have been identified in the southern part of the province (Fig. 1).

One new record of clubroot from Vermillion County reported in 2014 (7) could not be confirmed by DNA analysis or soil bioassays, and hence has been removed from the total number of documented infestations in the province. Nonetheless, the identification of two new records of the disease in the Municipal District of Bonnyville, along with the earlier confirmation of another clubroot-infested field in Vermillion County, indicate that the clubroot outbreak now stretches to the border with Saskatchewan (Fig. 1). A grand total of 2154 clubroot-infested fields have been confirmed in Alberta since surveys for the disease began in 2003.

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Table 1. Distribution of *Plasmodiophora brassicae*-infested canola fields identified in Alberta in 2015.

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	5	0	0	0
Athabasca	21	2	12	14
Beaver	0	--	3	3
Bonnyville	26	2	0	2
Brazeau	8	0	0	0
City of Edmonton	2	2	0	2
Camrose	0	--	9	9
Cardston	10	0	0	0
Clearwater	20	4	6	10
Cypress	12	0	0	0
Flagstaff	0	--	2	2
Forty Mile	9	0	0	0
Foothills	14	0	0	0
Kneehill	19	0	0	0
Lacombe	0	--	19	19
Lac La Biche	20	0	0	0
Lac Ste. Anne	0	--	11	11
Lamont	0	--	13	13
Leduc	0	--	51	51
Lethbridge	10	0	0	0
Lesser Slave River	33	2	0	2
Minburn	0	--	4	4
Mountain View	0	--	1	1
Newell	15	0	0	0
Paintearth	26	0	0	0
Parkland	0	--	44	44
Pincher Creek	10	0	0	0
Ponoka	0	--	0	0
Provost	24	0	0	0
Red Deer	0	--	2	2
Rocky View	18	0	0	0
Smoky Lake	25	11	4	15
Special Area 2	20	0	0	0
Special Area 3	18	0	0	0
Special Area 4	25	0	0	0
Spirit River	8	0	0	0
Starland	28	0	0	0
Stettler	30	1	5	6
St. Paul	24	0	2	2
Strathcona	0	--	19	19
Sturgeon	90	9*	0	9
Taber	20	0	0	0
Thorhild	29	0	0	0
Two Hills	17	2	2	4
Vulcan	20	0	0	0
Wainwright	22	0	0	0
Warner	14	0	0	0
Westlock	92	20*	1	21

Table 1. (contd.)

Wetaskiwin	0	--	8	8
Wheatland	20	0	0	0
Willow Creek	10	0	0	0
Woodlands	22	3	10	13
Yellowhead	0	--	1	1
TOTAL	836	58	229	287

*A total of 14 clubroot-infested fields were identified among the 90 fields surveyed in Sturgeon County, but only nine of these represented new records of the disease; similarly, a total of 22 clubroot-infested fields were identified among the 92 fields surveyed in Westlock County, but only 20 of these represented new records of the disease.

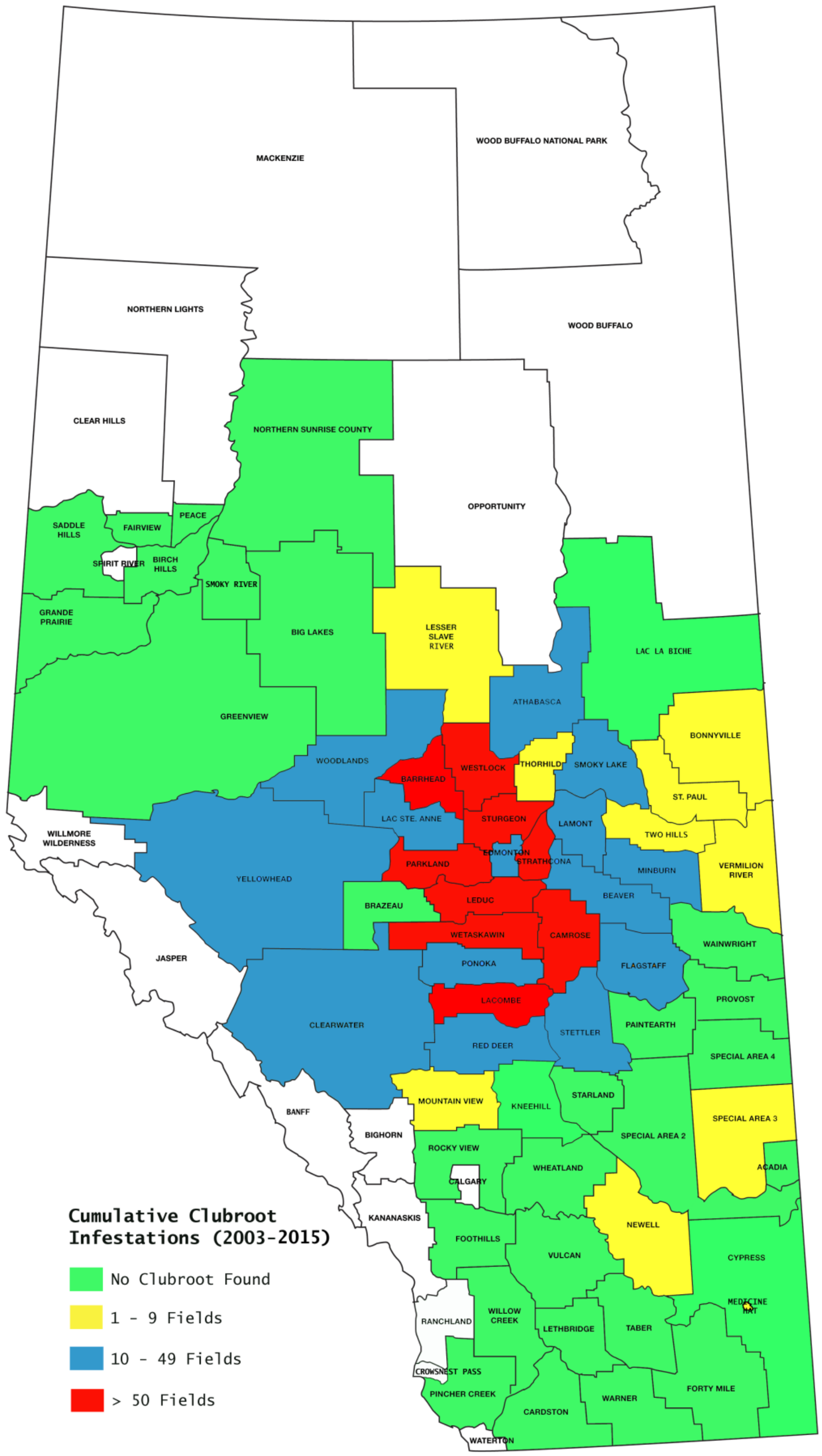

Figure 1. The occurrence of clubroot on canola in Alberta as of November 2015. Since clubroot surveys were initiated in 2003, the disease has been confirmed in a total of 2154 fields representing 31 counties and municipal districts in the province, as well as in rural areas of the cities of Edmonton and Medicine Hat, and the town of Stettler. *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

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TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2015

ABSTRACT: The annual survey in Saskatchewan covered 253 fields in six large regions. Sclerotinia stem rot was the most prevalent disease, occurring in 64% of the crops surveyed. The mean disease incidence among all crops surveyed in Saskatchewan was 7% but ranged from 5% to 10% among regions. Blackleg symptoms in the lower stem (reported as basal cankers) were observed in 59% of crops surveyed. The mean disease incidence among all crops surveyed in Saskatchewan was 9%, with mean incidence ranging from 5% to 16% among regions.

METHODS: A total of 253 canola crops were surveyed between August 1 and September 21 in the major canola production regions of Saskatchewan. The number of fields in each crop region was approximately proportionate to the canola production area in each region and consisted of northwest (40), northeast (44), west-central (27), east-central (69), southwest (29), and southeast (44) regions. Crops were surveyed, when possible, before swathing while plants were between growth stage 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 following a W-shaped pattern. Crops were assessed for the prevalence (percent crops infested) and incidence (percent plants infected per field) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma), 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 basal stem cankers (if blackening was observed when the stem was cut) using the 0 to 5 scale in Table 2 (Western Canada Canola/Rapeseed Recommending Committee 2009). Any other type of blackleg stem lesion (if external symptoms were observed elsewhere on the stem) was recorded but is not part of the results presented here. Sub-samples of up to 5 stems with basal canker blackleg symptoms were collected from 50 crops and submitted to AAFC/AGI (M. H. Borhan & N. Larkan) for culturing. For alternaria black spot (*Alternaria brassicae, A. raphani*), severity of lesions on the pods of each plant surveyed was assessed. However, unless there was large variation from plant to plant, severity was recorded as a crop score using a 1 to 50% scale (Conn et al. 1990). Plants in the crop with symptoms suspected of being fusarium wilt were collected and submitted to AAFC/AGI for testing (M. H. Borhan & N. Larkan).

When diseases were observed in the crop, but not in the sample of 100 plants, they were recorded as "trace" and counted as 0.1% incidence. Mean disease incidence and 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".

Calculations of disease incidence and severity were reported as in previous years with incidence reported as both the incidence in all canola crops surveyed in the year (reported here for sclerotinia and blackleg) and as the incidence of disease in canola crops infested by the disease in question that year (reported here for sclerotinia, blackleg, aster yellows, foot rot, and alternaria pod spot). Severity in previous years has been calculated per field as the sum of the severity ratings (as in Table 1) in each field, divided by the number of infected plants. In comparison, in other reports severity has been calculated as the sum of severity ratings divided by the total number of plants surveyed per field. To be consistent with other reports, the severity values discussed in this report were calculated using the second method, but mean severity values calculated by both methods are provided in Tables 3 and 4. Summaries of mean severity values calculated by both methods and drawn from historical provincial data for 2011-2015 are shown in Table 6 for sclerotinia stem rot and Table 7 for blackleg canker.

