Cor6-2011 - Disease Survey of Seed Corn and Commercial Corn in Ontario and Quebec (2010)

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Disease Survey of Seed Corn and Commercial Corn in Ontario and Quebec (2010)

Purpose:

Ontario is a world-class producer of seed corn, due to the region's exceptional combination of climate, soils, production expertise and infrastructure. As with other production areas, the competitive nature of the North American seed corn industry has had a significant impact in Ontario and the industry has gone through significant changes in recent years and unfortunately challenges to the industry will remain. However, problems in seed corn production in the United States during 2011 growing season highlights the importance of maintaining a healthy Ontario seed corn industry. Production of seed in the province enhances or increases the regional diversity of the seed corn production system in North America which is critical to meeting corn seed supply requirements in the future. Environmental concerns with nutrient and pest management and competition for land base with other rotational crops are part of these production challenges.

One advantage the Ontario seed corn industry possesses is “quality”. Maintaining our productivity and quality under variable growing conditions in the future is critical to the ongoing viability of the Ontario industry. There are many yield limiting factors such as diseases and understanding these factors are critical to the future health and growth of the seed corn industry in Ontario. An enhanced understanding of the barriers to yield and the compensatory management techniques for Ontario seed corn production is key to a sustainable and dependable Ontario seed corn and commercial corn production industry.

With the potential expansion of corn acres in Ontario and other areas within North America the increase in disease and insect pests will only increase with a reduction of rotation crop alternatives. The information obtained on disease and insect impacts in Ontario seed corn and commercial corn fields will assist both private and public breeders in hybrid development which will help meet this challenge and potentially reduce loses to diseases and other pests.

Methods and Materials:

From September 7 to September 22, 2011, a corn pest survey was conducted in Ontario and Qu9bec. As in previous years, the emphasis of this years survey was to determine the distribution and severity of corn diseases including northern leaf blight (*Exserohilum turcicum*), anthracnose leaf blight (*Colletotrichum graminicol*a), gray leaf spot (*Cercospora zeae-maydis*), common rust (*Puccinia sorghi*), eyespot (*Aureobasidium zeae*), common smut (*Ustilago maydis*), head smut (*Sporisorium holci-sorghi = Sphecelotheca reiliana*), ear rot (*Fusarium spp*.), stalk rot (*Fusarium spp*., and *C. graminicol*a), Stewart’s wilt (*Pantoea stewartii = Erwinia stewartii*). Additional information was collected on insect pests such as European corn borer (*Ostrinia nubilalis*), corn rootworm (*Diabrotica longicornis* and/or *D. virgifera*), and corn flea beetle (*Chaetocnema pulicaria*) as well as any new diseases or insects pests to Canada such as Goss’s Wilt ((*Clavibacter michiganensis* subsp. *nebraskensis = Corynebacterium michiganense* pv. *nebraskense*), Phaeosphaeria leaf spot (*Phaeosphaeria maydis)* and others,.

A total of 165 fields were surveyed (120 in Ontario and 45 in Québec) and at each location, the incidence of each pest and the severity of the predominant pests were recorded. Seven Stewart's wilt-like leaf samples were collected during this survey from Southern Ontario. An additional four corn seedling samples were collected earlier in the growing season. ELISA tests on these 11 samples for the pathogen *P. stewartii* (Stewart's wilt) were conducted at the AAFC Central Experimental Farm laboratory in Ottawa using the reagent sets, protocols, and antibodies provided by AGDIA Inc. (Elkhart, Indiana 46514, USA).

Results:

Fungal leaf diseases:

Northern leaf blight (NLB) was detected in 115 fields in Ontario and 42 fields in Québec. As was the case in previous years, NLB was the most common leaf disease in Canada in 2011. The ubiquitous distribution of NLB is reflected in the fact the disease was not detected in only 8 of the corn fields surveyed (Table 1). In Ontario 39 fields were determined to have intermediate to severe NLB infection, including 10 seed corn fields, 13 commercial corn fields with very severe infections in Chatham-Kent, Huron, Elgin, Oxford, Wellington, Dufferin, Leeds and Grenville, Renfrew, Ottawa-Carleton, and Stormont, Dundus & Glengary counties, ON. In Quebec 14 commercial grain corn fields with intermediate and severe severity were observed, including 6 fields with very severe NLB in Vandreuil-Soulanges, Haut Richelieu, D'Acton, Nicolet-Yamaska, and Agenteuil counties, QC.

