OPMC

Ontario Pest Management Conference 2014

12th Annual

Advancing Plant Health in a Changing World

November 13, 2014

Victoria Park East Golf Course
1096 Victoria Road South
(1 km south of Stone Road E.)

Website: www.opmconference.ca

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Ontario Pest Management Conference

OPMC Organizing Committee

Denise Beaton, Ontario Ministry of Agriculture, Food and Rural Affairs
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Mary Ruth McDonald, Department of Plant Agriculture, University of Guelph
Ian Scott, Interim Chair - OPMC, Agriculture and Agri-Food Canada, London
Cynthia Scott-Dupree, School of Environmental Sciences, University of Guelph
Harold Wright, CropLife Canada (Ontario Council)

AGENDA

8:30 a.m – 9:00 a.m **Registration and Coffee**
Poster Set Up

We thank Denise Beaton for IT support throughout the morning and afternoon sessions.

MORNING SESSION

Morning Session Chair: Jamshid Ashigh, Dow Agrosciences

9:00 am **Welcome: Ian Scott**, Acting Chair, Ontario Pest Management Conference

9:10 am Distribution and control of glyphosate resistant common ragweed (*Ambrosia artemisiifolia* L.) in Ontario. **Annemarie Van Wely**, P. Sikkema, D. Robinson, D. Hooker and M. Lawton. (Student Competition)

9:25 am Thiamethoxam enhances soybean compatibility with weeds. **Hae Won Kim**, M. Afifi, E. Lee, L. Lukens and C. Swanton (Student Competition).

9:40 am DuPont™ Lumivia™ insecticide seed treatment. **Saghir Alam,** E.I. du Pont Canada Company**.**

9:50 am **Plenary Speaker:**

Dr. Eric Tedford

Fungicide Technical Lead, Syngenta Crop Protection

"Changing view on fungicides: Are they no longer just for fungal disease control?"

10:25 am – 10:55 am Coffee Break and Poster Viewing

10:55 am Biological control of dollar spot disease in creeping bentgrass using maize endophytes. **Hanan Shehata**, K. Jordon, E. Lyons and M. Raizada. (Student Competition)

11:10 am Light, shade and carbon partitioning – how does a neighbour do it? **A. McKenzie-Gopsill**, C. Swanton and S. Amirsadeghi. (Student Competition)

11:25 am Controlling house fly (*Musca domestica*) pressure in duck production facilities using management techniques to reduce manure suitability. **Justine Shiell**, C. Scott-Dupree, M. Guerin and S. Lachance. (Student Competition)

11:40 am Managing fertilizer nitrogen to improve crop performance. **Craig Drury,** W.D. Reynolds and X. Yang, AAFC. (Invited Speaker)

12:00 pm - 1:00 pm Lunch and Poster Viewing

AFTERNOON SESSION

Afternoon Session Chair: Maryam Sultan, Bayer CropScience

1:00 pm Oxathiapiprolin – A step change in oomycete control. **Jennifer Foster,** Syngenta Canada Inc**.**

1:10 pm Glyphosate-resistant *Conyza canadensis* (L.) Cronq. and *Ambrosia trifida* L. in Ontario: Control for 'Balance GT' soybean. **Scott Ditschun**, F. Tardif and P. Sikkema. (Student Competition).

1:25 pm An agricultural plant health strategy for Ontario: The way forward. **Hugh Berges**, OMAFRA

1:45 pm **Plenary Speaker:**

Dr. Roger Day

Deputy Director, CABI

"Advancing IPM in Africa – Challenges and Opportunities"

2:20pm-2:50 pm Coffee Break and Poster Viewing

2:50 pm Phytoplasma diseases in Ontario vineyards: Review and future projects. **Chrystel Olivier**, AAFC. (Invited Speaker)

3:10 pm Capture (bifenthrin) now registered in Canada. **Mark McMillan**, FMC Agricultural Solutions.

3:20 pm **Panel Discussion:**

IPM and Plant Health – What's the fit?

Moderator: Jason Deveau

Panel Participants:

Eric Tedford, Roger Day, Hugh Berges

4:10 pm Presentation of Student Competition Award Winners **– Ian Scott**

Closing Remarks and Adjourn

PLENARY SPEAKERS

Dr. Eric Tedford – Fungicide Technical Lead, Syngenta Crop Protection, Greensboro, North Carolina

Biography

Eric Tedford is a Fungicide Technical Product Lead for Syngenta in Greensboro, North Carolina. He has a Ph.D. in Plant Pathology from the University of California in Davis, and has worked in fungicide research and development over 19 years in both the US and globally. Areas of research and development focus include fungicides development for field crops, specialty crops, and postharvest uses; biological control of nematodes, and tobacco breeding for disease resistance.

Dr. Roger Day – Deputy Director, CABI, Nairobi, Kenya

Biography

Roger Day is Deputy Director at CABI's regional centre in Nairobi, Kenya. He has 30 years' experience of tropical agricultural research and development in Africa and Asia, over 20 of them with CABI in Africa including three as the Regional Director. He is an entomologist by training, and his experience covers plant health issues in relation to production and trade. He has become increasingly interested in aspects of agricultural extension and communication, capacity development, and policy, insofar as they affect the uptake of technical solutions to plant health problems.

CROP LIFE STUDENT COMPETITION –

Student Oral Presentations:

OP-1 Distribution and control of glyphosate resistant common ragweed (*Ambrosia artemisiifolia* L.) in Ontario. **Annemarie Van Wely**, P. Sikkema, D. Robinson, D. Hooker and M. Lawton.

OP-2 Thiamethoxam enhances soybean compatibility with weeds. **Hae Won Kim**, M. Afifi, E. Lee, L. Lukens and C. Swanton.

OP-3 Biological control of dollar spot disease in creeping bentgrass using maize endophytes. **Hanan Shehata**, K. Jordon, E. Lyons and M. Raizada.

OP-4 Light, shade and carbon partitioning – how does a neighbour do it? **A. McKenzie-Gopsill**, C. Swanton and S. Amirsadeghi.

OP-5 Controlling house fly (*Musca domestica*) pressure in duck production facilities using management techniques to reduce manure suitability. **Justine Shiell**, C. Scott-Dupree, M. Guerin and S. Lachance.

OP-6 Glyphosate-resistant *Conyza canadensis* (L.) Cronq. and *Ambrosia trifida* L. in Ontario: Control for 'Balance GT' soybean. **Scott Ditschun**, F. Tardif and P. Sikkema.

Judges: Michael Celetti - OMAFRA (Judging Supervisor)

1. Sean Westerveld – OMAFRA
2. John Purdy – Canpolin
3. Cary Gates – Flowers Canada (Ontario)
4. Coralie Sopher – University of Guelph

Student Poster Presentations:

PP-1 Characterization of an exopolysaccharide depolymerase encoded by the *Myoviridae* bacteriophage ϕEa35-70. **Brittany Howcroft**, A. Yagubi, A. Castle and A. Svircev. UNDERGRADUATE. **(Time of judging 9:00-9:15 am**)

PP-2 Susceptibility of western corn rootworm (Coleoptera: Chrysomelidae) populations to Bt toxins in Ontario. **Andrea Hitchon**, J. Smith and A. Schaafsma. **(Time of judging 9:15-9:30 am)**

PP-3 Investigating *Dalotia coriaria* as a biological control agent for *Drosophila suzukii*, a new invasive fruit pest. **Zach Telfer,** J. Renkema, T. Gariepy and R. Hallett. UNDERGRADUATE**. (Time of judging 9:30-9:45 am)**

PP-4 Monitoring strawberry aphids in Ontario. **Erica Pate**, P. Fisher and R. Hallett. UNDERGRADUATE. **(Time of judging 10:55-11:10 am)**

PP-5 Vertical profile (surface to 0.5 m) of *Plasmodiophora brassicae* resting spores in soil. **Travis Cranmer,** B. Gossen and M.R. McDonald. **(Time of judging 11:10-11:25 am)**