Soil samples (~1L) were collected from 134 fields and analyzed for the presence of *P. brassicae* at the Saskatchewan Ministry of Agriculture Crop Protection Laboratory using the PCR-based diagnostic test of Cao et al. (2007).

RESULTS AND COMMENTS: Approximately 4.3 million ha (10.7 million acres) of canola were seeded in Saskatchewan in 2015 (Stats Canada, 2015). Lack of moisture and cool weather delayed crop development in the spring. Harvest progressed earlier than in 2014 with 52% of the crop combined by Sept. 14 compared to 23% in 2015. There were delays in some areas later in the season due to wet weather. By October 19, 97% of the crop had been harvested (Saskatchewan Crop Report, 2015).

Sclerotinia stem rot was observed in 64% of the canola crops surveyed. The average incidence in the province was 7% (11% incidence in infested crops). Average incidence was highest in the NW region (10%) and lowest in the EC region (5%). The average severity of sclerotinia in canola crops in Saskatchewan was 0.24. The severity of sclerotinia was highest in the SE (0.35), and lowest in the SW region (0.16). See Table 3.

Symptoms of blackleg basal infection (rated after cutting of lower stems) were present in 59% of Saskatchewan canola crops. The average incidence in the province was 9% (15% incidence in infested crops). The average incidence was highest in the WC region (16%) and lowest in the SW region (5%). The average severity of blackleg basal cankers in the province was 0.19. Average severity was highest in the WC region (0.36) and lowest in the SW region (0.11). Blackleg stem lesions were present in 26% of canola crops with an average incidence of 9%. The highest average incidence was in the NW region (13%) and the lowest in the SW region (4%). See Table 4.

Fifty field samples of basal cankers were submitted to AAFC/AGI (M.H. Borhan & N. Larkan) for blackleg confirmation: 47 were visually confirmed as containing at least one stem with internal symptoms consistent with blackleg (94%). However, when samples from 32 fields were cultured to look for causal species, all but one produced fungal growth but only 20 samples (62.5%) produced *Leptosphaeria*. *Fusarium avenaceum* and *Alternaria alternata* were identified by ITS sequencing (Schoch et al. 2012) from several cultures, as well as multiple plurivorous plant pathogens (*Fusarium redolens*, *Alternaria arborescens*, *Phoma plurivora*, *Plectosphaerella cucumerina*). Of the *Leptosphaeria* isolates, 10 (50%) were *L. maculans* 'brassicae', 9 (45%) were *L. biglobosa* 'canadiensis' and one isolate (5%) was identified as *L. maculans* 'lepidii'. Pathotyping and molecular genotyping of the 10 *L. maculans* 'brassicae' isolates, testing for thirteen *R*-gene interactions (*Rlm1*, *Rlm2*, *Rlm3*, *Rlm4*, *Rlm6*, *Rlm7*, *Rlm9*, *Rlm11*, *RlmJ1*, *RlmS*, *LepR1*, *LepR2*, *LepR3*), identified only three races: *AvrLm2-4-6-7-11-J1-S, AvrLep1-2* (7 isolates), *AvrLm2-4-6-7-11-J1, AvrLep1* (2 isolates) and *AvrLm2-3-6-9-11-J1-S, AvrLep1-2* (1 isolate).

Aster yellows was observed in 8% of canola crops with an average incidence of <1% (3% in infested crops) which was slightly lower than in 2014 when it was observed in 9% of canola crops with an average incidence of 0.4% (4% in diseased crops). The highest prevalence of aster yellows was in the EC region (13%) with an average incidence of <1% (3% in infested fields). See Table 5.

Foot rot was recorded in 3% of canola crops in the province with an average incidence of <1% (4% in infested crops). The highest incidence was in the NE region (1%; or 4% in infested crops). Foot rot was not detected in the northwest, southwest or west-central regions.
See Table 5.

Alternaria black spot occurred in 80% of canola crops surveyed in the province with 61% of crops identified as having pod spot. The highest incidence of pod spot was in the northwest region (59%; 88% in infested crops). The lowest incidence was in the southeast region (31%; 45% in infested crops). See Table 5.

Samples of plants suspected to be infected with fusarium wilt were collected from 8 fields and sent to AAFC (N. Larkan) for confirmation, but *F. oxysporum* was not detected in the laboratory analysis.

A total of 134 soil samples were collected for the Saskatchewan clubroot survey and submitted to the Saskatchewan Crop Protection Laboratory for analysis by qPCR testing. Clubroot was not detected or quantifiable in any of the samples.

In 2015 the Saskatchewan Ministry of Agriculture assisted the Canadian Food Inspection Agency (CFIA) with its survey for verticillium wilt (*Verticillium longisporum*). Permission was obtained from canola growers to collect samples from >100 fields to supplement samples collected by CFIA staff and the Canola Council of Canada. Samples have been submitted to the CFIA lab for analysis..

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

Disease Ratings	Lesion Locations	Symptoms
0	None	No symptoms
1	Pod	Infection of Pds only
2	Upper plant parts	Lesion situation on main stem or branch(es) with potential to affect up to ¼ of seed formation and filling on plant
3		Lesion situation on main stem or on a number of branches with potential to affectup 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 disease incidence and severity of sclerotinia stem rot of canola in Saskatchewan in 2015

REGION (NO. OF FIELDS)	Sclerotinia Stem Rot All Fields Surveyed		Sclerotinia Stem Rot Infected Fields Only	
	Incidence	Severity[1]	Incidence	Severity[1]
Northwest (40)	10	0.19 (1.6)	14	0.27 (2.3)
Northeast (44)	8	0.20 (2.1)	10	0.26 (2.9)
West-central (27)	6	0.13 (1.5)	9	0.19 (2.1)
East-central (69)	5	0.13 (1.9)	7	0.20 (2.7)
Southwest (29)	6	0.09 (1.0)	10	0.16 (1.7)
Southeast (44)	7	0.14 (0.91)	18	0.35 (2.2)
Overall mean (253)	7	0.15 (1.6)	11	0.24 (2.4)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants)

Table 4. Mean disease incidence and severity of blackleg basal stem symptoms (recorded as cankers) in Saskatchewan in 2015

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 (40)	80	9	0.11 (1.0)	11	0.14 (1.3)
Northeast (44)	30	7	0.098 (0.54)	22	0.33 (1.8)
West-central (27)	56	16	0.20 (0.69)	29	0.36 (1.2)
East-central (69)	67	8	0.11 (1.0)	11	0.16 (1.5)
Southwest (29)	48	5	0.055 (0.54)	11	0.11 (1.1)
Southeast (44)	66	11	0.13 (0.78)	16	0.20 (1.2)
Overall mean (253)	59	9	0.11 (0.81)	15	0.19 (1.4)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants)

Table 5. Mean disease incidence of alternaria pod spot, aster yellows, and foot rot of canola fields surveyed in Saskatchewan in 2015

REGION (NO. OF FIELDS)	Alternaria Black Spot	Aster Yellows	Foot Rot
Northwest (40)	88	6	0
Northeast (44)	47	4	14
West-central (27)	87	2	0
East-central (69)	60	3	1
Southwest (29)	66	1	0
Southeast (44)	45	2	3
Overall mean (253)	63	3	4

Table 6. Mean disease incidence and sclerotinia severity reported as both, the average severity across infected plants and the average severity across all plants surveyed per field from 2011-2015

YEAR (NO. OF FIELDS)	Sclerotinia Stem Rot All Fields Surveyed		Sclerotinia Stem Rot Infected Fields Only	
	Incidence	Severity[1]	Incidence	Severity[1]
2011 (265)	20	0.56 (2.5)	22	0.61 (2.7)
2012 (253)	19	0.52 (2.5)	21	0.57 (2.8)
2013 (269)	5	0.10 (1.3)	9	0.17 (2.2)
2014 (274)	14	0.40 (2.2)	18	0.51 (2.8)
2015 (253)	7	0.15 (1.6)	11	0.24 (2.4)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants per field)

Table 7. Mean blackleg canker severity reported as both, the average severity across infected plants and the average severity across all plants surveyed per field from 2011-2015

REGION[1] (NO. OF FIELDS)	Blackleg Basal Cankers All Fields Surveyed			Blackleg Basal Cankers Infected Fields Only	
	Prevalence	Incidence	Severity[1]	Incidence	Severity[1]
2011 (265)	42	3	0.041 (.59)	7	0.10 (1.4)
2012 (253)	34	4	0.069 (0.54)	11	0.21 (1.7)
2013 (269)	25	2	0.029 (0.34)	8	0.12 (1.4)
2014 (274)	55	8	0.10 (0.7)	15	0.19 (1.3)
2015 (253)	59	9	0.11 (0.81)	15	0.19 (1.4)

[1] Severity as divided by number of plants surveyed per field (Severity as divided by the number of infected plants per field)

CROP: Canola

LOCATION: Manitoba

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TITLE: SURVEY OF CANOLA DISEASES IN MANITOBA IN 2015

ABSTRACT: A total of 152 canola crops were surveyed in Manitoba for the prevalence and incidence or severity of sclerotinia stem rot, blackleg, alternaria pod spot, aster yellows, foot rot and clubroot. Seventy-nine of the 152 crops were surveyed for fusarium wilt. Blackleg and sclerotinia stem rot were the most prevalent diseases throughout the province. No canola plants collected from the 152 canola crops were confirmed to have clubroot or verticillium wilt.