In the Ontario Corn Committee (OCC) Performance Trials in Ridgetown, West Lorne, Exeter, Blyth, Dublin, Alma, Ottawa, Winchester, Pakenham, and Lancaster, some hybrids were moderately susceptible to NLB, whereas in Belmont and Orangeville OCC trials, some hybrids expressed moderate to highly susceptible reactions to NLB. Both resistant and susceptible lesions of NLB were observed at 27 fields in Ontario and 7 fields in Québec, some even on the same leaf. This again indicates different pathogenic races exist in both Ontario and Québec. Although the inclusion of a NLB resistance gene did not eliminate the disease in these plants, it was however beneficial since disease development and premature plant death (senescence) was delayed even in severely infected plants. We revisited two locations in Ontario (Elgin and Stormont, Dundus & Glengary) which had severe NLB epidemics in 2010. At both of these locations an area of 10 hectares or more were dead due to NLB at the survey time in 2011.

Anthracnose leaf blight (ALB) was found in 92 fields in Ontario and 35 in Québec (Table 1). Overall, ALB was not as important as in previous years but this may be partly the result of the delayed 2011 season. Some hybrids at the Pakenham OCC trial location expressed moderate susceptibility to NLB whereas only one hybrid in Orangeville OCC trial was found to be highly susceptible to ALB.

Typical symptoms of gray leaf spot (GLS) were found in 76 fields in 13 counties of Ontario and 1 field in 1 county in Québec (Table 1). Some hybrids expressed intermediate susceptible to GLS at Tilbury, Ridgetown, Kerwood, and Woodstock OCC trial locations. In four seed corn fields, female inbred lines were found to be moderately to highly susceptible to GLS. A few leafy silage corn hybrids in Oxford County showed susceptibly to GLS. Since 2004, GLS continues to not only spread in Ontario each year but in many incidences has become the predominant leaf disease in many fields. This survey confirms pervious detections of gray leaf spot in the province of Quebec.

Common rust was found in 101 fields in Ontario and 41 fields in Québec (Table 1). As in 2010, Southern Ontario had more common rust than in Eastern Ontario and Québec. There were 20 fields, including 3 seed corn fields displaying intermediate to high severities in Southern Ontario. There were 2 and 9 fields had intermediate common rust in Eastern Ontario and Québec respectively, in 2011. Southern rust (*Puccinia polysora* Underw.) was not found in 2011.

Eyespot was again a common leaf disease in 2011 and was found in 118 fields (74 in Ontario and 44 in Québec (Table 1)). Twenty-four fields had intermediate severities to Eyespot, including 4 in Southern Ontario, 8 in Eastern Ontario, and 12 in Québec. Some hybrids were found to be moderately susceptible to eyespot at Orangeville, Ottawa, Winchester, and Lancaster OCC trial locations.

Brown spot (Physoderma maydis) was found on sheath or leaves everywhere in both Ontario and Québec; however, leaves were still alive even at the survey time. Fusarium sheath rot was found often, especially on secondary ears leaves which resulted in the leaf dieing prematurely. Phaeosphaeria leaf spot (PLS), a new leaf disease to Canada which is caused by *Phaeosphaeria maydis*, was found in 8 fields in Ontario (including 6 OCC trials) and 5 fields in Québec during the 2011 survey. At each location the incidence was low with only a few plants showing typically symptoms (round or elongated spot surrounded by dark brown margins). Northern leaf spot, a disease found in 2010, was not found in 2011.