PP-6 Overwintering survival and fecundity of the vinegar fly pest *Drosophila suzukii* (Diptera: Drosophilidae). **Lisa Emiljanowicz**, G. Ryan and J. Newman. **(Time of judging 11:25-11:40 am)**

PP-7 Metam-sodium and chloropicrin soil treatments for the management of *Plasmodiophora brassicae*. **Justin Robson**, B. Gossen and M.R. McDonald. **(Time of judging 11:40-11:55 am).**

PP-8 Assessment of dry bean tolerance and the efficacy of biological and chemical controls for soybean cyst nematode. **Xinyu Zhang** and C. Gillard. **(Time of judging 1:00-1:15 pm)**

PP-9 Susceptibility of the candy-striped spider, *Enoplognatha ovata* (Clerck, 1757), to the ryanoid insecticide Coragen® (chlorantraniliprole). **Mike Tomascik** and J. Schmidt. **(Time of judging 1:15-1:30 pm)**

PP-10 Strategy for pest control: Interference of cytochrome C subunit Va gene in spider mites through transgenic plants. UNDERGRADUATE. **Roberta Lima**, M. Urizarna, H. Hosseinzadeh and V. Grbic. **(Time of judging = 1:30-1:45 pm)**

**** Judging time - Students should be present at their poster at the time indicated.***

Judges: Michael Celetti – OMAFRA (Judging Supervisor)

1. Abhinandan Deora – Syngenta
2. Rachel Riddle – Ontario Ginseng Growers Association
3. Amy Fang Shi – University of Guelph
4. Amanda Green – OMAFRA

-REGULAR POSTER PRESENTATIONS -

RP-1 Evaluation of insecticide application timings for control of swede midge, *Contarinia nasturtii*, in canola. **Jonathon Williams**, B. Hall and R. Hallett.

RP-2 Toward the characterization of the two-spotted spider mite plant feeding pattern and associated damage. **Nicolas Bensoussan**, E. Santamaria and V. Grbic.

RP-3 Management of stemphylium leaf spot (*Stemphylium vesicarium*) of asparagus (*Asparagus officinalis* L.) with fertility and disease forecasting. **Jennifer Foster** and M.R. McDonald.

RP-4 Nematode management of vegetable crops in Ontario using fumigant and non-fumigant nematicides. **Dennis VanDyk,** K. Jordan and M.R. McDonald.

RP-5 Soil amendments for the management of Fusarium wilt in spinach. **Brian Collins** and M.R. McDonald.

RP-6 Effect of spore load on growth of clubroot-resistant canola and napa cabbage. **Jill Dalton,** B. Gossen and M.R. McDonald.

RP-7 Brown marmorated stink bug spreads through Ontario: 2014 survey results and next steps. **Cynthia Scott-Dupree**, H. Fraser, T. Gariepy and T. Baute.

RP-8 The mystery of ginseng replant disease. **Sean Westerveld**, R. Riddle and A. Fang Shi.

RP-9 The effect of indole glucosinolates and myrosinase in life table characteristics of two-spotted spider mite *Tetranychus urticae*. **Golnaz Salehipour-shirazi**.

RP-10 Integrated Pest Management of muck vegetable crops in the Holland Marsh, Ontario. **Dennis Van Dyk** and M.R. McDonald.

ORAL PRESENTATION ABSTRACTS
MORNING SESSION

CROP LIFE STUDENT COMPETITION (OP-1):

Distribution and control of glyphosate-resistant common ragweed (*Ambrosia artemisiifolia* L.) in Ontario

Annemarie Van Wely[1], P. Sikkema[1], D. Robinson[1], D. Hooker[1] and M. Lawton[2]
[1]Dept. of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON, NOP 2C0
[2]Monsanto Canada, Guelph, ON, N1G 0B4

Glyphosate resistant crops have allowed for the repeated use of glyphosate and thus the selection of glyphosate resistant biotypes. In 2011, a population of common ragweed was confirmed to be resistant to glyphosate. Field surveys conducted in 2012 and 2013 have found four additional sites with glyphosate resistant (GR) common ragweed in Essex County. Twenty-eight field experiments were conducted to determine alternative control measures in Roundup Ready (glyphosate resistant) and Roundup Ready 2 Extend (glyphosate plus dicamba resistant) soybean (*Glycine max* L. Merr.) The objectives of the research were to determine a) the biologically effective rate of glyphosate for the control of a resistant and susceptible biotype of common ragweed, b) the efficacy of glyphosate tankmixes for the control of GR common ragweed applied prior to and after soybean emergence, and c) the control of GR common ragweed with dicamba in Roundup Ready 2 Xtend soybean. Linuron and metribuzin, applied preplant, provided the most consistent control of GR common ragweed (>80%) 28 and 56 days after application. None of the post-emergence tankmixes provided commercially acceptable control of GR common ragweed. Dicamba in Roundup Ready 2 Xtend soybean effectively controlled GR common ragweed.

CROP LIFE STUDENT COMPETITION (OP-2):

Thiamethoxam enhances soybean compatibility with weeds

Hae Won Kim, M. Afifi, E. Lee, L. Lukens and C. Swanton
Dept. of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

Presence of neighbouring weeds lowers light quality in the absence of competition for light; this low quality light can cause physiological changes in plants that may ultimately result in yield loss. Previous research in corn has shown these changes can be averted if the seed was treated with thiamethoxam. This research tested the hypothesis that soybean seedlings arising from the seeds treated with thiamethoxam would maintain root structure and biomass, isoflavonoid content and nodule number while growing in a low light quality environment. A detailed physiological analysis of soybean root, grown in a growth-cabinet condition, was conducted using WinRhizo software, laboratory assays and HPLC. The data showed that thiamethoxam seed treated soybean seedlings maintained root structure and isoflavonoid contents under a low light quality condition. This study suggests that seed treatments can be a new tool to enhance plants' tolerance to early weed or high density signaling stresses.

INDUSTRY PRESENTATION:

DuPont™ Lumivia™ insecticide seed treatment

Saghir Alam
E.I. du Pont Canada Company – Crop Protection, Mississauga, ON, L5M 2H3

DuPont™ Lumivia™ Insecticide Seed Treatment in Corn is a new insecticide from a whole new class of chemistry! It is Group 28 - the "anthranilic diamides" and the active ingredient common name is "Chlorantraniliprole". Lumivia™ when applied as a corn seed treatment prevents the build-up of pest populations by controlling early-season Lepidoptera species and selected other important soil pests. Lumivia™ delivers rapid and effective plant protection. Lumivia™ has a unique MOE and it impacts insect behavior by impairing muscle function. Lumivia™ provides enhanced early growth, better seed germination and excellent crop stand establishment.

PLENARY PRESENTATION:

Changing view on fungicides: Are they no longer just for fungal disease control?

Eric Tedford
Syngenta Crop Protection, Greensboro, North Carolina, USA, 27409

In the past fungicides were seldom used on corn other than high value specialty corn or seed corn. The pathogens infecting corn back then are no different than the ones present today. However, more fungicides are used today than in the past due to the physiological benefits that QoI (strobilurin) fungicides provide to some plants. However, there has also been considerable controversy over claims of yield benefits between university researchers and researchers from Industry. This presentation will address some of the science behind the physiological effects from fungicides on plants as well as discuss how experimental methods impact yield differences. Under low-to-no disease pressure plot size is critical for meaningful interpretation of corn yield benefits. Border and alley effects will be discussed along with the difficulties and challenges of increasing plot size in order to generate grower relevant data.