METHODS: A total of 152 canola crops were surveyed in the southwest (69), northwest (27), eastern/interlake (21) and central (35) regions of Manitoba from mid-August to early September. All crops were *Brassica napus* and the majority 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.

The 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 83 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 the 152 Manitoba canola crops surveyed in 2015. One plant sample submitted from a canola crop not included in the above survey was confirmed positive for clubroot. Further information on the recent 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 2015 (Tables 1, 2 and 3). The prevalence of sclerotinia-infested crops ranged from a high of 86% in the central region to 62% in the eastern/interlake region with a provincial mean of 71%. Mean disease incidence averaged across all crops was 10% and ranged from 20.6% in the central region to 4.1% in the northwest region. For infested crops only, mean disease incidence was 14.7%. Throughout the province, mean severity of sclerotinia stem rot was low at <2.0. In 2015, the prevalence and incidence of sclerotinia were slightly higher than in 2014.

Aster yellows was observed in 4.6% of canola crops in Manitoba with a mean disease incidence of 1.4% 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, 2014 and 2015, aster leafhopper numbers were considerably lower than in 2012 (Canola Council of Canada, 2013; Manitoba Agriculture, Food and Rural Development, 2014; Gavloski, 2015) reducing the risk of this disease.

Blackleg basal cankers occurred in 80% of the crops surveyed in 2015 (Table 1), with prevalence ranging from 97% in the central region to 59% in the northwest region. The mean incidence of basal cankers averaged across all crops was 14.3%, while the incidence in infested crops was 18.0%. In 2014, basal cankers were found in 93% of crops surveyed with a mean disease incidence of 25.7% 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 2015 was 65%. In previous years, 66%, 64%, 68%, 63% and 71% of crops had stem lesions in 2010, 2011, 2012, 2013 and 2014, respectively (McLaren et al. 2013; 2014; 2015). The mean incidence of blackleg stem lesions was 8.3% in infested crops and 5.4% in all crops.

The mean prevalence of alternaria pod spot in 2015 was 57%, 67%, 26% and 44% 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 16% of 79 canola crops surveyed in Manitoba, with a mean incidence of 9.7% in diseased fields and an average severity of 3.5 (Table 1). No fusarium wilt was observed in the northwest region. Foot rot occurred in 14% of canola crops surveyed with a provincial mean incidence of <2%. The prevalence of crops reported to be affected by foot rot was highest in the central region (34%) and lowest in the southwest region (10%). No foot rot was observed in the northwest region. White rust (*Albugo candida*) has not been confirmed in any crop of *B. napus* since 2011 (McLaren et al. 2012). Verticillium wilt was not detected in any of the 152 surveyed canola crops. However, wilt caused by *Verticillium* spp. was identified in eight different canola crops from plant samples (one per field) submitted to the Manitoba Crop Diagnostic Centre.

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Table 1. Mean prevalence, incidence and severity of sclerotinia stem rot and blackleg in Manitoba in 2015.

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	86	20.6	24.1	2.0	2.3	97	26.8	27.6	1.5	1.6	74	7.0	9.4
(35)													
East./Inter.	62	16.3	26.4	1.3	2.2	71	17.9	25.0	0.9	1.2	81	4.5	5.6
(21)													
Northwest	63	4.1	6.5	1.6	2.5	59	3.5	5.9	0.8	1.3	41	2.4	6.0
(27)													
Southwest	70	5.9	8.5	2.0	2.9	81	11.2	13.8	1.2	1.5	65	6.1	9.3
(69)													
All regions	71	10.4	14.7	1.8	2.6	80	14.3	18.0	1.2	1.5	65	5.4	8.3
(152)													

[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 2015.

Crop Region	Alternaria pod spot		Aster yellows			Fusarium wilt[4]					Foot rot		
(No. of crops)	P[1]	Sev.[3]	P[1]	Inc.[2]	Inc.[3]	P[1]	Inc.[2]	Inc.[3]	Sev.[2]	Sev.[3]	P[1]	Inc.[2]	Inc.[3]
Central (35)	57	1.0	11.4	0.1	1.0	56	3.4	6.0	2.5	3.6	34	2.9	8.3
East./Inter. (21)	67	1.2	0	0	0	15	0.8	5.5	1.3	2.9	14	0.4	2.7
North-west (27)	26	1.0	11.1	0.2	2.0	0	0	0	0	0	0	0	0
South-west (69)	43	1.1	0	0	0	6	1.9	30.5	1.2	3.5	10	1.1	10.7
All regions (152)	47	1.1	4.6	0.1	1.4	16	1.6	9.7	1.4	3.5	14	1.2	8.3

[1] Prevalence (P).
[2] Disease incidence (DI) and severity (Sev.) across all surveyed crops.
[3] Disease incidence and severity in infested crops.
[4]Seventy-nine fields were surveyed for fusarium wilt in the central (16), eastern/interlake (13), northwest (17) and southwest (33) regions.

Table 3. Distribution of incidence (sclerotinia, blackleg, aster yellows, fusarium wilt[1] and foot rot) and severity (alternaria pod spot) classes in 152 crops of *Brassica napus* in Manitoba in 2015

	Percentage of crops with						
Incidence range	Sclerotinia stem rot	Blackleg basal cankers	Blackleg stem lesions	Aster yellows	Fusarium wilt[1]	Foot rot	Alternaria pod spot
0%	29	20	35	95	84	86	53
1-5%	27	32	32	5	8	5	47
6-10%	16	12	17	0	5	6	0
11-20%	15	11	9	0	2	2	0
21-50%	8	16	7	0	1	1	0
>50%	5	9	0	0	0	0	0

[1]Seventy-nine fields were surveyed for fusarium wilt in the central (16), eastern/interlake (13), northwest (17) and southwest (33) regions.

CROP: Flax

LOCATION: Manitoba/Saskatchewan

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TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2015

ABSTRACT: A survey of 24 flax crops in Manitoba and 43 crops in Saskatchewan revealed that pasmo was the most prevalent disease in 96% of crops surveyed in 2015, followed by fusarium in 43%, alternaria blight in 27%, aster yellows in 24%, and powdery mildew in 13% of the crops surveyed. Rust and sclerotinia stem infections were absent in all surveyed flax crops.

METHODS: A total of 67 flax crops were surveyed in 2015: 24 in southern Manitoba and 43 in central, southern and eastern Saskatchewan. Forty-seven crops were surveyed in the third week of August and 20 crops 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, nine 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: Seventy three percent of the flax crops surveyed in 2015 had excellent stands and the rest were good to fair. Fifty-four percent of the crops surveyed were maturing earlier than usual. Fifty percent of the crops had excellent vigour and the rest were poor. Eight-five percent of the crops were brown seed-colour flax, and the remainder were yellow seed-colour. The 2015 growing season in Manitoba started with normal growing conditions but in June above-normal precipitation resulted in wet soils along the Manitoba and Saskatchewan border which delayed seeding and crop maturity. Subsequently growing conditions were relatively normal throughout the growing season in Manitoba but dry and with below normal precipitation in Saskatchewan which resulted in record low powdery mildew levels. Total flax area was ~650,000 ha, approximately 80% in Saskatchewan according to Statistics Canada. The 2015 disease survey showed some minor differences between Manitoba and Saskatchewan; incidences of wilt/root rot, alternaria blight, and powdery mildew were higher in Manitoba than in Saskatchewan. Lodging was at record low levels with only a trace to 5% in 18% of the Manitoba flax crops.

Pasmo, the most prevalent disease in 2015, was observed in 95% 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 probably to dry conditions in July-August especially in Saskatchewan. Pasmo severity was mostly at trace to 5% levels in most of the 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 most flax crops (Table 1).

Root infections and fusarium wilt were observed in 47% of the flax crops in Manitoba and in 35% in Saskatchewan. Incidence was very low (trace to 5%) even in the most affected crops (Table 1). Prevalence of these diseases in 2015 was lower than in 2014-2012 (1, 2, 3, 4).

Powdery mildew was present in 13% of the crops surveyed in 2015 (Table 1); severity ranged from trace to 1% leaf area affected. Powdery mildew infections started very late, and severity was at a record low, similar to 2014 but much lower than in 2012-2013, due to low humidity from July-August (1, 2, 3, 4).

Rust was not observed in any of the crops surveyed in 2015, nor in the flax rust trap nurseries planted at Morden and Portage la Prairie in Manitoba, or at Indian Head and Saskatoon in Saskatchewan.

Aster yellows was present at trace levels in 24% of the crops surveyed in Manitoba and Saskatchewan in 2015. This was more frequent than in 2014-2012 (1, 2), but disease severity was very low (traces to 5% in most surveyed crops 3, 4). This disease is transmitted by the aster leafhopper **(***Macrosteles quadrilineatus)* that usually migrates from the south during the growing season but migration of the insect was very late in 2015. Alternaria blight was observed at trace levels in 46% of the crops in Manitoba and 16% of crops in Saskatchewan. No sclerotinia stem infections had been evident in any of the crops surveyed in 2014.

Of the nine samples submitted to the MAFRD Crop Diagnostic Centre in 2015, two were affected by pasmo, one by alternaria blight, two by nitrogen deficiency, one by environmental injury, and three by herbicide injury.