Fungal Ear and Stalk diseases:

Common smut was distributed across 86 fields in Ontario and 25 fields in Québec in 2011 (Table 1). The disease was most problematic in southwestern Ontario with the greatest incidence (5-50%) being 5 seed corn fields in which gall formations on female inbreds were common on stalks, tassel, or ears. There are significant differences in female inbred susceptibility to common smut. Four grain corn fields in Southern Ontario and three grain corn field in Eastern Ontario had 1 - 30% incidence as well. In Quebec common smut was difficult to find as illustrated by the fact no field in the province had greater then 1% common smut. Head smut was found in 3 fields in Eastern Ontario with one in particular (Ottawa-Carleton) having a 10 - 70% incidence which occurred on various different genotypes and throughout the field. Five fields in Québec had a low incidence (<1%) of head smut in 2011. One plant with four ears, three of them were head smutted, but one of them had kernels and no disease which indicates head smut could be partially systemic transmitted in the plant.

Gibberella/Fusarium/Penicillum ear rots were observed in 71 fields in Ontario and 35 fields in Québec (Table 1). Incidence in seed corn field ranged from 5% incidence to 90%. Three grain corn fields found with incidence up to 60% with multiple pathogens (Fusarium, Penicillum, and others) being present. As expected, there is variation in hybrid genetic resistance or partial resistance to ear rots as was found at the OCC trials in Tilbury, Kerwood and Wingham where many of the hybrids were shown to moderately to highly susceptible to ear rot. Sprouting of corn kernels occurred on many rotted ears with high ear moisture. Overall, the incidence of ear rot in 2011 was the highest since 2006 in Ontario. No severe ear rot was found in Québec in 2011. As in previous years, many ears had black mold /spores (Cladosporum, Alternaria, others) on kernels as a result of bird and insect damage.

As expected with saturated soil conditions this spring and the delay in planting resulted in ideal conditions for Crazy Top (*Sclerophthora macrospore*) infection and subsequent systemic spread within the plant. Two fields in the Chatham-Kent area with incidences up to 19% were the most problematic with typical symptoms of Crazy Top on infected plants including multiple ears (barren), distorted leaves, long husk leaves, etc as well as common smut on diseased tassels.

Stalk rot, including Anthracnose stalk rot/top-die back, *Fusarium* stalk rot, and *Pythium* stalk rot were found in 86 fields in Ontario and 43 fields in Québec (Table 1). Fourteen in Ontario and 16 fields in Québec had severe top-die back with 60-100% incidence. *Pythium* stalk rot, also called early death, was detected more frequently in 2011, especially in Québec. The incidence of Pythium stalk rot up to 30% was found in one field in Ontario and 6 fields in Québec. Those fields were low lying and were flooded by rainfall at the early maturity period from middle August to middle September.

Bacterial diseases:
In 2010, no typical Stewart's wilt symptoms were detected. All 11 samples tested were negative for *P. stewartii* by ELISA test. The populations of Corn flea beetle (CFB) were lower during 2011 in Southern Ontario than in 2010.

No Goss's bacterial wilt (*Clavibacter michiganensis* subsp. *nebraskensis* = *Corynebacterium michiganense* pv. *nebraskense*) symptoms were observed in 2011. Goss's wilt continues to spread in the US corn belt and has recently been confirmed in the nearby states of Michigan and Indiana.

Viral diseases:
One viral disease-like Maize Dwarf Mosaic plant was observed at the survey time in southern Ontario; however, ELISA test was not applied.

Others:
As in other years, bird and other animal damage were severe in many fields in both Ontario and Québec. Hail damage was observed in numerous locations in both Ontario and Québec in 2011. An early frost occurred on September 17, 2011 in Eastern Ontario and Quebec whereas in other parts of Ontario a significant frost did not occur until October 28, 2011.

Summary:
Environmental conditions from June through to October although favourable for crop development with warm temperatures and frequent precipitation also promoted certain corn diseases in 2011 such as northern leaf blight and gray leaf spot. Ninety-five percent of corn fields surveyed had northern leaf blight, including 20 severely infected fields in 15 counties in both Ontario and Québec made 2011 an epidemic year for NLB again. Gray leaf spot continues to increase and is now epidemic are being observed in Southern Ontario especially in seed corn fields. Common smut infection especially on seed corn fields in Southern Ontario were frequent as was head smut found in Eastern Ontario and Québec in 2011. Ear rots including Gibberella were at the highest levels since 2006 in Ontario. Pythium stalk rot was another disease which was favoured by the the environmental conditions this summer. Anthracnose leaf blight, rust, and eyespot were less important diseases in 2011. Stewart's wilt and Goss's wilt were not found in 2011.