CROP LIFE STUDENT COMPETITION (OP-3):

Biological control of dollar spot disease in creeping bentgrass using maize endophytes

Hanan Shehata[1], K. Jordon[1], E. Lyons[1] and M. Raizada[2]
[1]Dept. of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1
[2]Dept. of Microbiology, Mansoura University, Mansoura, Egypt

Endophytes are microbes that inhabit plant tissues without causing disease. Endophytes can benefit plant health by improving plant nutrition or tolerance to pathogens. Turfgrass is used for recreational, aesthetic and environmental purposes. Creeping Bentgrass (*Agrostis stolonifera*) is the most widely used turf on golf greens in the US and Canada. Dollar spot disease, caused by *Sclerotinia homoeocarpa,* is one of the most important diseases affecting Creeping Bentgrass, and there are limited control strategies. We hypothesized that some maize endophytes may suppress *S. homoeocarpa*. In this study, ~200 maize endophytes were tested *in vitro* and *in planta* for antifungal activity. Four endophytes showed *in vitro* and *in planta* anti-fungal activities. Replicated greenhouse trials demonstrated that 3 strains partially suppressed dollar spot disease *in planta* using Assess software analysis. Strain A12 was selected further to understand the mechanism of action of the antifungal activity. Culturing strain A12 and *S. homoeocarpa* side by side on a sterile microscope slide coated with PDA, followed by staining with vitality stains, revealed cleavage and hyphal death of

S. homoeocarpa. GFP-tagging and confocal microscopy revealed the location of A12 in creeping bentgrass. A mutant screen was conducted on 3000 Tn5-mutagenized colonies; 12 mutants showed loss of antifungal activity. The knocked out genes were identified, following plasmid rescue and sequencing, and shown to encode 3-hydroxypropionate dehydrogenase, Tol operon, fatty acid Co-A ligase, transcriptional regulators, succinate dehydrogenase and UDP-N-acetylenolpyruvoyl-glucosamine reductase. These results suggest that maize endophytes can help creeping grasses resist dollar spot disease, and suggest mechanisms of action.

CROP LIFE STUDENT COMPETITION (OP-4):

Light, shade and carbon partitioning – how does a neighbour do it?

Andrew McKenzie-Gopsill, C. Swanton and S. Amirsadeghi
Dept. of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

Plants have the ability to detect the presence of neighbouring plants through changes in the red: far-red ratio of light reflected or transmitted off vegetation. This triggers the shade avoidance response before direct shading occurs and has been shown to be important in understanding yield loss especially when it occurs during the critical period for weed control. Previous work in our lab has shown that this response is triggered upon emergence and can have long lasting negative effects on plant yield. While the morphological and hormonal changes associated with this response are well documented, investigations into how carbon and nitrogen assimilation may be impacted are lacking. Through a growth chamber study, we hypothesized that soybean seedlings exposed to weedy conditions and non-limiting resources would have reduced rates of carbon assimilation and in turn direct consequences on the sugar and starch pools, compared to weed-free plants. Through direct measurements of photosynthesis, chlorophyll content and soluble and insoluble sugars, we indentified key changes to carbon partitioning in plants exposed to early season neighbouring weeds. While we found significant effects on the carbon cycle, nitrogen assimilation did not seem to be impacted. A better understanding of carbon partitioning during plant-weed interactions will shed light on the mechanisms of yield loss in soybean. This work can help improve our understanding of yield loss in soybeans and can be applied to management and breeding programs to improve plant health.

CROP LIFE STUDENT COMPETITION (OP-5):

Controlling house fly (*Musca domestica*) pressure in duck production facilities using management techniqes to reduce manure suitability

Justine Shiell[1], C. Scott-Dupree[1], M. Guerin[2] and S. Lachance[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2W1
[2] Department of Population Medicine, University of Guelph, Guelph, ON, N1G 2W1
[3]University of Guelph-Campus d'Alfred, Alfred, ON, K0B 1A0

Poultry manure provides a suitable environment for house flies to feed and lay eggs. Management techniques that render the manure less suitable for fly production can be important in decreasing infestations by creating unfavourable conditions for larval growth, egg-laying and adult feeding. Four different types of poultry manure (broiler, layer, turkey and duck) were compared. House fly landing preference was highest on duck manure, however no significant differences were found for adult fly emergence. Laboratory tests investigated house fly preference to duck manure of different humidity levels (60-90%). Adult emergence numbers were highest when moisture content was 70 – 80%, while oviposition was highest between 65 - 80%. Adult fly emergence and landing preference from manures treated with 7 concentrations of acetic acid (0.5, 1.0, 2.0, 3.25, 4.5, 5.75 and 7.0 %) and 7 concentrations of boric acid (0.25, 0.5, 1.0, 1.5, 2.0, 3.25, and 4.5%) was also assessed. All concentrations of acetic and boric acid tested significantly reduced adult fly emergence. Adult flies

were not repelled from landing on the treated manures, but oviposition studies should be performed. Practicality and cost of applying the acids to duck manure in production facilities needs to be further investigated. The addition of circulating fans inside duck barns was also examined; however the fans did not have a significant impact on manure moisture content.

INVITED ORAL PRESENTATION:

Managing fertilizer nitrogen to improve crop performance

Craig Drury, W.D. Reynolds and X. Yang
Research Scientist – Soil Biochemistry and Soil Management, Agriculture and Agri-Food Canada, Harrow, ON, N0R 1G0

There were 4.2 million tonnes of N fertilizer products sold in 2010 in Canada with urea being the dominant N source at 46% of all N fertilizer sales and UAN was the next largest fertilizer N source at 22.5%. Ammonium nitrate fertilizer only represented 2.4% of N fertilizer usage. With increased application of urea-based fertilizers and UAN solutions to field crops, ammonia volatilization losses from just these two forms may exceed 186,000 t N in Canada at a fertilizer replacement cost of $259 million/yr. Increased farm sizes have resulted in greater time constraints for producers to apply nitrogen fertilizers to crops. Hence, some producers are applying N fertilizer by either streaming UAN onto their soils or they are considering adding inhibitors with urea or UAN to reduce losses of applied N. There is however very little data available in humid regions of Canada (Ontario and Quebec) to demonstrate how effective these methods are from a crop utilization perspective. Hence we evaluated N fertilizer application methods (broadcast vs banded vs streamed) and fertilizer N additives (control vs urease vs the combination of urease and nitrification inhibitors) on ammonia volatilization, nitrous oxide emissions and corn N uptake on a Brookston clay loam soil in South-western Ontario. Broadcasting urea resulted in the greatest ammonia volatilization losses followed by streaming and injection. The addition of urease inhibitors decreased ammonium volatilization losses compared to regular urea or UAN fertilizers. Injecting sidedress N fertilizers increased N uptake in both grain and total above-ground biomass compared to either broadcasting or streaming N fertilizers. The inclusion of inhibitors (urease with/without a nitrification inhibitor) resulted in greater yields and above-ground biomass than the control especially when the N fertilizer was broadcast or streamed. Nitrogen application methods were found to influence nitrogen losses from soils and the inclusion if inhibitors reduced losses and enhanced N uptake and crop yields.

AFTERNOON SESSION

INDUSTRY PRESENTATION:

Oxathiapiprolin – A step change in oomycete control

Jennifer Foster
Syngenta Canada Inc., Guelph, ON, N1G 4Z3

Oxathiapiprolin (OXTP) is a new fungicide in the piperidinyl thiazole isoxazoline chemical class. OXTP binds to the oxysterol binding protein and has preventive and antisporulant activity on several pathogens. The spectrum of diseases controlled is exclusively Oomycete including downy mildews, *Phytophthora* spp. and *Pythium ultimum*. Even at very low application rates, OXTP provides excellent residual control. The active ingredient has both translaminar and acropetal redistribution, which protects key vegetable crops from devastating diseases such as phytophthora blight and downy mildew.