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Table 1. Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 67 crops of flax in Manitoba and Saskatchewan in 2015

Fusarium Wilt				Pasmo				Powdery Mildew			
Disease Class		Crops		Disease Class		Crops		Disease Class		Crops	
Incid.[1]	Sever.[2]	No	%	Incid.[1]	Sever.[2]	No	%	Incid.[1]	Sever.[2]	No	%
0%	0%	38	57	0%	0%	3	5	0%	0%	58	87
1-5%	1-5%	27	40	1-10%	1-5%	21	31	1-10%	1-5%	4	6
5-20%	5-10%	2	3	10-30%	5-10%	15	22	10-30%	5-10%	4	6
2-40%	10-20%	0	0	30-60%	10-20%	22	33	30-60%	10-20%	1	1
>40%	10-40%	0	0	>60%	20-50%	6	9	>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: Lentil

LOCATION: Saskatchewan

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TITLE: SURVEY OF LENTIL DISEASES IN SASKATCHEWAN, 2012-2015

ABSTRACT: A total of 101 lentil crops were surveyed in Saskatchewan in 2012, 2013, 2014, and 2015. Root rot and anthracnose were generally the most prevalent diseases observed in the survey, while ascochyta blight levels remain low.

METHODS: Saskatchewan lentil crops were surveyed for disease in 2012 (28 fields), 2013 (37 fields), 2014 (18 fields), and 2015 (18 fields). Regions surveyed included west-central (17), south-west (2), and south-east (9) Saskatchewan in 2012; west-central (12), south-west (12), and south-east (9) Saskatchewan in 2013; west central (15), east-central (1), and south-west (2) Saskatchewan in 2014; and west-central (15), east-central (1), and south-east (2) Saskatchewan in 2015. Disease assessments were made qualitatively in each crop by observing several representative plants to ascertain general health and presence or absence of symptoms. Prevalence of the following diseases was recorded: root rot (*Fusarium* spp. / *Pythium* spp. / *Rhizoctonia solani / Aphanomyces euteiches),* anthracnose (*Colletotrichum lentis),* ascochyta blight (*Ascochyta lentis),* sclerotinia stem and pod rot *(Sclerotinia sclerotiorum*), botrytis stem and pod rot / grey mould *(Botrytis cinerea),* and stemphylium blight (*Stemphylium* spp.). Percentages of the crops surveyed showing symptoms of each of these diseases were calculated for each region surveyed (Tables 1-3), as well as provincial totals (Table 4).

RESULTS AND COMMENTS:
Approximately 1.5 million ha (3.7 million acres) of lentil were seeded in Saskatchewan in 2015. The 2015 season was relatively dry early on and frost led to some reseeding of crops. Late season rain created harvest delays in parts of the province, and sometimes resulted in crop regrowth. However, early reports indicated good quality lentil seed rated in the top two quality grades, which was better than average.

Approximately 1.22 million ha (3 million acres) of lentil were seeded in Saskatchewan in 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 due to weather conditions. In mid-September only about a quarter of the provincial crop had been harvested, i.e. about half of the 5- year average for that time. However, with warmer weather later in September and continuing into October, harvest was completed in most areas before snow fell.

Approximately 1.06 million ha (2.62 million acres) of lentil were seeded in Saskatchewan in 2013. Seeding, emergence and crop development were delayed across the province due to below-normal temperatures for much of the growing season. Precipitation was above-normal in most areas throughout much of the growing season but an extended period of high temperatures at harvest allowed farmers to harvest the crop in a timely fashion.

Almost 1 million ha (2.43 million acres) of lentil were seeded in Saskatchewan in 2012. Excess precipitation early in the growing season created many challenges for farmers. Crops were stressed from excess moisture and disease pressure. However, in most areas, warm summer weather and an extended period of high temperatures at harvest allowed the harvest to be completed in a timely fashion.

In only one of the 18 lentil crops surveyed in 2015 and one of the 37 lentil crops surveyed in 2013, were there no diseases noted. In fields in all other years at least one disease was observed in each field.

Ascochyta blight was observed in 32% of lentil crops surveyed in 2012, but decreased each year after that and was not observed on any of the crops surveyed in 2015. Improved resistance to ascochyta blight in lentil cultivars has likely led to a decrease in levels of this devastating disease. This observation has also been made in seed testing labs, where the overall percentage of *Ascochyta*-free lentil seed samples was 99% in 2014, 95% in 2013, and over 90% in 2012 (Morrall et al, 2015; Morrall et al, 2014; Morrall et al, 2013). A cautious approach should be taken with disease management to avoid breakdown of resistance under tight rotations or conditions conducive to disease development.

Anthracnose and root rot were consistently observed in at least 2/3 of the lentil crops surveyed every year. Anthracnose reached a peak of prevalence in 2014, observed in 83% of lentil crops surveyed. Root rot was the most prevalent compared to other diseases in 2012-2013, as well as 2015, when it reached a peak in prevalence of 83% of lentil crops surveyed.

Anthracnose may not be highly transmitted from seed to seedling., and average levels of *Colletotrichum lentis* on seed were less than 0.3% in 2012, 2013, and 2014 seasons relative to this field survey. However, in 2012, only 71% of lentil seed samples were free of anthracnose in seed testing labs surveyed, which was lower than in the previous 10 years (Morrall et al, 2013). Similarly, only 78% of lentil samples were anthracnose-free in 2014. In this field survey, 2013 results showed the lowest prevalence of anthracnose (60% of crops surveyed), which also corresponded to the highest percentage of anthracnose-free samples (88%) reported by seed testing labs (Morrall et al, 2014).

Root rot has been a notable issue in pea and lentil crops in recent years, with a number of potential pathogenic causes (*Fusarium* spp. / *Pythium* spp. / *Rhizoctonia solani / Aphanomyces euteiches)* in addition to environmental stress due to excess moisture. *Aphanomyces euteiches* was reported for the first time in Saskatchewan in 2012, and was found in half of the lentil samples tested in 2014 (Armstrong-Cho et al, 2015; Armstrong-Cho et al, 2014; Banniza et al, 2103). Based on those reports, it is likely that some of the root rot observed in this field survey could be attributed to *Aphanomyces euteiches*; however no sampling or further testing was performed.

Sclerotinia stem and pod rot *(Sclerotinia sclerotiorum*), botrytis stem and pod rot / grey mould *(Botrytis cinerea),* and stemphylium blight (*Stemphylium* spp.) were present in less than half of the fields surveyed across the province every year with the exception of 2014, when sclerotinia stem and pod rot was observed in 56% of the lentil crops surveyed. Similarly low, percentages of *Botrytis*-free samples reported by seed testing labs were 45% in 2014, 65% in 2013, and 52% in 2012, and percentage of *Sclerotinia*-free samples was 49% in 2014 and 65% in 2013 (Morrall et al, 2015; Morrall et al, 2014; Morrall et al, 2013). While there was a relatively low prevalence of stemphylium blight in this survey, pulse growers continue to ask questions about the disease.

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Table 1. Prevalence of plant diseases in lentil crops surveyed in West-Central Saskatchewan, 2012-2015

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (17)	76	76	24	24	24	53
2013 (12)	83	83	42	33	17	50
2014 (15)	67	80	7	67	0	40
2015 (15)	87	73	0	0	0	40

Table 2. Prevalence of plant diseases in lentil crops surveyed in South-West Saskatchewan, 2012-2015

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (2)	0	0	100	0	0	0
2013 (16)	38	50	38	38	31	38
2014 (2)	100	100	0	0	0	0
2015 (0)	-	-	-	-	-	-

Table 3. Prevalence of plant diseases in lentil crops surveyed in South-East Saskatchewan, 2012-2015

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (9)	80	70	30	50	40	10
2013 (9)	89	44	0	22	33	11
2014 (0)	-	-	-	-	-	-
2015 (2)	6	11	0	6	11	11

Table 4. Prevalence of plant diseases in lentil crops surveyed in Saskatchewan, 2012-2015

Year (Number of Crops)	Percentage (%) of Lentil Crops Surveyed with Disease Symptoms					
	Root Rot	Anthracnose	Ascochyta Blight	Sclerotinia Stem and Pod Rot	Botrytis Stem and Pod Rot	Stemphylium Blight
2012 (28)	75	71	32	32	29	36
2013 (37)	65	60	30	32	27	35
2014 (18)	72	83	6	56	0	39
2015 (18)	83	78	0	11	17	50

CROP: Field pea (*Pisum sativum* L.)

LOCATION: Alberta

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TITLE: MICROORGANISMS AND THE OCCURRENCE OF ROOT ROT OF FIELD PEA IN ALBERTA IN 2015

ABSTRACT: Surveys were conducted from late July to mid-August, 2015 to determine the incidence and severity and causal microorganisms of root rot in pea crops in Alberta. A total of 63 crops were surveyed across seven counties, with 100 root samples collected per crop. Root rot occurred at all locations, with an average disease incidence of 85% and a range from 18% to 100%. Average disease severity was 1.6 on a scale of 0-4, and ranged from 0.2 to 3.6. Species of *Fusarium* were most commonly isolated from infected root tissue, followed by *Pythium* spp. and then *Phytophthora* spp. *Fusarium* spp. and *Pythium* spp. often co-existed in the infected root tissues of pea.

METHODS: Between July 27 and August 14, 2015, a total of 63 commercial field pea (*Pisum sativum* L.) crops across seven counties in Alberta were surveyed for the incidence and severity of root rot. The survey was conducted by inspecting five random sites along the arms of a ‘W’ sampling pattern in each crop. At each of the five sampling sites, 20 pea plants were randomly selected and carefully dug from the ground. Root rot incidence was recorded as the percent of symptomatic plants sampled within a field, while severity was rated on a 0-4 scale as described by Chang et al. (2013). Microorganisms were isolated from diseased roots according to the method of Chang et al. (2005). Cultures with similar colony morphology to *Phytophthora* spp. on potato dextrose agar plates were transferred to a selective medium designed by Dorrance et al. (2008) for confirmation.

