Disease Survey Of Seed And Commercial Corn In Ontario And Quebec (2012)

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 substantial changes in recent years and unfortunately challenges to the industry will continue. However, problems in seed corn production in the United States during the 2011 and 2012 growing seasons 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 nutrients and pests 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 August 29 to September 14, 2012, a corn pest survey was conducted in Ontario and Quebec. 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*), Goss’s Wilt ((*Clavibacter michiganensis* subsp. *nebraskensis = Corynebacterium michiganense* pv. *nebraskense*), Phaeosphaeria leaf spot (*Phaeosphaeria maydis)* and others,.

A total of 173 fields were surveyed in Ontario and 67 in Québec and at each location, the incidence of each pest and the severity of the predominant pests were recorded.

Results:

Fungal leaf diseases: Northern leaf blight (NLB) was found in 149 fields in Ontario and 37 fields in Québec (Table 1). Although NLB incidence was lower in 2012 compared to last year, the disease was still the most common foliar disease in 2012. There were 32 fields with intermediate and severe severity in Ontario, including 7 seed corn fields (Table 3). In 6 commercial fields each located in Chatham-Kent, Elgin, Lambton, Middlesex, Perth, and Ottawa-Carleton, ON, over 10 acres had very severe NLB damage. The adverse environmental conditions in parts of Ontario led to premature senescence in some areas this year and a good example was a 100 hectare area between Elgin and Norfolk County, ON with severe NLB infection at the survey time (yield losses estimated up to 10%). In Québec, a similar situation occurred with 4 fields, including one Reseaux Grandes Cultures du Québec (RGCQ) trial and 3 commercial fields had intermediate and severe NLB severities. In one particular field, more than 60 acres were dead due to severe NLB in Becancour, QC.

In 10 Ontario Corn Committee (OCC) trials (Table 2), some hybrids were found to be moderately susceptible to NLB; whereas in Tilbury, Kerwood, Ilderton, Thorndale, and Waterloo OCC trials, some hybrids expressed moderate to high susceptibility to NLB. As in previous years, both resistant and susceptible NLB lesion types were frequently observed on the same leaf which indicates the presence of different pathogenic races existing in both Ontario and Québec. Although environmental conditions reduced the overall NLB incidence in 2012, the fields or areas most affected by the disease had some similarities such as 1) surrounded by trees or wood-lots, 2) not far from a river (lake), 3) a recent history of NLB and 4) higher corn residue levels. In addition the most affected areas occurred in low lying areas of the field compared to higher elevation areas which provided more favorable conditions for infection.

Anthracnose leaf blight (ALB) was found in 118 fields in Ontario and 53 in Québec (Table 1). Although ALB was widely distributed its importance was reduced in 2012. In the 6 seed corn fields and OCC trials in southern Ontario with moderate ALB infection, the presence of other foliar diseases such as NLB, common rust, eyespot, or gray leaf spot contributed to the damage.

Typical symptoms of Gray Leaf Spot (GLS) were found in 100 fields in 13 counties of Ontario (Table 1). As with most foliar diseases, GLS severity was less severe in 2012 than in 2011. Some hybrids expressed intermediate susceptibility to GLS at Ridgetown, Wabash, Blyth, and Belmont OCC trials (Table 2). In three seed corn fields, the female inbreds at these locations were intermediate to highly susceptible to GLS (Table 3). Only three commercial corn fields had moderate severity in Chatham-Kent and Elgin, ON. Gray leaf spot was not found in Québec in 2012.

Common rust was the most frequency disease in 2012, found in 155 fields in Ontario and 59 fields in Québec (Table 1). As in 2010 and 2011 [3, 4], the incidence of common rust was greatest in Southern Ontario than in Eastern Ontario and Québec. There were 58 fields, including 13 seed corn fields (Table 3), and 24 commercial corn fields with severe common rust during our survey in Southern Ontario (Chatham-Kent, Elgin, Essex, Lambton, Middlesex, Huron, Oxford, Waterloo, Wellington). In comparison only 2 and 6 fields had intermediate common rust in Eastern Ontario and Québec in 2012, respectively. In 21 OCC trials, 13 locations had commercial hybrids displaying intermediate susceptibility to common rust whereas 6 other trials at Ridgetown, Blyth,

Wingham, Dublin, Waterloo and Alma had hybrids which were intermediate to highly susceptible to common rust. Hybrids in three of seven RGCQ trials showed intermediate susceptibility to common rust (Table 2). In seed corn, 13 of the 21fields had female inbreds which were found to be intermediate to highly susceptible to common rust (Table 3); however, two females were found to be highly resistant (no pustule formation) in this survey. Southern rust (*Puccinia polysora* Underw.) was not found in 2012 either in Ontario or Quebec during our survey period.

Eyespot was found in 115 fields in Ontario and 51 fields in Québec (Table 1). Unlike previous years, no severe eyespot was found in Eastern Ontario and Québec in 2012. Some hybrids showed intermediate to highly susceptible infection to eyespot at Ridgetown, Kerwood, Exeter, Blyth, and Wingham OCC trials (Table 2), and one female of seed corn expressed intermediate susceptibility to eyespot.