CROP LIFE STUDENT COMPETITION (OP-6):

Glyphosate-resistant *Conyza canadensis* (L.) Cronq. and *Ambrosia trifida* L. in Ontario: Control for 'Balance GT' soybean

Scott Ditschun[1], F. Tardif[1] and P. Sikkema[2]
[1]Dept. of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1
2Dept. of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON, N0P 2C0

New weed control strategies are needed to control glyphosate-resistant Canada fleabane (*Conyza canadensis* [L.] Cronq.) and giant ragweed (*Ambrosia trifida* L.) in soybean (*Glycine max* [L.] Merr.) fields. With the pending release of new isoxaflutole-tolerant soybeans cultivars such as 'Balance GT', a control strategy for the resistant weeds can be developed using a combination of isoxaflutole (IFT), metribuzin (MTZ) and glyphosate (GLY). Experimental field trials conducted in 2013 and 2014 included rates of MTZ and IFT in a 4 to 1 ratio, which are then mixed with a standard 900 g ae/ha rate of glyphosate. 63, 74 and 85% control of Canada fleabane and 48, 69, and 87% control of giant ragweed was achieved at MTZ and IFT rates of 210+52.5, 316+79, and 420+105 gai/ha respectively. Control using GLY+IFT was 64% and 56% of Canada fleabane and giant ragweed respectively while control using GLY+MTZ was 49% and 24% of Canada fleabane and giant ragweed respectively. Commercial comparison treatments with the highest control were 92% and 86% control of giant ragweed with amitrole at 2000 gai/ha and 2,4-D at 500 gae/ha respectively and GLY+MTZ at 1120 gai/ha which gave 80% control of Canada fleabane. Greenhouse experiments in progress follow similar trends to that observed in field experiments.

INVITED ORAL PRESENTATION:

An agricultural plant health strategy for Ontario agriculture: The way forward

Hugh Berges
Manager – Horticulture Technology, OMAFRA, Guelph, ON, N1G 4Y2

Agricultural Plant Health (APH) is an important economic factor for Ontario's economy. Risks to APH from pests and diseases are increasing due to increased globalization and trade, climate change etc. Recent pest introductions have affected the marketability and competitiveness of our provincial agriculture sector, e.g. spotted winged drosophila, brown marmorated stink bug, kudzu and the European grapevine moth, all of which threaten agriculture in this province. While the CFIA has the authority to manage many risks and hazards, and the powers of the federal Plant Protection Act are

quite broad, there are gaps in authority and resources concerning other plant health risks of importance to Ontario's production agriculture sectors. These deficiencies fall outside of the mandate of the CFIA and the federal government and often leave OMAFRA with the responsibility of dealing with these pest situations. With this background, the Ontario Ministry of Agriculture, Food and Rural Affairs initiated the development of and an Agricultural Plant Health Strategy which, based upon effective hazard oversight systems, would enable the province to more proactively prevent, detect, respond and recover from an agricultural plant health event.

PLENARY PRESENTATION:

Advancing IPM in Africa – Challenges and Opportunities

Roger Day
CABI, Nairobi, Kenya

Integrated pest management is widely promoted as a sustainable approach to pest management in Africa, including in the African Union's Comprehensive Africa Agriculture Development Programme (CAADP). CAADP envisages a progression from subsistence to more market oriented production, increased local and regional trade, greater use of inputs, and increased productivity and profitability. Under such intensified production, what are the challenges and opportunities for integrated pest management (IPM)? Traditional subsistence agriculture exhibits various features of IPM, but efforts to promote adoption of science-based IPM have met with mixed success. When production becomes more market oriented, risks of unsustainable practices increase. Pesticide use in Africa is still very low, yet problems are already being experienced. But market forces can also be beneficial; some of the best examples of IPM in Africa are in high value export horticulture. What needs to be done to encourage the use of sustainable plant health management as agriculture in Africa intensifies? Seven areas are discussed with examples. (i) National organisations for crop protection must be able to meet current and future needs, but are often still based on legacies from the colonial era. (ii) Plant protection policy frameworks need updating in alignment with the CAADP vision. (iii) Strong regulatory systems are required for pesticides, biological control, seeds, and export and import control. (iv) Regional collaboration and cooperation can make more efficient use of resources and capacity. (v) Capacity development is required in many aspects of plant protection, but has tended to focus on technical knowledge of individuals rather than organisations and systems. (vi) Research must be aligned to farmers' and other stakeholders' needs, and through public-private partnership, lead to innovation. (vii) Farmer advisory services have to respond to farmers' changing needs, whether due to climate change, market demands or other factors. Plantwise, a global plant health programme, addresses a number of these areas. Experience with the programme from 12 countries in Africa is presented and discussed.

INVITED ORAL PRESENTATION:

Phytoplasma diseases in Ontario vineyards: Review and future projects

Chrystel Olivier
Research Scientist - Entomology, Agriculture and Agri-Food Canada, Saskatoon, SK, S7N 0X2

Grapevine Yellows, caused by phytoplasmas, are economically important diseases that have been detected in most grape-growing regions of the world. Since 2006, surveys were conducted in vineyards located in Ontario (ON) and Quebec (QC). The overall detection of phytoplasmas ranged from 2.4 to 8.3% in ON and QC respectively, with significant variability between the years, cultivars and locations. A large proportion of phytoplasma-infected grapevines were symptomless. Cultivars merlot and pinot gris were the only two cultivars in which no phytoplasma were detected. Sixteen new

AY phytoplasma strains were identified in grapevines and in leafhopper species. Most of the leafhopper species in which phytoplasma DNA were detected were grass feeders. Preliminary results on a new project on red blotch disease and its potential insect vectors will also be presented.

INDUSTRY PRESENTATION:

Capture (bifenthrin) now registered in Canada

Mark McMillan
FMC Agricultural Solutions, Moffat, ON, L0P 1J0

Capture (Bifenthrin) used on millions of acres in the United States and other countries, is finally available in Canada. Wireworms have become one of the major pests in potatoes for numerous growing regions of Canada. Wireworm damage can downgrade the quality of potato crops significantly, creating scars on the surface of and boring holes within daughter tubers. These lesions can make it difficult for processors to cut potatoes into french fries or potato chips, and reduce the marketability of table stock potatoes. In potatoes, Capture insecticide is used as an in-furrow spray application at-planting creating a “zone of protection” around the mother tuber and developing daughter tubers. The unique characteristics of bifenthrin allow for extended activity, reducing the wireworm damage on the potatoes. For raspberry growers, the registration of Capture provides control of black vine weevil and obscure root weevil.

PANEL DISCUSSION:

IPM and Plant Health: What`s the fit

Moderator: Jason Deveau
Panelists: Eric Tedford, Roger Day, Hugh Berges

Join the panel members to discuss how we can better protect agricultural crops by improving surveillance networks and supporting sustainable integrated pest management programs. The panel, representing global, industry and government perspectives, will enable us to discuss this topic more effectively.

POSTER PRESENTATION ABSTRACTS

STUDENT POSTER COMPETITION

PP-1 (Undergraduate Student):

Characterization of an exopolysaccharide depolymerase encoded by the *Myoviridae* bacteriophage ϕEa35-70

Brittany Howcroft[1], A. Yagubi[1], A. Castle[1] and A. Svircev[2]
[1]Department of Biological Sciences, Brock University.St. Catharines, ON, L2S 3A1
[2]Agriculture and Agri-Food Canada, Vineland, ON, L0R 2E0

Fire blight disease, caused by the bacterium *Erwinia amylovora*, threatens the survival of many pome fruit trees worldwide. This disease is destructive and causes a substantial negative impact on agricultural businesses. Currently, the only successful applied control is through the use of antibiotics, which comes with harmful effects on both humans and the environment. An alternative method of biocontrol is through the use of bacteriophages. Our group is currently evaluating their use as biopesticides against *Erwinia amylovora.* The use of phages as a pesticide has great potential and should alleviate mounting concerns about antibiotic resistant bacteria. The production of an exopolysaccharide by *Erwinia amylovora* is correlated to its virulence, pathogenicity, and its interaction with phages. However, it is ambiguous whether *Erwinia amylovora* exopolysaccharide promotes susceptibility to phage infection or acts as an antiphage defence mechanism. Our recent sequence analysis of the *Myoviridae* ϕEa35-70 genome revealed the presence of a gene with a similar sequence to the depolymerase gene of *Podoviridae* phage. The depolymerase protein is located on the tail and allows them to bind and degrade the host exopolysaccharide. The existence of a depolymerase gene in *Myoviridae* phages is not common; therefore, investigating the function of this gene is very important in understanding *Myoviridae* phage-host interaction.