RESULTS AND COMMENTS: Root rot occurred in all 63 pea crops surveyed, despite the dry weather conditions that prevailed during the growing season in 2015 (Table 1). The incidence of root rot was very high in the crops that were sampled in Lac Ste. Anne, Wheatland, Barrhead and Minburn counties, which ranged between 68 and 100% with a mean incidence of over 92%. Root rot incidence ranged from 18 to 96% with a mean of 72% in Sturgeon County. The incidence of root rot was somewhat lower in the crops that were surveyed in Willow Creek and Newell, ranging from 31-88% with a mean of 66%. Across all counties surveyed, the mean incidence was 85%. The mean severity of root rot was 1.6, and ranged from 0.2 to 3.6 among individual fields.

A total of 900 root samples were processed for pathogen isolation. Species of *Fusarium* were most commonly isolated from diseased pea roots collected from four counties, followed by *Pythium* spp. and *Phytophthora* spp. (Table 2). An equal number of mixed isolations of *Fusarium* spp. and *Pythium* spp. were obtained from the same root tissues of pea indicated the complexity of root rot in nature. Twenty-nine isolates of *Phytophthora* spp. were isolated from diseased root tissues. This is the first year in which the widespread occurrence of *Phytophthora* spp. has been observed. *Rhizoctonia solani* was only recorded in the county of Minburn at an incidence of 1%.

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Table 1. Occurrence of pea root rot in central and southern Alberta in 2015

County	No. of fields surveyed	Root rot incidence (%)		Root rot severity (0-4)	
		Range	Mean	Range	Mean
Newell	2	63-72	65	0.8-0.9	0.8
Sturgeon	13	18-96	72	0.2-2.0	1.9
Lac Ste. Anne	11	85-100	94	1.4-2.5	1.9
Wheatland	20	68-99	92	0.9-2.9	1.9
Willow Creek	7	31-88	67	0.5-1.8	1.1
Minburn	5	83-97	92	1.4-2.2	1.9
Barrhead	5	85-100	93	1.3-3.6	1.7
Total/Average	**63**	**18-100**	**85**	**0.2-3.6**	**1.6**

Disease incidence and severity were calculated based on 100 plants sampled per field.

Table 2. Incidence (%) of the microorganisms most commonly isolated from pea plants collected in Alberta in 2015 and showing symptoms of root rot.

County	Roots tested	***Fusarium* spp. (*F*)**	***Pythium* spp. (*P*)**	***F + P***	***Phytophthora* spp.**	***Rhizoctonia solani***
Newell	50	96	16	16	6	0
Willow Creek	350	76	15	15	3	0
Minburn	250	87	6	6	2	1
Barrhead	250	85	11	11	2	0
Total/Average	**900**	**83**	**11**	**11**	**3**	**0**

CROPS / CULTURES: Field pea (*Pisum sativum* L.)

LOCATION / RÉGION: Alberta

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TITLE / TITRE: SURVEY OF ROOT ROT IN ALBERTA FIELD PEA IN 2015

ABSTRACT: A total of 93 field pea crops were surveyed in Alberta for root rot and mycosphaerella blight. Root rot and mycosphaerella blight were present in all regions, and in 99% and 30% respectively of fields surveyed. Roots with symptoms of aphanomyces root rot were observed in all regions surveyed, but confirmation of the pathogen with PCR tests is ongoing. Root rot incidence and severity were lower in 2015 compared to 2014 for crops in east and west central 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 2015 (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, 93 pea fields were surveyed at flowering in July 2015 for above- and below-ground symptoms of root rot. Representative samples were collected from each field to allow the causal agents of disease to be isolated and identified.

Eight fields were surveyed in northern Alberta (north of Hwy 16), 30 in east-central Alberta (east of Hwy. 36 between Hwy 1 and Hwy 16), 31 in southern Alberta (south of Hwy. 1) and 25 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 presence and 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 4ºC 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). For isolation of *A. euteiches*, roots were plated onto cornmeal agar amended with metalaxyl, benomyl, vancomycin and amphotericin (7). *Fusarium* cultures isolated on APDA are currently being identified using cultural morphology characteristics and PCR with species-specific primers.

RESULTS AND DISCUSSION: All regions in Alberta received below-normal levels (40 – 85%) of precipitation from April to July (8). Field pea crops produced below average yields estimated at 2300 kg/ha (33 - 40 bushels/acre) (1, 9).

Root rot symptoms were found in 99% of pea crops surveyed. Disease incidences ranged from 12 to 100%, with means of root rot incidence and severity of 79% and 2.8, respectively (Table 1). In west-central Alberta, 96% of sample sites had root rot, and 76% of roots showed root rot symptoms. The mean severity in this region was 2.4. In the east-central Alberta, root rot was found at 98% of sites, and in 91% of roots, with a mean severity of 3.2, which was the highest of all regions. In southern Alberta, a mean root rot incidence of 86% was observed, 72% of roots had root rot and the mean severity was 2.9. Disease incidence and severity were lowest in the Peace River, where a mean root rot incidence of 91% was observed and 65% of roots had root rot with a mean disease severity of 2.3.

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. At the time this report was submitted, *F. avenaceum* and *F. solani* were the predominant species isolated from roots, and *Aphanomyces euteiches* was isolated from 5 fields. However, screening of root samples from fields with *A. euteiches* specific primers (10) was not yet complete, and ~40% of crops displayed root rot symptomology that was characteristic of *A. euteiches* infection. Root rot severity was much reduced in east and west central Alberta in 2015 compared to 2014, when conditions were wetter than average across Alberta (11). In southern Alberta, mean root rot severity was the same in 2014 and 2015, whereas in the Peace River root rot severity increased in 2015 compared to 2014. These results indicate that the impact of root rot on pea can be reduced in drier than normal environmental conditions.

Mycosphaerella blight was present in 30% of fields across Alberta with a mean site incidence of 21%. Mean disease scores for crops where mycosphaerella blight was present was 1.3, indicating that at the time of survey, mycosphaerella blight was primarily present in the lower to mid-canopy (Table 2). In east-central Alberta, mycosphaerella blight was observed in 60% of fields, with a mean disease score of 1.3 in crops where it was present. In southern Alberta, mycosphaerella blight was found in 15% of crops with an incidence and mean disease score of 36% and 1.8, respectively. The Peace River region had 38% of crops showing symptoms, and with a mean disease score of 1.0, when present. Mycosphaerella blight was lowest in west-central Alberta where it was only present in 4% of crops surveyed, with a mean disease score of 0.2.

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Table 1: Root rot prevalence, incidence and severity in 93 field pea crops in Alberta in 2015.

	Root rot prevalence (%)	Root rot incidence (%)	% roots with symptoms	Severity (1-7)	Severity Range
Northern AB	100	91	65	2.3	1.0 – 5.4
East-central AB	100	98	91	3.2	1.0 – 7.0
Southern AB	97	86	72	2.9	1.0 – 6.2
West-central AB	100	96	76	2.4	1.0 – 6.8
Total	99	93[1]	79[2]	2.8[3]	1.0 – 7.0

[1] standard error of the mean for root rot incidence = 0.8
[2] standard error of the mean for % root rot symptoms = 1.1
[3] standard error of the mean for disease severity = 0.04

Table 2: Mycosphaerella blight prevalence, incidence and mean disease score in 93 field pea crops in Alberta in 2015.

	MB prevalence (%)	MB incidence (%)	Mean disease score[1]
Northern AB	38	38	1.0
East-central AB	60	40	1.3
Southern AB	15	36	1.8
West-central AB	4	1	0.2
Total	30	21	1.3

[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

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TITLE: FIELD PEA DISEASE IN MANITOBA IN 2015

ABSTRACT: A total of 40 and 39 pea crops were surveyed in Manitoba for root and foliar diseases, respectively. Fusarium root rot was the most prevalent root disease and mycosphaerella blight the most widespread foliar disease throughout the province. Diseases less frequently observed included sclerotinia stem rot, anthracnose, downy mildew, rust, septoria leaf blotch and bacterial blight.

METHODS: Field pea crops were surveyed for root and foliar diseases at 40 and 39 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 over the last three years with approximately 20,000, 22,000 and 26,000 ha in 2013, 2014 and 2015, respectively (Manitoba Pulse and Soybean Growers 2015).

The survey of root diseases was conducted during late June to mid-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 each of the 40 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 40 pea crops were frozen for future PCR analysis of the root rot pathogens.

Foliar diseases were assessed during the last week of July and first week of August when most plants were at the intermediate to round pod stage. 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, downy mildew, rust, septoria leaf blotch, bacterial blight and downy mildew severity were rated as the percentage of foliar area infected.

RESULTS AND COMMENTS: Favorable weather and field conditions resulted in an early start to the 2015 growing season, followed by cool weather late in May and early June (Manitoba Agriculture, Food and Rural Development, 2015a; 2015b). Hot, humid weather in July advanced crops quickly, with scattered, isolated showers reported throughout the pea growing regions. Later in the summer, warm, dry weather conditions prevailed, with some early fields being harvested in mid-August with yields in the 40 to 65 bu/acre range. However, wet field conditions in some regions delayed harvest of pea crops (Manitoba Agriculture, Food and Rural Development 2015c).

Three diseases were identified based on laboratory assessment of the roots collected from the 40 pea crops (Table 1). Fusarium root rot was the most prevalent as in previous years (McLaren et al. 2014, 2015). The 39 crops from which *Fusarium* spp. were isolated had root rot severity ratings ranging from 1.2 to 6.9 with a mean of 3.0. The most predominant *Fusarium* species isolated in 2013, 2014 and 2015 was *F. acuminatum*. Rhizoctonia root rot (*Rhizoctonia solani*) was not detected in any of the crops sampled. Ten 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 detected in 30 of the 40 crops sampled for fungal isolation and identification.