Brown spot (Physoderma maydis) was ubiquitous in both Ontario and Québec; however, in areas experiencing dry conditions symptoms were reduced on the sheath but not on leaves. Fusarium sheath rot was found most often in the fields which were dry and then had subsequent rains. Phaeosphaeria leaf spot (PLS), caused by *Phaeosphaeria maydis*, were found in 4 fields in Ontario in 2012, including 2 OCC trials. In each incidence only a few plants with typical lesions were found (round or elongated spot surrounded by dark brown margins). Northern leaf spot was not found in Ontario or Quebec in 2012.

Fungal Ear and Stalk diseases: Common smut was distributed across 95 fields in Ontario and 39 fields in Québec in 2012 (Table 1). Dry conditions this year did not decrease the percentage of common smut infected fields, but severity did increase (both percentage of infected plants and percentage of infected kernels on an ear). There were 6 commercial corn fields which had 10 – 80 % incidence of common smut in Norfolk, Wellington, Dufferin, and Ottawa-Carleton, ON. At Alma, Orangeville, Ottawa, and Pakenham OCC trials, some hybrids were moderately to highly susceptible to common smut (Table 2). Four grain corn fields had 1 - 20% incidence in Québec. Head smut was found in 3 fields in Eastern Ontario and one in Québec, all had low incidence (<1%) in 2012.

Gibberella/Fusarium/Penicillum/Trichoderma ear rots were observed in 103 fields in Ontario and 45 fields in Québec (Table 1) in 2012. Three seed corn fields (Table 3) had 5-30% incidence of ear rot. Five commercial corn fields were found to have incidences up to 30% with multiple pathogens in Waterloo, Wellington, and Dufferin, ON. Some hybrids expressed moderate to high susceptibility to ear rot at Thorndale, Waterloo, Alma, Orangeville and Lancaster OCC trials (Table 2). In the incidence of ear rot caused by *Fusarium spp*. increased on short husked ears in late season (September) because more frequent rain events in both Ontario and Québec in 2012. As in other years, many ears had black mold /spores on kernels damaged by birds or insects.

Two fields in Chatham-Kent and Essex, Ontario were found to have Crazy top (*Sclerophthora macrospore*), with disease incidences of up to 10% in 2012. As discussed in the 2011 survey [4], crazy top infected plants had in most cases other symptoms, such as multiple barren ears, longer leaves on husks, and common smut on the diseased tassels.

Stalk rots, including Anthracnose stalk rot/top-die back, *Fusarium* stalk rot, and *Pythium* stalk rot were found in 139 fields in Ontario and 62 fields in Québec (Table 1). Fourteen in Ontario and two fields in Québec had severe top-die back with 50-90% incidence.

Some hybrids expressed moderate to high susceptibility to top-die back at Ridgetown, Wabash, Ilderton and Winchester OCC trials (Table 2). *Pythium* stalk rot, (or early death), was found in four fields in Ontario and 2 fields in Québec with the incidence of early death ranging from 10 to 30%. In occurrence of early death was in fields with adequate to excessive moisture levels compared to reduced incidence in fields which experienced drought conditions.

Bacterial diseases: In 2012, no typical Stewart's wilt symptoms were detected. Symptomatic plants were collected and tested in the lab but all were found to be NLB. However, the populations of Corn flea beetle (CFB) increased slightly again in Southern Ontario in 2012. Although the incidence of Goss's bacterial wilt has increased in the U.S. the disease was not detected again in 2012 in either Ontario or Quebec.

Viral diseases: No typical viral disease symptoms were observed at the survey time in 2012. The occurrence of red/purple plants similar to viral disease symptoms, were observed in 14 Ontario fields and 2 Québec fields. In Ontario reddish plants were observed mostly in Chatham-Kent and Essex. One field in Chatham-Kent had up to 80% incidence in a 60 acre field along its 40 × 200 m^2 border. Another location in Essex had 40-90% red plants in all hybrids in 2012. Red plants late in the season can suggest a problem with kernel set or ear size and although plants in these fields had normal plant and ear heights, in many of the affected plants kernel set was reduced, non-existent (barren ears) or had arrested ears (beer canning).

Summary:

Moisture stress was observed throughout much of Ontario and Quebec early in the season followed by more consistent rainfall events later in the season which resulted in less foliar diseases in 2012. However, NLB and common rust were still widely distributed and as in previous years NLB did cause severe damage in many locations in both Ontario and Québec. Late season ear and stalk diseases, ear rot and stalk rots in seed corn were still high since much of the seed corn production area in Chatham-Kent and Essex counties received adequate rainfall. Common smut was observed more frequently on plants with shorter husks. As expected mite severity was related to drought conditions and was more apparent in 2012 than in 2011. ALB, GLS, and eyespot were less important diseases in 2012 due to the unfavourable weather conditions. Again, Stewart's wilt and Goss's wilt were not found in 2012. European corn borer, corn rootworm, and grasshopper were less problematic in 2012 in both Ontario and Québec. We observed red plants late in the season especially in the Chatham-Kent and Essex area and although plants in these fields had normal plant and ear heights, in many of the affected plants kernel set was reduced, non-existent (barren ears) or had arrested ears (beer canning).