PP-2:

Susceptibility of western corn rootworm (Coleoptera: Chrysomelidae) populations to Bt toxins in Ontario

Andrea Hitchon, J. Smith and A. Schaafsma
Dept. of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON, NOP 2C0

Monitoring for resistance by *Diabrotica virgifera virgifera* LeConte to Bt corn, *Zea mays* L., is needed to prolong the usefulness of Bt corn as a pest control tactic. A whole-plant assay has been used by public sector entomologists to confirm resistance by *D. virgifera* to multiple Bt traits in the United States Corn Belt. Here, this approach is applied to field-collected Ontario populations of *D. virgifera* as well as five susceptible lab colonies. Populations collected in 2012 were tested on the Bt trait Cry3Bb1. Populations collected in 2013 were tested on the Bt traits Cry3Bb1, Cry34/35Ab1, and mCry3a. All Bt treatments were compared to a non-Bt isoline with similar genetic background. Corn plants were grown to the V5 stage in the greenhouse and infested with ten F_1 neonate *D. virgifera* larvae which were incubated for ≈ 230 Celsius degree days, at which point larvae were extracted and counted. More larvae were recovered from the control when compared to the Bt treatment for all populations and traits, indicating a lack of complete resistance to Bt varieties in Ontario *D. virgifera* populations. Differences in susceptibility were seen between field-collected populations and these are discussed in the context of the field history. Results from future whole-plant assays can be compared with susceptibility characterized here and used to confirm resistance, an important step to ensuring adequate risk mitigation.

PP-3 (Undergraduate Student):

Investigating *Dalotia coriaria* as a biological control agent for *Drosophila suzukii,* a new invasive fruit pest

Zach Telfer[1], J. Renkema[1], T. Gariepy[2] and R. Hallet[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2M7
[2]Southern Crop Protection and Food Research Centre, Agriculture and Agi-Food Canada, London, ON, N5V 4T3

Drosophila suzukii Matsumura (Diptera: Drosophilidae) is a recent invader of North and South America and Europe which causes pre-harvest damage to fruits, resulting in significant economic damage. Currently, *D. suzukii* control requires repeated insecticide applications and labour-intensive field sanitation. Biological control options for *D. suzukii* are limited. Here we report the predatory capability of *Dalotia (Atheta) coriaria* Kraatz (Coleoptera: Staphylinidae), a commercially available predator of other small dipteran pests. In a laboratory predation assay, *Da. coriaria* displayed a Type II functional response against all *D. suzukii* instars, with a maximal consumption of 26 first, 15 second, and 6 third instars in 24 hours. Zero pupae were consumed. An assay designed to determine the ability for *Da. coriaria* to prey on *D. suzukii* in fallen infested berries showed 6 *Da. coriaria* could reduce *D. suzukii* abundance in raspberries placed on soil by 50%. Our results suggest *Da. coriaria* could play a role in reducing sanitation efforts involved with *D. suzukii* infestations. The biological control potential for *Da. coriaria* against *D. suzukii* should be further assessed and the impact fallen berries have on *D. suzukii* populations should be investigated.

PP-4 (Undergraduate Student):

Monitoring strawberry aphids in Ontario

Erica Pate[1], P. Fisher[2] and R. Hallett[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2M7
[2]Ontario Ministry of Agriculture, Food and Rural Affairs, Simcoe, N3Y 4N5

Viruses have recently become a major problem for strawberry production in Ontario. These viral diseases are capable of reducing crop yields by 10-60%. The main vector of strawberry viruses is the strawberry aphid, *Chaetosiphon fragaefolii*. A better understanding of the life cycle, timing of population build-up, and dispersal of aphids will help producers develop an effective pest management program and make sound production decisions. Throughout the summer of 2014 we monitored and collected information from 15 strawberry farms across the province. At two of these sites we used a variety of sampling methods, including weekly sampling of foliage, bowl traps or sticky traps. The strawberry aphid population grew from early May until mid-June, and spiked again in August. Strawberry aphids were most common in the vigorous and succulent growth of the newest leaves, and the rise in aphid populations in August was mostly in new plantings. *Chaetosiphon fragaefolii* was the most common species of aphid found on strawberry plants. The flight period of the winged adults began in early July, and the winged aphids were continually found into August. Direct sampling of foliage provided more information than using bowl traps or sticky traps. The results of this project will help growers assess aphid populations in their fields in order to optimize timing of control efforts.

PP-5:

Vertical profile (surface to 0.5 m) of *Plasmodiophora brassicae* resting spores in soil

Travis Cranmer[1], B. Gossen[2] and M.R. McDonald[1]
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1
[2]Agriculture and Agri-Food Canada, Saskatoon Research Centre, Saskatoon, SK, S7N 0X2

Plasmodiophora brassicae Woronin, the causal agent of clubroot, is an important pathogen of canola (Brassica napus L.) and Brassica vegetable crops in Canada. Resting spores are the sole source of primary inoculum of P. brassicae. They are produced inside the clubbed roots of infected plants, and released into the soil when the roots decay. Resting spores can survive in soil for many years, and movement of spores in soil is the main source of new infestations. Information on the vertical distribution of resting spores in the soil profile is needed to target management approaches, and for soil management for applications such as roads, pipelines, and housing construction. Vertical soil cores from the soil surface to 53-cm depth were collected using a hand soil corer from naturally infested mineral soil sites near Bassano Alberta and Milgrove Ontario, and a muck soil (~70% organic matter) from the Holland Marsh in Ontario. A multiplex TaqMan qPCR assay with an internal control based on GFPuv1 was used to quantify resting spore concentration at selected depths in each soil. Spore concentrations ranged from 1 x 103 to 6 x 106 spores g-1 of dry soil. The variability within individual cores and among cores collected in close proximity (< 1 m) was very high, but resting spores were present throughout the soil profile at each site. Additional studies are underway to examine samples from deeper in the soil profile and to assess if spores are moved in soil by water.

PP-6:

Overwintering survival and fecundity of the vinegar fly pest *Drosophila suzukii* (Diptera: Drosophilidae)

Lisa Emiljanowicz, G. Ryan and J. Newman
School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2M7

Drosophila suzukii is a vinegar fly pest of Asian origin that has recently invaded North America, causing substantial economic damage to soft skinned fruit growers. The overwintering biology of this pest is not well understood. An overwintering survival analysis for *D. suzukii* was conducted under conditions that may be experienced in overwintering microhabitats during an Ontario winter. This experiment considered sex, ecotype, photoperiod exposure, mated status, acclimation, rearing temperature, and fecundity after cold exposure. I tested survival after a 6-week exposure to -5, -3, -1, 1, 3, and 5 °C. I found that flies could not survive for 6 weeks below 1 °C. There was a significant main effect of temperature on overwintering survival, as survival was higher at higher temperatures. Pre-planned contrasts did not reveal any difference between ecotypes, mated status, photoperiod exposure, or sex at any temperature. When assessing the fecundity of mated overwintering females, it was found that surviving females that were mated prior to the 6-week cold exposure could produce viable offspring after cold exposure. I conclude by comparing this work to other data on *Drosophila* and discuss future research that could be explored as a result of this experiment.