Six foliar diseases were observed (Table 2). Mycosphaerella blight (*Mycosphaerella pinodes*) was the most prevalent, as in previous years (McLaren et al. 2014, 2015), 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 one crop only. The prevalence of sclerotinia-infested crops was 3% (1/39) in 2015 compared with 15% in both 2014 and 2013. Environmental conditions during the latter half of the 2015 field season were not as conducive to the development of sclerotinia stem rot compared with the previous two years and contributed to reduced disease risk. Downy mildew (*Peronospora viciae*) was detected in twenty (51%) of the crops surveyed with a mean disease severity of 0.1. Anthracnose (*Colletotrichum pisi*) and powdery mildew (*Erysiphe pisi*) were 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 in August on a few susceptible lines at AAFC-Morden, which suggests that there may have been crops in which powdery mildew developed after the survey. Rust (*Uromyces viciae-fabae*) was detected on three plants in one pea crop while septoria leaf blotch (*Septoria pisi*) was identified on one plant in a different pea crop. Bacterial blight (*Pseudomonas syringae* pv. *pisi*) was found in three (8%) of the crops with a mean disease severity of 0.2% leaf area infected.

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Table 1. Prevalence and severity of root diseases in 40 crops of field pea in Manitoba in 2015.

		Disease severity (0-9)[1]	
Disease	**Crops affected (%)**	**Mean**	**Range**
Fusarium root rot	98	3.0	1.2-6.9
Rhizoctonia root rot	0	0	0
Fusarium oxysporum	75	3.2	1.2-6.9

[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 39 crops of field pea in Manitoba in 2015.

		Disease severity (0-9 or % leaf area infected)[1]	
Disease	**Crops affected (%)**	**Mean**	**Range**
Mycosphaerella blight	100	5.4	3.2-7.7
Sclerotinia stem rot	3	0.1	0.1
Powdery mildew	0	0%	0%
Downy mildew	51	0.1%	<0.1-0.3%
Anthracnose	0	0	0
Rust	3	0.2%	0.2%
Bacterial blight	8	0.2%	<0.1-0.6%
Septoria leaf blotch	3	0.2%	0.2%

[1]Powdery mildew, downy mildew, rust, septoria leaf blotch and bacterial blight 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.

CROPS / CULTURES: Alfalfa (*Medicago sativa* L.), Dry bean (*Phaseolus vulgaris* L.), Faba bean (*Vicia faba* L.), and Lentil (*Lens culinaris* Medikus)

LOCATION / RÉGION: Alberta

NAMES AND AGENCY / NOMS ET ÉTABLISSEMENT:
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TITLE / TITRE: SURVEY OF ROOT ROT OF ALFALFA, DRY BEAN, FABA BEAN, AND LENTIL IN ALBERTA IN 2015

ABSTRACT: Fields of alfalfa, dry bean, faba bean and lentil were surveyed for root rot in 2015. Root rots were observed in 87.3% of fields with an overall average incidence of 57.5% and severity of 1.75 as estimated using a 1-7 disease rating scale. Lentils had the highest root rot incidence (91%) and severity (2.5) while alfalfa had the lowest (53% and 1.2, respectively). Below-average precipitation levels in most of Alberta in April – July, 2015 may have reduced the severity of root disease in some cases, but root rots were a major issue in a number of fields in 2015, particularly those of lentils and faba beans.

INTRODUCTION AND METHODS: The pea root rot pathogens, *F. avenaceum* and *Aphanomyces euteiches,* can have a broad host range within the legume family (Moussart et al. 2008; Holtz et al. 2012). Since 2013, root rots caused by these pathogens have become a severe problem for many Alberta pea producers (Chatterton et al. 2014; Chatterton et al. 2015). To assess the prevalence, incidence and severity of root rot in potential legume host crops, other than pea, fields of alfalfa, faba bean, dry bean and lentil were surveyed at flowering in July 2015 for symptoms of root rot. Representative samples were collected from each field to allow the causal agents of disease to be isolated and identified (not shown).

Seventeen alfalfa crops throughout Alberta, 15 dry bean and 19 lentil crops in southern Alberta, and 30 faba bean crops in central Alberta were surveyed. These regions represent the primary growing areas for each of these crops in Alberta. Fields that had a pea crop in their rotational history were preferentially chosen, when possible. Crops were evaluated at 10 sites per field along a U-shaped pattern, with a minimum of 20 m between sites. To assess disease, roots from 5-10 plants were dug up at each of the 10 sampling sites per field, bagged and stored at 4ºC 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) (Bilgi et al. 2008). Roots with a severity rating of 5, 6 or 7 were retained for pathogen identification using PCR with specific primers for *F. avenaceum* and *A. euteiches* (data not shown).

RESULTS AND DISCUSSION: All regions in Alberta received below-normal levels (40 – 85%) of precipitation from April to July (AAFC, 2015). Dry bean produced average yields of 3,100 kg/hectare, while faba bean and lentils produced below average yields of 2,600 and 1,390 kg/hectare, respectively (Statistics Canada, 2015).

In alfalfa crops, 22% of sampled sites had root rot, and 10% of roots had root rot with a mean disease severity of 1.2 (Table 1). In dry bean crops, 52% of sampled sites had root rot, and 35% of roots showed root rot symptoms with a mean severity of 1.6. In faba bean crops, root rot was found at 65% of sites, and in 42% of roots, with a mean severity of 1.7. In lentil crops, a mean root rot incidence of 91% was observed, 76% of roots had root rot and the mean severity was 2.5. Results indicate that these legume crops are not impacted by root rot to the same extent as field pea, except lentil, which showed similar root incidence and severity to field pea in 2015.

ACKNOWLEDGEMENTS: Funding for this project was 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, Brooke Groenenboom and Aaron Lorenz for technical assistance.

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Table 1: Root rot prevalence, incidence and severity in pulse and forage crops in Alberta in 2015.

	Root rot prevalence[1] (%)	Root rot incidence[2] (%)	Roots with symptoms[3] (%)	Severity[4] (1-7)	Severity Range
Alfalfa	53	22	10	1.2	1.0 – 3.2
Dry bean	100	52	35	1.6	1.0 – 3.8
Faba bean	96	65	42	1.7	1.0 – 6.0
Lentils	100	91	76	2.5	1.0 – 5.1
Average	87.3	57.5	40.8	1.75	n/a

[1] Prevalence is defined as: (# fields with root rot ÷ total fields) x 100.
[2] Incidence is defined as: (# sampling sites with root rot ÷ total sampling sites) x 100.
[3] Roots with symptoms is defined as (# roots with root rot ÷ total number of roots) x 100.
[4] Severity is estimated using a 1-7 rating scale previously described by Bilgi *et al,* (2008).

CROP: Soybean (*Glycine max* (L.) Merr.)

LOCATION: Southern Alberta

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TITLE: THE OCCURRENCE OF SOYBEAN ROOT ROT IN SOUTHERN ALBERTA IN 2015

ABSTRACT: A survey was conducted in August 2015 to determine the incidence and severity of root rot in soybean crops in southern Alberta. A total of 41 crops were surveyed across nine locations with 100 root samples collected per field. Root rot occurred at all locations with an average incidence of 81%, and ranged from 33% to 100% and with an average severity of 1.4, ranging from 0.9 to 2.6 on a scale of 0-4. Nodulation also was assessed on a scale of 0-4 and averaged 1.6 with a range of 0.3-3.1.

INTRODUCTION: Soybean (*Glycine max* L.) has great potential as an alternative crop in western Canada (3). In southern Alberta, the area seeded to soybean increased from a few hectares to about 4,050 ha. in 2014, and it is expected to continue to increase as early maturing and cold-resistant cultivars become available. However, root rot is a common constraint in crop production, and its occurrence was documented in all 29 soybean crops surveyed in southern Alberta in 2014 (Fig. 1.) (2, 4). Root rot reduces plant stand, directly impacting productivity, and also allows competitive weed species to outgrow the crop. A survey was conducted in August 2015 across southern Alberta in order to assess the occurrence of root rot and its impact on soybean crops.

METHODS: The survey was conducted over the period of August 17-23, 2015, when soybean crops were at the pod set to early pod filling stages. Root samples were collected from 41 crops in nine locations of southern Alberta (Bow Island, Brooks, Drumheller, Lethbridge, Medicine Hat, Seven Persons, Taber, Tilley and Vauxhall) (Fig. 2). The samples were collected from five points in each crop along W-shaped transects. Twenty plants were dug at each sampling point for a total of 100 root samples per crop. Plants were also collected outside the sampling points (primarily in low lying areas of the field), where the crop canopy was 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 coolers 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. In the laboratory, the roots were gently washed under running water and then visually rated for root rot incidence and severity and nodulation on the 0-4 scale described by Nyandoro et al. (5). Microorganisms were isolated from infected root tissues using the method described by Chang et al. (1).

RESULTS AND DISCUSSION: Root rot was observed in all 41 crops sampled, at a high incidence in most fields. Disease severity varied with the crop. Mean severity was highest (1.9) at Taber and lowest (0.6) at Tilley (Table 1). Root nodulation was low to moderate in most fields. Overall, root rot disease incidence and severity in the surveyed locations was higher in 2015 than in 2014 (5), but nodulation was lower. This suggests that high disease pressure reduced nodulation in soybean. The great majority of microorganisms isolated from roots exhibiting symptoms of root rot consisted of *Fusarium* spp., followed by *Pythium* spp. and then *Rhizoctonia solani* (Table 2). There was a considerable amount of combined infection caused by *Fusarium* spp. and *Pythium* spp. in the infected soybean roots obtained from crops near Lethbridge and Brooks. Root rot caused extensive stunting and mortality of the soybean seedlings in some low lying areas of the fields; this allowed the growth of weeds such as kochia [*Kochia scoparia* (L.) Schrad.]. Low crop density and increased weed competition reduced yield to near zero in affected areas (Fig.1.) (Patrick Fabian, personal communication).

