Status of Corn Diseases In Ontario, 2015 Crop Season

Purpose:

Ontario is a world-class producer of seed and commercial field corn due to the region's exceptional combination of climate, soils, production expertise and infrastructure. There are many yield-limiting factors such as diseases and understanding these factors is critical to the future health and growth of the Ontario corn industry. For this reason, a corn disease insect survey was conducted in 2015 across the province which builds on surveys from previous years.

The 2015 corn disease survey provides vital information on endemic pathogen populations and allows for 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).

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 and potentially reduce losses to diseases and other pests in the future.

Methods:

A total of 181 corn fields were surveyed across Ontario from August 27 to September 9, 2015 to document the occurrence and incidence (number of affected plants) 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 (*Fusaium* spp.)
- stalk rot (*Fusarium* spp., and *Colletotrichum graminicola*)
- Stewart's bacterial wilt (*Pantoea stewartii* Mergaert et al.).

In addition to surveying for the occurrence and incidence (number of affected plants) of the above diseases, greater focused was placed on the major leaf diseases (eyespot, GLS, NCLB and common rust) and disease severity was recorded for these at all 181 surveyed fields.

Results and Summary:

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 fields with NCLB had incidences ≥30% and 59 had severity ratings ≥4. These most affected fields 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)], illustrating how widespread NCLB is in Ontario and why it has become the most economically important foliar disease of corn. The disease was found in all the fields sampled in Southern and Western Ontario, compared to Eastern Ontario (92.8%). Mean disease incidence in affected fields was also considerably lower in Eastern Ontario (15%) and Central Ontario (19%) compared to Southern (32%), and Western Ontario (25%); however, five fields in Eastern Ontario had a disease incidence of ≥32%. Mean disease severity in affected fields was similar in Central (3.2), Eastern (3.1), Southern (3.3) and Western Ontario (3.1). In addition to favourable environmental conditions, higher NCLB incidence and severity have resulted from changing agronomic practices in Southern and Western Ontario regions (shorter crop rotations, increased corn on corn, higher residue levels due to greater conservation tillage adoption) and changes in pathogen population dynamics (new races) causing increased susceptibility of corn hybrids to the disease (Wise and Mueller, 2011). Furthermore, all seed corn fields 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 for commercial corn fields. The high incidence of NCLB in Ontario is concerning because yield losses are associated with the disease, and this erodes producer profits. As a result, there is a need for additional disease management strategies, such as foliar fungicides which increase production costs and is an environmental risk. In the future, sustainable and economic corn production will require the development of new NCLB *Ht* genes/inbreds and their incorporation into high yielding commercial corn hybrids.

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

Common Rust was also one of the 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 incidence of 18%. In contrast to NCLB and eyespot, common rust severity and incidence were similar at sites 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 providing infection was uniform throughout the field. In seed corn, one of 17 fields 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 fields sampled (Table 1). As in 2014, GLS was not widely spread across Ontario in 2015. The disease was most prevalent (97%) in five counties, Chatham-Kent, Elgin, Essex, Middlesex and Oxford in Southern Ontario. In Eastern Ontario, where 70 fields were sampled, GLS was not detected. GLS severity and incidence was low (≤2.0 and ≤25.0, respectively) in five of 14 seed corn fields 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 production, and warm and humid conditions through late July and August favour 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 fields (11%). Fourteen of these fields were found in Eastern Ontario.Severity and incidence was low with the exception of 10 fields 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 fields and 17 OCC trial sites.

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

Fungal ear and stalk diseases: Common smut and Head smut were found in only 17 (9%) of the sampled fields (Table 1). Overall, mean common smut and head smut incidence was 9% in affected fields. Incidence levels of ≥10% were found in two fields in Chatham-Kent. Common smut and head smut were found in four fields of seed corn with 60% incidence in one field in Chatham Kent. Ear rot was found in eight fields at a low incidence level. Ears with exposed kernels were found to have *Fusarium* spp. infection. Stalk rot was found in one field 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, this survey was conducted too early to detect high levels of ear and stalk rots. Ear rots (*Diplodia, Fusarium* and *Penicillium*) were very low at harvest as was Gibberella ear rot and its accompanying mycotoxin (deoxynivalenol or DON) for the majority of the province with only a few fields above 2 ppm, which is in contrast to problem years such as 2011(Stewart and Tenuta, 2014).

Stewart's bacterial wilt, which historically has been the most economically important disease in Ontario seed corn production, once again was not detected in any of the seed or commercial corn fields sampled in 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 were not found in Ontario in 2015.

Next Steps:

A 2016 corn disease survey is planned.

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Table 1. Disease occurrence in Ontario corn fields grouped by county, Aug 27-Sept 9, 2015

County	No. fields	Disease / number of fields affected							
		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 = Antracnose leaf blight and die back, **GLS** = Grey leaf spot, **NCLB** = Northern corn leaf blight, **Rust** = Common and Southern rust, **Smut** = Common smut, **Ear rot** = including Gibberella ear rot and Fusarium ear rot, **Stalk rot** = including Fusarium stalk rot and Pythium stalk rot