PP-7:

Metam-sodium and chloropicrin soil treatments for the management of *Plasmodiophora brassicae*

Justin Robson[1], B. Gossen[2] and M.R. McDonald[1].
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1
[2]Agricultre and Agri-Food Canada, Saskatoon Research Centre, Saskatoon, SK, S7N 0X2

Clubroot (*Plasmodiophora brassicae*) is a disease affecting many important Brassica crops. Fumigation may be an effective method to control clubroot. The efficacy of the fumigants metam-sodium (Vapam HL and Busan 1236) and chloropicrin (Pic Plus) were assessed in growth room and field trials. A disease severity index (DSI) was calculated based on root swelling on Shanghai pak choy (*Brassica rapa* L. subsp. chinensis var. communis) plants. In field trials conducted on soil with high organic matter and disease pressure, treatment with Pic Plus reduced DSI compared to the untreated check (DSI 45 and 89, respectively). Treatment with Vapam at 292 or 585 L ai ha-1 was not effective (DSI 78, 89). A field of mineral soil was treated with Vapam (146, 292, and 585 L ai ha-1), Busan (290 L a.i ha-1), and with Pic Plus (168.2, 224.2, 280.3, and 336.4 kg a.i ha-1). Soil was collected 21 days following treatment and seeded with pak choy in a growth room. The untreated check had 7 DSI. No clubroot developed on plants grown in treated soil.). In controlled environment studies, 3.5L of the high organic soil was treated with Busan (145,290, 581 L a.i. ha-1) or Vapam (146,292,585, L a.i. ha-1) and sealed for 3 weeks. Plants grown in treated soil had a DSI < 2, compared to DSI of 70 in the untreated check. Controlled environment trials suggest that higher rates or more effective “sealing” of the soil may improve the effectiveness of both chloropicrin and metam-sodium.

PP-8:

Assessment of dry bean tolerance and the efficacy of biological and chemical controls for soybean cyst nematode

Xinyu Zhang and C. Gillard
Dept. of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON, NOP 2C0

Soybean cyst nematode (*Heterodera glycines* Ichinohe; SCN) is the most serious yield-limiting parasite of soybean. As the alternate host of SCN, dry bean (*Phaseolus vulgaris L.*) is under increasing threat from SCN, but there is limited knowledge on the relationship between the two. Field studies were conducted in 2013-2014 near Rodney and Exeter ON in naturally infested soil to address this need. The first study determined the SCN tolerance of 22 commercial dry bean varieties representing navy, black, cranberry, otebo, adzuki, pinto, and kidney bean market classes. Other studies investigated the role that biological and chemical controls may play in SCN management, since genetic controls are poorly understood. *Pasteuria* spp. and *Bacillus firmus* were evaluated as seed treatments and spirotetramat was evaluated as a foliar treatment in tolerant and susceptible market classes. Nematode reproduction, plant growth and yield were measured in each study. Results from 2013 showed differential response among dry bean market classes to SCN, while seed and foliar treatments were ineffective against moderate SCN pressure under typical field conditions.

PP-9:

Susceptibility of the candy-striped spider, *Enoplognatha ovata* (Clerck, 1757), to the ryanoid insecticide Coragen® (chlorantraniliprole)

Mike Tomascik and J. Schmidt
School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2M7

Coragen® (Rynaxypyr®) is a recently commercialized anthranilic diamide insecticide developed by DuPont which selectively disrupts calcium homeostasis in insect muscles by interfering with the function of ryanodine receptors. Coragen® has generally low mammalian toxicity. However, little is known concerning the susceptibility of non-insect beneficial arthropods that may be exposed to spray applications. In this study we have examined the effects of Coragen® on the Candy-striped Spider, *Enoplognatha ovata* (Clerck, 1757) (Araneae: Theridiidae), a web-building, generalist predator common in fields and field margins throughout Southern Ontario. Coragen® applied topically as an aerosol to adult female *E. ovata* using a mini Potter tower caused significant mortality (> 40%) at application rates greater than four times the maximum recommended field rate (2.25 $\mu g/cm^2$). Symptoms of intoxication appeared within 24 hours and were similar to those observed for anthranilic diamide poisoning in insects, including progressive loss of coordination, prolonged leg flexion and paralysis. In lab tests using petri dish arenas and adult *Drosophila* as prey we observed no detrimental effects on feeding behaviour at sublethal doses. Pre-application of 1% piperonyl butoxide (PBO) one hour before treatment with sublethal doses of Coragen® (2.25 $\mu g/cm^2$) resulted in >80% mortality within 48h. These results demonstrate that the ryanodine receptors of *E. ovata* are susceptible to Coragen® and implicate mixed function oxidases in the detoxification of Coragen® by *E. ovata*. The significance of these findings for the use of Coragen® in IPM and the development of resistance management strategies will be discussed.

PP-10 (Undergraduate Student):

Strategy for pest control: Interference of cytochrome C subunit Va gene in spider mites through transgenic plants

Roberta Lima, M. Urizarna, H. Hosseinzadeh and V. Grbic.
[1]Department of Biology, University of Western Ontario, London, ON, N6A 5B7

One of the major agricultural pests, the two-spotted spider mite *Tetranychus urticae*, has been frequently studied due to its wide host range such as tomatoes, strawberries, peppers and grapes, causing significant losses in crop yield. Also, the two-spotted spider mite easily develops resistance to pesticides that have been used to control it. For this reason, recently, many researches have been putting effort into developing new strategies in order to better control this pest. One of the most used technologies is RNA interference (RNAi). In this study, transgenic plants expressing foreign genes are being used as a method to deliver RNAi to the spider mites. The main objective of this project is to verify whether, once the spider mites feed from these plants, RNA interference formed by the inserted gene would silence the Cytochrome c oxidase subunit Va. As this gene is related to the mitochondrial respiration in these arthropods, the silencing of this gene could cause their death or a delay in their development. This method has the potential to be adopted in crop protection programs because it can be directed towards specific pests, such as spider mites, without having an effect on beneficial arthropods that have divergent sequences of the target gene.

REGULAR POSTERS

RP-1:

Evaluation of insecticide application timings for control of swede midge, *Contarinia nasturtii*, in canola

Jonathon Williams[1], B. Hall[2] and R. Hallett[1].
[1]School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2W1
[2]Ontario Ministry of Agriculture, Food and Rural Affairs, Stratford, ON, N5A 6S4

The swede midge, *Contarinia nasturtii* (Kieffer) (Diptera: Cecidomyiidae), is a small gall midge native to Europe and an invasive pest in North America. Larval swede midge feed on cruciferous crops causing a range of serious damage symptoms. In 2005, the first instances of swede midge on canola in Canada were reported in Southern Ontario and Quebec by the Canadian Food Inspection Agency. Since then the swede midge has become an increasingly significant concern for canola growers in Ontario. Larval swede midge feed on young, fast growing plant tissue causing damage symptoms that may not become apparent until after larvae have vacated the plant. Using canola phenology to optimize insecticide application timing may be an effective method for reducing damage caused by swede midge larvae. Insecticide timing trials were conducted in Ontario canola grower fields in 2013 and 2014 comparing foliar application of Coragen (Chlorantraniliprole 200g/L, DuPont) and Matador (λ-cyhalothrin 120g/L, Syngenta Canada Inc.) at several growth stages of spring canola. The trials included spray treatments at the 3-leaf stage, late vegetative stage, and the secondary bud stage, as well as an untreated control. Swede midge populations were also monitored throughout the trials at each site using pheromone traps. Results describing the effects of the treatments on plant damage symptoms and canola yield will be presented.