ACKNOWLEDGEMENTS:
This survey was financially supported by the Growing Forward 2 Program, the Government of Alberta, and the Manitoba Pulse Growers Association. We gratefully acknowledge Mr. Patrick Fabian from Fabian Seed Farms Inc., Tilley, AB for providing contact information for growers and information on field locations. We also acknowledge the support provided by staff from the Crop Diversification Centre North in Edmonton and the Crop Diversification Centre South in Brooks.

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Table 1. Root rot incidence, severity and nodulation in 41 soybean crops in southern Alberta in 2015.

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	7	57-100	84	0.6-2.1	1.4	0.7-3.1	1.9
Brooks	10	63-100	83	0.8-2.2	1.4	0.5-2.1	1.1
Drumheller	1	-*	55	-	1.1	-	1.6
Lethbridge	2	70-93	81	0.8-1.3	1.0	0.9-1.1	1.0
Medicine Hat	10	85-100	95	1.3-2.6	1.8	0.3-2.7	1.7
Seven Persons	4	69-99	85	0.9-1.9	1.3	1.4-2.7	2.2
Taber	2	88-98	93	1.6-2.2	1.9	1.4-2.0	1.7
Tilley	4	33-63	44	0.4-0.9	0.6	1.1-2.3	1.5
Vauxhall	1	-	81	-	1.2	-	1.1
Total/Average	**41**	**33-100**	**78**	**0.4-2.6**	**1.3**	**0.3-3.1**	**1.5**

* Data not available.

Table 2. Incidence (%) of microorganisms most commonly isolated with roots of soybean plants collected in southern Alberta in 2015 and exhibiting symptoms of root rot.

Location	No. of plants sampled	Isolation of microorganisms (%)						
		Fusarium* spp. *(F)	***Pythium* spp. *(P)***	***Rhizoctonia solani (R)***	***F + P***	***F + R***	***P + R***	***F + P +R***
Bow Island	140	86	37	3	29	1	1	0
Brooks	238	87	41	4	35	4	1	1
Drumheller	20	95	15	0	15	0	0	0
Lethbridge	40	90	88	3	78	3	0	0
Medicine Hat	200	91	24	12	19	9	1	0
Seven Persons	80	90	33	0	29	0	0	0
Taber	40	95	25	8	23	8	0	0
Tilley	81	85	7	0	7	0	0	0
Vauxhall	20	95	0	35	0	35	0	0
Total/Average	**859**	**90**	**30**	**8**	**26**	**7**	**0.3**	**0.1**

Figure 1. Soybean plants affected by severe root rot in low lying areas under a flooding irrigation system near Brooks. Reduced plant stands facilitated invasion of the field by weeds such as kochia (right).

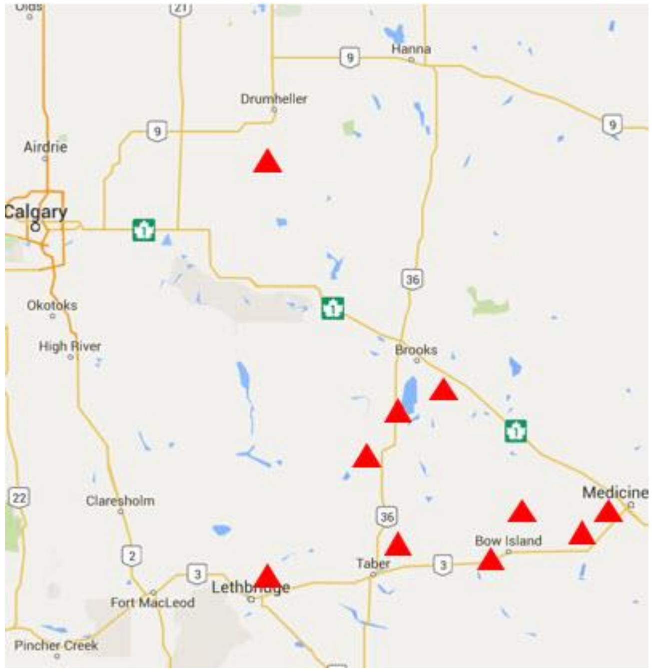

Figure 2. Map showing the approximate locations of the surveyed soybean crops in southern Alberta in 2015.

CROP: Sunflower

LOCATION: Manitoba

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TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2015

ABSTRACT: A survey of 28 sunflower crops in Manitoba in 2015 revealed that verticillium wilt was the most prevalent disease in 96% of the crops, followed by rust in 71%, sclerotinia wilt/basal stem rot in 71%, sclerotinia head rot in 32%, and downy mildew in 29%. Disease severity ranged from low to moderate with no severe epidemics.

METHODS: Twenty-eight sunflower crops were surveyed in 2015 in Manitoba. Seventeen crops were surveyed in the third week of August and 11 in the first 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, seven samples of diseased sunflower plants were submitted by the National Sunflower Association of Canada from crops that were surveyed early in the season for downy mildew infections alone. Samples were collected for race identification. Twenty-one samples of sunflower plants were submitted for analysis to the Crop Diagnostic Centre of Manitoba Agriculture, Food and Rural Development by agricultural representatives and growers.

RESULTS AND COMMENTS: Eighty-six of the sunflower crops surveyed in 2015 had excellent to good stands, but only 68% had good vigor, and the rest had fair to poor vigor. Only 71% of the sunflower crops were early maturing, and the remaining 29% were late to very late (Table 1). The crops surveyed were split 79%:21% between confectionery and oilseed hybrids, thus showing an increase in the confection acreage in 2015 in comparison with previous years (1, 2, 3).

The 2015 growing season started with normal soil moisture and temperature conditions, and this contributed to an increase in area seeded to sunflower in Manitoba (~50,000 ha in 2015 in comparison with 35,000 ha in 2014, according to Statistics Canada). Growing conditions were relatively normal throughout the growing season with dry weather in August. These conditions resulted in relatively low disease incidence and severity, similar to 2014 but lower than in the previous years (1, 2, 3). The dry conditions in August and the lack of an early frost resulted in lower disease levels than usual and provided a long season and good yields in most sunflower crops.

Sclerotinia wilt/basal stem rot was present in 71% of the crops surveyed in 2015, 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 32% of infested crops. The prevalence and incidence of head rot in 2015 were low in comparison with the 10 previous years (1, 2, 3, 4).

Rust was present in 71% of the crops surveyed, with severity ranging from trace to 5% leaf area affected in most fields but as a high as 40% leaf area affected in a few crops (Table 1). Rust infections started relatively late in 2015 and did not develop rapidly in most of the crops surveyed. Preliminary analysis of the rust isolates collected indicates the prevalence of races 777, 775, and 377 of *P. helianthi*, which are virulent on most commercial sunflower hybrids. Rust incidence and severity in 2015 were similar to 2012-2014, record low years for rust epidemics (1, 2, 3), These were probably due to late onset of infection and dry weather and normal temperatures in August. However, a major shift to the highly virulent race 777 was observed in 2015.

Verticillium wilt was present in 96% of the crops surveyed in 2015 with traces to 5% severity in the oilseed hybrids, and 10-40% severity in the confection sunflower hybrids (Table 1). The incidence and severity of verticillium wilt were higher in 2015 than in 2014 and previous years (1, 2, 3).

Downy mildew was at a record low in 2015 and observed in only 29% of crops with incidence ranging from trace to 5% (especially in the seven crops surveyed early in the season for downy mildew) (Table 1). Preliminary analysis of isolates collected indicates the predominance of races 732,722, and 332. Fifty percent of the downy mildew isolates collected in 2015 are either insensitive or partially insensitive to metalaxyl seed treatment, similar to levels reported in previous years (1, 2, 3). Downy mildew was less prevalent in 2015 than in 2014 and was at trace levels in most crops due perhaps to normal soil moisture from the seedling stage through the rest of the growing season, and the wide use of downy mildew- resistant hybrids (1, 2, 3).

Traces to 5% leaf area infected by *Septoria helianthi* were observed in 14% 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 5% of stem lesions caused by *Phoma* and *Phomopsis* spp. were present in 40% of the crops in 2015, similar to 2014-2012 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 a few crops. Infestations at trace to 1% levels with sunflower midge (*Contarinia schulzi*) were encountered in 21 of the crops. Traces of infestation with grasshoppers were observed in a few crops. Moderate infestations by green aphids (*Aphis sp*.) were encountered in 54% of the crops.

All seven diseased sunflower samples submitted by the NSAC were identified to be infected with downy mildew. Of the 21 samples received by the MAFRD Crop Diagnostic Centre in 2015, four were affected by fusarium root rot, one with pythium root rot, two by alternaria leaf spot, two by phomopsis stem canker, one erwinia bacterial rot, one by sclerotinia head rot, one by sclerotinia stalk rot, two by environmental injury, and seven with herbicide injury.

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Table 1. Prevalence and indeces of diseases in 28 crops of sunflower in Manitoba in 2015, seven 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	20	71%	1.3	1 – 2
Sclerotinia head rot/stem rot	9	32%	1.1	T - 1
Verticillium wilt	27	96%	1.7	T – 3
Downy mildew	8	29%	1.6	T – 2
Rust	20	71%	2.2	1 – 4
Leaf spots (*Septoria* & *Alternaria*)	4	14%	1.0	T – 1
Stem lesions (*Phoma* & *Phomopsis*)	13	40%	1.0	T – 1
Lateness[2]	8	29%	2.3	1 – 3
Poor Stand	4	14%	1.9	1 - 3
Poor Vigour	9	32%	2.3	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

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TITLE / TITRE: DISEASES OF GARLIC AND ONION IN ALBERTA IN 2015

ABSTRACT: A survey of garlic and onion diseases was done in Alberta in 2015. This represents the third and final year of a three-year surveillance project. Plant and soil samples were collected from five garlic and ten onion crops in Alberta in 2015. In total, 7 garlic and 21 onion plants were evaluated. Nine phytopathogenic fungal genera and one phytoplasma were detected on symptomatic plants. Bacterial soft rot was noted, but causal agents were not identified. Plant and soil samples were also sent for characterization of plant parasitic nematodes, if present.