European corn borer, corn rootworm, grasshopper, and mites were less problematic in 2011 in both Ontario and Québec.

Next Steps and Acknowledgements:

Plans for 2012 are to continue with the disease survey. This survey was supported in part by the Seed Corn Growers of Ontario which obtained funding through the Farm Innovation Program (a component of Growing Forward) which is administered by the Agricultural Adaptation Council in Guelph. We would also like to thank our grower co-operators and the following seed corn companies (Dow (Hyland), Maizex, Pioneer Hi-Bred and Pride) for their financial support and access their fields.

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(**Captions for Table 1**)
Rust = common rust. GLS = Gray leaf spot. ALB = Anthracnose leaf blight, NLB = northern leaf blight, NLS = northern leaf spot, Smut = Common smut. Ear rot: including Gibberella ear rot and Fusarium ear rot. Stalk rot: including Fusarium stalk rot, Pythium stalk rot, Anthracnose stalk rot, and top-die back. ECB = European corn borer. CRW = Corn rootworm, including both western and northern corn rootworm.

Table 1: Distribution of disease in corn fields in Ontario and Québec in 2011

County	# of Fields	NLB	ALB	GLS	RUST	Eyespot	PLS	Smut	Head smut	Ear rot	Stalk rot
Ontario											
Bruce											
Chatham-Kent	35	35	30	35	29	12		26		18	16
Duffrin	3	3	3		3	3	1	2		6	3
Elgin	6	6	4	6	6	2		4		3	5
Essex	5	5	3	5	3	1		5		3	3
Frontenac	2	1	2			2		1		1	2
Huron	7	7	5	3	7	5	3	5		3	6
Lambton	2	2	2	2	2			2			
Lanark	4	2	3		3	4		2		2	4
Leeds & Grenville	4	3			2	4		1		2	4
Middlesex	7	7	7	7	7	4	1	6		5	6
Norfolk	2	2	2	1	2	2		1		1	2
Ottawa-Carleton	6	6	4	2	6	6		5	2	5	6
Oxford	9	9	6	7	8	4	1	7		6	6
Perth	4	4	4	1	4	2		3		2	3
Prescott & Russel	2	2	1		2	2		2		1	2
Renfrew	8	7	5		5	8		3	1	2	5
Stormont, Dundus & Glengary	7	7	4	3	5	7	2	4		5	6
Waterloo	1	1	1	1	1	1		1		1	1
Wellington	6	6	6	3	6	5		6		5	6
Total	**120**	**115**	**92**	**76**	**101**	**74**	**8**	**86**	**3**	**71**	**86**
Québec											
Argenteuil	2	2	1		1	2		2		1	2
Bas-Richelieu	1	1	1		1	1				1	1
Becancour	3	2	3		2	3		1	1	3	3
Brome-Missisquoi	3	3	2	1	3	3		2			3
D'Acton	1	1	1		1	1		1		1	1
D'Autray	1	1	1		1	1		1	1		1
Drummond	3	3	3		3	3				3	3
Haut-Richelieu	4	3	1		4	4	2	2		3	2
Jardins-de-Napierville	2	2	2		2	1		1		1	2
Jolietle	1	1	1		1	1		1		1	1
Maskinonge	5	4	5		5	5		2	1	3	5
Maskoutains	5	5	4		4	5	2	1		5	5
Mirabel	2	2	2		2	2		2	1	2	2
Montcalm	2	2	1		2	2		2	1	2	2
Nicolet-Yamaska	4	4	3		4	4	1	2		4	4
Rouville	2	2	1		1	2		2		2	2
Vandreuil-Soulanges	4	4	3		4	4		3		3	4
Total	**45**	**42**	**35**	**1**	**41**	**44**	**5**	**25**	**5**	**35**	**43**