RP-2:

Toward the characterization of the two-spotted spider mite plant feeding pattern and associated damage

Nicolas Bensoussan, E. Santamaria and V. Grbic
[1]Department of Biology, University of Western Ontario, London, ON, N6A 5B7

The two-spotted spider mite, *Tetranychus urticae* is one of the most polyphagous Arthropods and is a major agricultural pest worldwide. The spider mite has a rapid life cycle and feeds on over 1000 plant species belonging to more than 150 different plant families, including many agriculturally important crops such as tomatoes, peppers, strawberries, grapes and citrus. Damage to crops as a result of spider mite feeding is estimated to be ~1 billion (USD) a year. Therefore, understanding the molecular mechanism underlying plant's ability to recognize and respond to spider mites is essential for addressing this problem. Presently, the primary effect of spider mite feeding on plant tissue is largely unknown. The objective of this study is to further characterize the feeding mode of *T. urticae,* its pattern and associated damage. Analyses of histological leaf cross section from *Arabidopsis* and beans infested with mites were performed to identify the feeding site and to reconstitute the stylet penetration through the mesophyll cells. Microscopic analysis of these sections reveals for the first time that stylets insert between epidermal cells and follow a straight route through the tissue. A selective dye that stains only dead cells (trypan blue) was used to determine the pattern of tissue damage. According to preliminary results, it seems that spider mite feeding causes the death of a small number of mesophyll cells. Understanding the immediate effects of *T. urticae* feeding will help us better understand plant-arthropod interactions at the cellular level and will ultimately lead to novel crop protection strategies.

RP-3:

Management of stemphylium leaf spot (*Stemphylium vesicarium*) of asparagus (*Asparagus officinalis* L.) with fertility and disease forecasting

Jennifer Foster and M.R. McDonald.
Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

Stemphylium leaf spot (*Stemphylium vesicarium*) is a foliar disease of asparagus (*Asparagus officinalis* L.) that reduces the spear quality at harvest and prematurely defoliates the fern, which decreases the yield in subsequent crops. Currently, growers rely on protectant foliar fungicides applied to the fern every 10 to 14 days; studies conducted in 2012 and 2013 established a 20 disease severity value (DSV) trigger point for the TOM-Cast forecasting model in asparagus. The objectives of this research were a) to compare TOM-Cast calculated from in-field or site-specific weather data and b) to assess fungicide programs in an aggressive or standard fertility program. In 2014, a trial arranged in a randomized complete block design was placed in a 10-year-old commercial 'Millennium' asparagus field to evaluate 14-day and TOM-Cast (in-field and site-specific) fungicide programs that included chlorothalonil, metiram and/or azoxystrobin + difenoconazole. In the same field, a second trial was arranged in split-block design to compare fungicides applied on either a 14-day interval or according to TOM-Cast (in-field) in fern that was fertilized only pre-harvest or both pre- and post-harvest. By Sep 19, TOM-Cast treatments from in-field and site-specific weather data had similar foliar yellowing (%), defolation (%) and AUDPC values ($P \leq 0.05$). In the fertilizer trial, the program that included two fertilizer applications had less defoliation than the program with a single fertilizer application on Sep 4 ($P \leq 0.05$). Further research is warranted to validate the results and to establish fertilizer recommendations in new asparagus cultivars.

RP-4:

Nematode management of vegetable crops in Ontario using fumigant and non-fumigant nematicides

Dennis VanDyk, K. Jordan and M.R. McDonald.
Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

Nematode issues are quickly becoming a concern in many vegetable crops in Ontario. With the loss of fumigants such as dichloropropene (Telone) and further restrictions on registered products, finding new non-fumigant nematicides has become a priority. An important nematode pest of carrot (*Daucus carota* L., subsp. *sativus* (Hoffm) Arcang) in Ontario is the northern root-knot nematode (*Meloidogyne hapla* Chitwood). Carrots are extremely sensitive to root-knot nematode damage so the economic threshold for treatment in Ontario is 0 nematode/kg of soil. Growth room and field trials were conducted to compare registered fumigants to new, non-fumigant nematicides. A growth room trial was conducted using muck soil (pH~6.8, organic matter 69.4%) inoculated with *Meloidogyne hapla* at 10940 eggs/L soil. The treatments were Busan 1236 (metam sodium 42.5%, 210 L a.i. ha^{-1}), Dazitol (capsaicin 0.42%, oleoresin of capsicum 3.7%, 59 L a.i. ha^{-1}), MustGrow (oriental mustard seed meal 100%, 1680 kg ha^{-1}), Movento (spirotetramat 24%, 685 g a.i. ha^{-1}), Agri-Mek (abamectin 2%, 2 L a.i. ha^{-1}), and Nimitz (fluensulfone 15%, 4 kg a.i. ha^{-1}). Inoculated and non-inoculated checks were included. Carrots cv. Cellobunch, were seeded into treated soil and grown at 24^{o}C with a 12 hour photoperiod. Dazitol, MustGrow, and foliar-applied Movento did not reduce nematode damage. Busan effectively reduced nematode damage (13.0%) compared to the inoculated check (92.3%). Nimitz and Agri-Mek reduced gall severity (1.3, 1.2) compared to the inoculated check (3.0). Busan, Nimitz and Agri-Mek show some potential to reduce root knot nematode damage on carrot.

RP-5:

Soil amendments for the management of Fusarium wilt in spinach

Brian Collins and M.R. McDonald
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

Fusarium wilt, caused by the soilborne pathogen *Fusarium oxysporum* f. sp. *spinaciae*, is a destructive and persistent disease in spinach production. Field trials were conducted in July and August of 2013 and 2014 in naturally infested soils in Hamilton, Ontario. Disease severity and vascular discolouration was assessed six weeks after seeding. The population of *F. oxysporum* in the soil was measured using soil dilution plating on Komada's media. In 2013, Basamid (97% dazomet), Busan 1236 (42% metam sodium) (tarped and untarped), Perlka (40% calcium cyanamide), Mustgrow (100% *Brassica juncea*) and high nitrogen (XCU 43% N) were applied six weeks before seeding. Disease pressure was low in 2013 with the untreated check having a maximum disease incidence of 11.5%. All treatments reduced disease severity compared to the untreated check. In 2014, the highly susceptible spinach cultivar Norgreen replaced the cultivar Greyhound used in 2013. A Pic-Plus (85.1% chloropicrin) and compost application (75t/ha) were evaluated in addition to the treatments used in 2013. Perlka and compost had a disease severity of 13.3% and 14.6%, respectively and did not differ from the untreated control (14.1%). The treatments Busan and high nitrogen, reduced disease severity to 6% while Basamid and Pic-Plus reduced disease severity to 3.1% and 1.0%, respectively. The population of *F. oxysporum* in the soil was reduced with Busan, Basamid and Pic-Plus from 975 ppg (propagules per gram) to 162 ppg, 75 ppg and 0 ppg, respectively prior to seeding. Soil amendments can be effective tools in managing Fusarium wilt in spinach.

RP-6:

Effect of spore load on growth of clubroot-resistant canola and napa cabbage

Jill Dalton[1], B. Gossen[2] and M.R. McDonald[1]
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1
[2]Agriculture and Agri-Food Canada, Saskatoon Research Centre, Saskatoon, SK, S7N 0X2

Clubroot, caused by *Plasmodiophora brassicae* (Woronin), reduces yield in canola (*Brassica napus* L.) and Brassica vegetables such as Napa cabbage (*B. rapa* L. ssp. *pekinensis*). Genetic resistance is essential for clubroot management. However, studies indicate that high spore loads may reduce growth and delay development in clubroot-resistant cultivars of canola and Napa cabbage. Area under the growth stairs (AUGS) was calculated using weekly measurements of height for canola and leaf length for Napa cabbage. Inoculation with 1×10^6 spores ml^{-1} of *P. brassicae* reduced plant height by 12% in three resistant canola cultivars, but leaf length of Napa cabbage cultivars was only reduced by 3%. A field trial was conducted in 2014 to compare the growth of clubroot-resistant canola cultivars at two adjacent sites at the Muck Crops Research Station differing only in spore loads of *P. brassicae*. There were no symptoms of clubroot in the resistant cultivars, but severe clubroot developed in the susceptible control at both sites. At the location with a high spore load, plant height of the resistant canola cultivars was reduced by 39% and leaf length of Napa cabbage was reduced by 19% relative to the lower spore load. These results support previous reports that the growth of resistant cultivars is reduced when resting spore populations are high in canola and Napa cabbage. In canola, high levels of resting spores in soil reduce plant growth and (likely) yield.