INTRODUCTION AND METHODS: Alberta garlic and onion production is mainly comprised of many, small,(less than 1 ha), plantings in market gardens that supply local fresh market consumption and large-scale commercial production under irrigation in southern Alberta. These crops represent significant income to producers, regardless of the size of the operation. A number of fungal diseases, have been observed in Alberta plantings in previous years (Harding et al., 2014, 2015).

For the present survey, garlic and onion samples were either contributed by growers or collected by surveyors. Between one and eight plant/soil samples (whole plants plus 500-g of soil) were collected or received from each field, totalling 16 samples from five garlic fields and 46 samples from ten onion fields. The samples were collected or received from June through early August, 2015 from the fifteen locations shown in Fig. 1. Due to growing conditions in southern and central Alberta in 2015, and a desire to avoid post-harvest storage issues, harvesting of garlic was performed by several growers two to three weeks earlier than in previous years. As a result, fewer garlic fields were available for surveillance of early August and additional onion fields were sampled in their place.

All samples were inspected for disease symptoms and nearly all showed discolorations on above- or below-ground parts. Plants collected were often stunted or unthrifty. Damage to the bulb or basal plate was also observed in most samples. Symptomatic tissues were evaluated using a binocular stereomicroscope at 80x for signs of fungi. Additionally, symptomatic tissues were surface sterilized in 1% NaOCl, rinsed in sterile water and placed in humid chambers. Humid chambers were prepared by encapsulating surface sterilized tissue along with moistened paper towels with a sealed, air-filled plastic bag. Chambers were incubated at room temperature for at least 10 days to encourage growth of microorganisms. Fungi found growing out of symptomatic tissues were collected using one-sided transparent Scotch® tape and transferred to sterile water on a glass microscope slide and visualized with a phase contrast microscope at 400x. Identifications of plant pathogenic fungi were made to the genus level based on morphology of spores and associated structures. Detection of aster yellows phytoplasma (*Candidus* Phytoplasma asteris) was performed using a nested PCR method adapted from E. Boudon-Padieu et al. (2003).

RESULTS AND DISCUSSION: Nine phytopathogenic fungi were seen on garlic and onion in Alberta in 2015, namely *Alternaria* sp., *Arthrobotrys* sp., *Botrytis* sp., *Embellisia allii* (Campanile) E.G. Simmons), *Fusarium oxysporum* f. sp. *cepae* (H.N. Hans.) W.C. Snyder & H.N. Hans, *Fusarium* spp. *Penicillium* spp., *Rhizoctonia solani* Kühn, *Sclerotium cepivorum* Berk, and *Stemphylium* sp. (Table 1).

Fusarium basal plate rot is a very common disease on both onion and garlic in Alberta (Harding et al., 2014, 2015) and signs of *Fusarium* spp. were found at 80% and 50% of garlic and onion field locations, respectively. *Penicillium* spp., the causal agent of penicillium decay in stored bulbs, occurred at nine of the fifteen locations and was identified in 60% of samples. *Rhizoctonia solani* was also found at nine locations, more commonly in onion fields. Embellisia skin blotch, which was reported in Alberta for the first time in 2012, was also common as *E. allii* was observed on symptomatic tissues from five of the fifteen locations and on 60% and 20% of garlic and onion samples, respectively. *Botrytis* sp. was not found in garlic crops, but was found in two of the ten onion fields. White rot, caused by *S. cepivorum*, is a regulated pathogen, named in Alberta's *Agricultural Pests Act and Regulation*s and was detected in one garlic field in 2015. This was the second case of white rot in three years in Alberta as it was also found at one location in 2013 (Harding et al., 2014).

Although a species of the genus *Stemphylium* was identified from a single onion bulb, above-ground symptoms of *Stemphylium* leaf blight, caused by *Stemphylium vesicarium* (Wall.) Simmons, were not observed. Since 2010, this disease has had a significant economic impact on onion production in Ontario (Tesfaendrias et al., 2014), but was not reported in Alberta in 2013, 2014 or 2015 (Harding et al, 2014; Harding et al, 2015; Table 1). Other fungi reported at low or trace levels were *Alternaria* sp. and *Arthrobotrys* sp.

Aster yellows was a common problem throughout Canada on many crops in 2012 and the disease appeared to carry over into the 2013 garlic crop in Alberta as it was detected in all five samples tested in 2013 (Harding et al., 2014). It was again detected in garlic and onions in Alberta in 2014, but only in four of ten locations (Harding et al., 2015). In 2015 it appeared in four of the fifteen locations and in 40% of garlic and 20% of onion samples, respectively. (Table 1). These results indicated that while aster yellows was a significant problem in 2013 Alberta garlic plantings, the prevalence and incidence of this disease in Alberta has dropped significantly over the subsequent two years.

Soft-rotting bacteria were common on onion samples from 50% of locations, but were not observed in garlic samples. Bacterial species 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 plants and soil were performed. Results of the nematode analyses will be presented in a separate report.

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Table 1. Presence of nine fungal pathogens and the aster yellows phytoplasma on garlic (upper rows) and onion samples (lower rows) collected from fifteen locations in Alberta in 2015.

Location	Crop	ALT[1]	ART	AST	BOT	EMB	FUS	PEN	RHIC	ROT	SCL	STM
1	Garlic	nt[2]	nt	nt	nt	nt	nt	nt	nt	nt	+	nt
6	Garlic	-	-	-	-	-	+	+	-	-	-	-
7	Garlic	-	+	+	-	+	+	-	+	-	-	-
8	Garlic	-	-	-	-	+	+	+	-	-	-	-
11	Garlic	-	-	+	-	+	+	+	+	-	-	-
		0	1	2	0	3	4	3	2	0	1	0
Location	**Crop**	**ALT[1]**	**ART**	**AST**	**BOT**	**EMB**	**FUS**	**PEN**	**RHIC**	**ROT**	**SCL**	**STM**
2	Onion	-	-	+	-	-	+	+	-	-	-	-
3	Onion	-	-	-	-	-	-	-	+	-	-	-
4	Onion	-	-	-	-	-	+	+	+	-	-	-
5	Onion	-	-	-	+	-	-	+	+	+	-	-
9	Onion	-	-	-	-	-	+	+	+	+	-	+
10	Onion	-	-	-	-	-	-	+	+	-	-	-
12	Onion	+	-	-	-	-	+	+	-	+	-	-
13	Onion	-	-	-	-	+	+	-	+	-	-	-
14	Onion	-	-	-	-	+	-	-	+	+	-	-
15	Onion	-	-	+	+	-	-	-	-	+	-	-
		1	0	2	2	2	5	6	7	5	0	1

[1] Key to abbreviations: ALT = *Alternaria* sp.; ART = *Arthrobotrys*; AST = aster yellows phytoplasma; BOT = *Botrytis* sp.; EMB = *Embellisia allii*; FUS = *Fusarium* spp.; PEN = *Penicillium* spp. (?); RHIC = *Rhizoctonia solani*; ROT = Bacterial soft rots; SCL = *Sclerotium cepivorum*.
[2] not tested

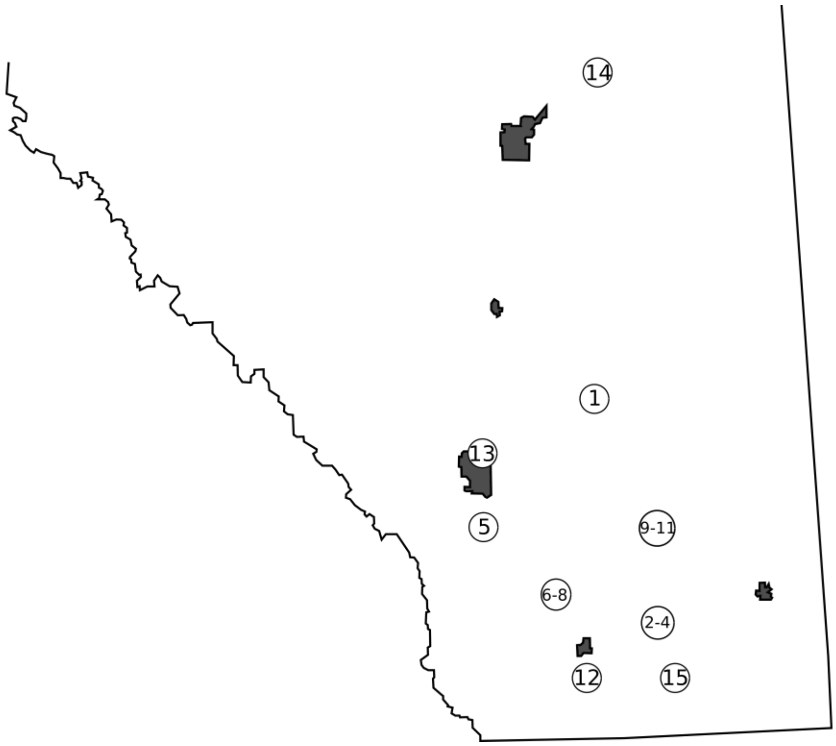

Figure 1. Garlic and onion sampling locations in Alberta in 2015

LIST OF CPDS AUTHORS IN ALPHABETICAL ORDER

List of figures (2015)