Next Steps

This was the final year of funding for this project although we hope to continue in 2013.

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Table 1: Distribution of pests in corn fields in Ontario and Québec in 2012

County	# of Fields	NLB	ALB	GLS	Rust	Eyespot	Smut	Ear rot	Stalk rot	ECB	CRW	Grasshopper	Mites	Drought
Ontario														
Chatham-Kent	34	34	26	33	33	17	23	16	20	10	26	21	18	1
Dufferin	3	3	2		3	3	3	3	2	1	3	3	2	
Durham	3	3	2		3	3		3	3	1	2	3	2	
Elgin	16	16	10	10	15	12	8	12	15	3	14	14	9	2
Essex	6	6	5	6	5	2	6	2	4	4	5	5	3	2
Frontenac	5	4	1		3	3	2	1	2	2	4	5	2	1
Hastings	3	1	3		1	3	1	2	3	1	3	3	1	2
Huron	11	11	9	9	11	9	7	10	11	4	11	11	9	4
Lambton	10	10	6	9	9	6	3	3	10	2	9	10	2	
Lanark	4	2	3		4	1	2	2	4	1	3	4	4	2
Leeds & Grenville	5	2	1		4	1	3	3	3	2	4	5	4	
Middlesex	8	8	8	8	8	6	5	4	8	4	8	8	4	2
Norfolk	4	4	2	3	4	3	3	1	3	2	4	4	3	2
Northumberland	4	2	2	1	3	4	1	1	4	1	4	4	1	1
Ottawa-Carleton	7	3	3		5	6	2	4	5	3	7	7	7	7
Oxford	7	7	3	6	7	7	5	4	6	1	6	7	5	4
Perth	8	6	8	7	7	5	4	5	5	2	7	7	6	1
Peterborough	1	1	1		1	1		1	1		1	1	1	
Prescott & Russell	4	3	2		3	4	2	2	4	2	3	4	4	4
Renfrew	7	1	1		4	4	1	3	4	1	7	5	7	4
Simcoe	1	1			1	1	1	1	1		1	1		
Stormont, Dundas & Glengarry	8	8	8	2	8	5	5	7	8	4	8	8	7	1
Waterloo	7	6	5	1	6	4	3	6	7	4	6	6	6	2
Wellington	6	6	6	5	6	4	5	6	5	2	6	6	5	4
York	1	1	1		1	1		1	1		1	1		
Total	**173**	149	118	100	155	115	95	103	139	57	153	153	112	46

County	# of Fields	NLB	ALB	GLS	Rust	Eyespot	Smut	Ear rot	Stalk rot	ECB	CRW	Grasshopper	Mites	Drought
Québec														
Argenteuil	2	2	1		2	2		2	2		2	2	1	
Beauharnois-Salaberry	3	2	3		3	3	3	2	3	2	3	3	1	
Becancour	4	2	3		3	2	2	1	3	4	4	4	2	
Brome-Missisquoi	4	2	2		3	3	1	1	3	2	4	4	2	1
D'Arthabaska	4	1	2		3	3	2	2	4	2	4	4	1	
D'Autray	2	2	2		2	2	2	2	2		2	2	1	
Drummond	3	1	2		3	2	3	2	3	2	3	3	3	
Haut-Richelieu	3	2	2		3	1		1	3	1	3	2	1	1
Haut-Saint-Laurent	3	3	1		2	3	2	2	2	1	3	3	1	
Jardins-de-Napierville	3	1	3		3	2	1	1	2	2	2	3	1	
Jolietle	1	1	1		1	1	1	1	1	1	1	1		
L'Erable	1	1	1		1	1	1	1	1	1	1			
Maskinonge	4	3	4		4	4	3	4	3	1	4	3	3	
Maskoutains	6	4	6		5	3	4	6	6	4	6	4	5	2
Mirabel	3	1	2		3	3	2	2	3	1	1	3	2	
Montcalm	2	1	1		2	2	2	2	2	2	2	1	1	
Nicolet-Yamaska	7	2	7		5	6	4	6	7	2	7	7	7	3
Roussillon	2		2		2	2		1	2		1	1	1	1
Rouville	2		1		1	1	1	2	2		2	2	2	
Trois-Rivoeres	2	1	2		2	2	1	1	2		2	2		
Vandreuil-Soulanges	6	5	5		6	3	4	3	6	1	6	5	4	2
Total	**67**	**37**	**53**	**0**	**59**	**51**	**39**	**45**	**62**	**29**	**63**	**59**	**35**	**10**

NLB = northern leaf blight, ALB = Anthracnose leaf blight, GLS = Gray leaf spot, Rust = common rust. PLS = Phaeosphaeria leaf spot, Smut = Common smut. Ear rot: including Gibberella ear rot, Fusarium ear rot, Penicilium ear rot etc. 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. Grasshoppers, most likely red-legged grasshopper, and Mites, most likely Two-spotted spider mite.