RP-7:

Brown marmorated stink bug spreads through Ontario: 2014 survey results and next steps

Cynthia Scott-Dupree[1], H. Fraser[2], T. Gariepy[3] and T. Baute[4]

[1]School of Environmental Science, University of Guelph, Guelph, ON, N1G 2W1
[2]Ontario Ministry of Agriculture, Food and Rural Affairs, Vineland, ON, L0R 2E0
[3]Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, ON, N5V 4T3
[4]Ontario Ministry of Agriculture, Food and Rural Affairs, Ridgetown, ON, N0P 2C0

The brown marmorated stink bug (*Halyomorpha halys* Stål) (BMSB) is a highly invasive insect pest native to East Asia. Since its documented establishment in Pennsylvania in 2001, it has spread through northeastern US, where it causes economic damage to a broad range of horticultural, fruit, field and nursery crops, and has become a household nuisance pest due to its affinity for overwintering in residential structures. The first record of BMSB in Ontario was in 2010 (homeowner finds) and by 2012 an established population was identified in the Hamilton area. A survey for BMSB in rural, urban/industrial, agricultural and transportation corridor sites in southern Ontario was initiated in 2013 - 264 survey sites (i.e., visual and pheromone monitoring). The survey continued in 2014 - 250 survey sites and has clearly documented the spread of this potentially devastating pest in southern Ontario. Positive finds in close proximity to agricultural crops heighten the concern over this pest and highlight the need to continue monitoring and develop efficient management strategies.

RP-8:

The mystery of ginseng replant disease

Sean Westerveld[1], R. Riddle[2] and A. Fang Shi[3]

[1] Ontario Ministry of Agriculture, Food and Rural Affairs, Simcoe, ON, N3Y 4N5
[2]Ontario Ginseng Growers Association, Simcoe, ON, N3Y 4N5
[3]Dept. of Plant Agriculture, University of Guelph-Simcoe Research Station, Simcoe ON, N3Y 4N5

Ginseng has the highest annual farm-gate value of any field-grown horticultural crop in Ontario with annual exports over $200,000,000. The industry is threatened by ginseng replant disease, a condition that prevents successful cultivation of ginseng on the same land twice, even decades later. Suitable sandy soils for ginseng cultivation are becoming scarce as a result. Although the disease is poorly understood, previous research had identified the involvement of the soil-borne fungus *Cylindrocarpon destructans*. While the fungus commonly develops in new gardens, it is much more aggressive in replanted gardens, developing earlier in the cropping cycle and usually leading to complete crop loss or substantially reduced yield. However, studies have also hypothesized additional factors may be involved including allelopathic effects of ginseng on subsequent plantings, other soil-borne fungi and oomycetes, or a combination of these factors. A research study was initiated in 2014 to identify the causes of replant disease, examine the impacts of fumigation practices, and test existing soil monitoring tools for identifying at-risk sites. *C. destructans* has been isolated from most replant gardens to date, confirming its involvement in the disease. Existing PCR-based soil tests were not sensitive enough to detect the fungus in the soil prior to the second ginseng crop. Fumigation greatly reduced the impact of *C. destructans* in the first year of production, but development of the disease was observed in treated fields. Future research will focus on other factors that may contribute to the disease, development of new soil monitoring tools and alternative management strategies.

RP-9:

The effect of indole glucosinolates and myrosinase in life table characteristics of two-spotted spider mite *Tetranychus urticae*

Golnaz Salehipour-shirazi

Dept. of Biology, University of Western Ontario, London ON, N6A 5B7

Glucosinolates are plant secondary metabolites that play important role in pest resistance of some plants in the family brassicaceae including the model plant, *Arabidopsis thaliana*. To be toxic to herbivores, glucosinolates should be broken down by the enzyme myrosinase which is found in the same plants but in separate cells. The damage induced by herbivory results in the exposure of glucosinolates to myrosinase and as a result degradation of glucosinolates. Previous studies have shown that indole glucosinolates (IGs) content of *A. thaliana* reduces performance of the key pest, two-spotted spider mite (*Tetranychus urticae*). However, the damage induced by *T. urticae* feeding is not enough to make glucosinolates and myrosinase to be exposed to each other. To investigate the effect of myrosinase and IGs on increase rate of *T. urtica* population I studied life table characteristics of *T. urticae* on three genotypes of *A. thaliana*: Col-0 (wild type), *cyp79B2,B3* (Col-0 mutant that lackes IGs) and *tgg1 tgg2* (Col-0 mutant that lacks myrosinase). The largest intrinsic rate of population increase (r_m) and the lowest mean generation time (T) were seen on *cyp79B2,B3* which shows the negative effect of IGs on *T. urticae* population. There was no significant difference in r_m and T of Col-0 and *tgg1tgg2* plants showing that plant myrosinase is not envolved in IGs degradation. The results suggest that even in plants that do not contain myrosinase, IGs application could be studied as a potential strategy in control of two-spotted spider mites on crops.

RP-10:

Integrated pest management of muck vegetable crops in the Holland Marsh, Ontario

Dennis Van Dyk and M.R. McDonald

Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

Integrated pest management (IPM) is an integrated approach to crop management with the primary aim of protecting crops from economic damage from pathogens, weeds and insect pests, while minimizing pesticide use. An IPM program is provided to vegetable growers in the Holland/Bradford Marsh, Ontario, by the University of Guelph Muck Crops Research Station (MCRS) in cooperation with the Holland Marsh Growers' Association, the Bradford Co-Operative Storage Ltd. and various chemical companies. The main objectives of the project are to scout growers' fields for diseases, weeds and insect pests, to provide growers with disease and insect forecasting information, and to identify and diagnose diseases, insect pests and weeds. In 2014, 79 commercial vegetable fields, totaling 843 acres (onion 378 A., carrot 405 A., and celery 60 A.), were scouted for 27 growers. Fields were scouted twice a week during the growing season and growers received scouting reports after each field survey. The IPM program also provides disease and insect forecasting based on spore traps, disease forecasting models (BOTCAST, DOWNCAST, and BREMCAST), degree day models and insect traps. The disease and insect forecasts, weather information and the IPM update are posted on the Muck Crops Research Station's web site (www.uoguelph.ca/muckcrop) and e-mailed to growers, industry, academia and OMAF experts.

NOTES

Post Event Evaluation – Ontario Pest Management Conference

Thank you for responding to the following questions. Your feedback will assist us in evaluating today's conference and improving future sessions.

Background

Profession: (Please circle) Research Government Grower Consultant Industry Rep

Input Supplier (retail/distribution) Student Other_____

Overall Feedback

1. How would you rate the following aspects of the conference? (circle the most appropriate number)

	Poor	Fair	Average	Good	Excellent
The content of the sessions	1	2	3	4	5
The speakers	1	2	3	4	5
The length of the sessions	1	2	3	4	5
The media used by the speakers	1	2	3	4	5
Practical information on pest management	1	2	3	4	5
The poster session	1	2	3	4	5

2. What session did you like the best/find most effective (and why)?

3. What sessions did you find the least helpful (and why)?

4. Please suggest changes we could make that would significantly improve the conference.

5. Please indicate the extent to which you agree or disagree with the following statements concerning the conference:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Topics were current.	1	2	3	4	5
It improved my understanding of new directions in pest management.	1	2	3	4	5
The information will influence my planning/work within the next two years.	1	2	3	4	5
In the end, I got what I needed from the conference.	1	2	3	4	5

6. Overall, how satisfied were you with the conference?

Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
1	2	3	4	5

Thank you very much for taking the time to complete this survey. Your feedback will help us in organizing future events.

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