OPMC
Ontario Pest Management Conference 2016

14th Annual

The Nexus of Science and Advocacy for Sustainable Pest Management

November 10, 2016

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

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Mike Celetti, Ontario Ministry of Agriculture, Food and Rural Affairs
Melanie Filotas, Ontario Ministry of Agriculture, Food and Rural Affairs
Cynthia Scott-Dupree, School of Environmental Sciences, University of Guelph
Harold Wright, Syngenta Canada

AGENDA

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

MORNING SESSION

Morning Session Chair: Meghan Moran, OMAFRA

9:00 am **Welcome: Ian Scott**, Acting Chair, Ontario Pest Management Conference
Opening Remarks and Introduction of Student Poster Presenters

9:15 am Carrot rust flies beware: Your natural enemies are thriving in the Holland Marsh. **Jason Lemay**, C. Scott-Dupree and M.R. McDonald. (Student Competition)

9:30 am Distribution and control of glyphosate-resistant waterhemp (*Amaranthus tuberculatus* var. *rudis*) in soybean (*Glycine max*) in Ontario. **Mike Schryver**, D. Hooker, P. Tranel, D. Robinson and P. Sikkema. (Student Competition)

9:45 am Seasonal dynamics of airborne inoculum and management of Stemphylium leaf blight on onions in Ontario. **Selasi Tayviah**, B.D. Gossen and M.R. McDonald. (Student Competition)

10:00 am Welcome to a new era of agri-food policy-setting: Science no longer rules! **Terry Daynard**, Retired Professor - University of Guelph. (Invited Speaker)

10:30 am – 11:00 am Coffee Break and Poster Viewing

11:00 am Plenary Speaker:

Dr. Len Ritter
Professor Emeritus, School of Environmental Sciences,
University of Guelph

"Glyphosate – Understanding the issues: Resolving the controversy"

11:45 am New trends in carrot weevil activity requires modification of IPM recommendations in Ontario. **Zachariah Telfer**, J. Lemay, M.R. McDonald and C. Scott-Dupree. (Student Competition)

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

AFTERNOON SESSION

Afternoon Session Chair: Roselyne Labbé, Agriculture and Agri-Food Canada

1:00 pm Nicosulfuron as a suppressant in a living mulch of annual ryegrass (*Lolium multiflorum* Lam.) in corn (*Zea mays* L.). **Taïga Cholette**, D. Robinson, D. Hooker and P. Sikkema. (Student Competition)

1:15 pm Resistance to fungicides in the turfgrass pathogen *Microdochium nivale*. **Ryan Gourlie** and T. Hsiang. (Student Competition)

1:30 pm Management of giant hogweed with selective herbicides. **Meghan Grguric** and F. Tardiff. (Student Competition)

1:45 pm Inscalis, A new insecticide for the Canadian horticultural sector. **Lindsey Goudis**, BASF Canada, Inc. (Industry Speaker)

2:00 pm Plenary Speaker:

Dr. Kevin Folta

Professor and Chair, Horticultural Sciences Department & Graduate Program in Plant Molecular and Cellular Biology, University of Florida

"Developing Public Trust in Agricultural Technologies"

2:45 pm-3:00 pm Coffee Break and Poster Viewing

3:00 pm Bacterial leaf spot – an emerging disease of squash and pumpkin. **Elaine Roddy** and C. Trueman. (Regular Speaker)

3:15 pm Progress toward the development of standardized pesticide risk assessment methodology for *Megachile rotundata*. **Andrew Frewin,** C. Scott-Dupree and A. Gradish. (Regular Speaker)

3:30 pm Of neonics, corn, dust and pollinators, what did we learn? **Art Schaafsma**, University of Guelph-Ridgetown. (Invited Speaker)

4:00 pm Presentation of Student Competition Award Winners **–** **Harold Wright**, CropLife Canada

Closing Remarks and Adjourn

PLENARY SPEAKERS

Dr. Len Ritter – Professor Emeritus, School of Environmental Sciences, University of Guelph

Biography

Since 1993, Dr. Ritter has been Professor of Toxicology in the School of Environmental Sciences at the University of Guelph and was Executive Director of the Canadian Network of Toxicology Centers from 1993 – 2011. Additionally, Dr Ritter also served as coordinator of a national metals research network from 1999 - 2009. In 2011, Dr Ritter was appointed Professor Emeritus in the School of Environmental Sciences. Dr Ritter is also Adjunct Professor of Toxicology at the Chulabhorn Research and Graduate Institutes in Bangkok, Thailand. From 1977 to 1993, he worked at the Health Protection Branch of Health Canada in various roles related to tobacco control, consumer product safety, environmental contaminants and the safety and regulation of pesticides and veterinary drug residues in food. Dr Ritter has served as Chair of the Agriculture and Agri-Food Canada Science Advisory Board, as a long serving expert advisor to the Joint Expert Committee on Food Additives of the World Health Organization and Food and Agricultural Organization of the United Nations, on the US EPA Human Studies Review Board and on various boards and expert panels organized by the Royal Society of Canada, Canada's Pest Management Regulatory Agency, the Council of Canadian Academies, the National Cancer Institute of Canada, the U.S. National Academy of Sciences, the World Trade Organization, the International Commission on Occupational Health and the International Centre on Pesticide Safety. Dr. Ritter has co-authored or contributed to several textbooks on toxicology and lectures widely nationally and internationally on hazard, risk and exposure assessment of environmental contaminants, food additives and pesticides.

Dr. Ritter holds a B.Sc. (Hons) and M.Sc. in biology and biochemistry from Sir George Williams University in Montreal, Canada and a PhD in biochemistry from Queen's University School of Medicine. Dr. Ritter is a Fellow of the Academy of Toxicological Sciences and, in 2006, was awarded a medal by the UN World Health Organization in recognition of his contributions.

Dr. Kevin Folta – Professor and Chairman of Environmental Sciences Department and Graduate Program in Plant Molecular and Cellular Biology, University of Florida

Biography

Kevin M. Folta is a Professor and the Chairman of the Horticultural Sciences Department at the University of Florida. He has been recognized as an expert in guiding the communications efforts in agricultural technologies, assisting everyone from small farmers to industry giants learn how to connect what they do to a curious and concerned public. His research examines how light signals are sensed in plants and how different parts of the spectrum can change shelf life and high-value fruit and vegetable traits. His group also uses novel genomics approaches to identify genes related to flavor and disease resistance. He recently has been recognized with the prestigious CAST Borlaug Award in Agricultural Communications. BS/MS Northern Illinois University 1989/1992, Ph.D. University of Illinois at Chicago, 1998.

INVITED SPEAKERS

Dr. Terry Daynard – Retired Professor, Department of Plant Agriculture, University of Guelph and local farmer for 43 years

Biography

Terry was raised on a farm near Mitchell, Ontario and received three degrees including a Ph.D. from the University of Guelph. Following a post-doctorate at the University of Kentucky, he served as a faculty member in the Department of Crop Science (now Dept. of Plant Agriculture), University of Guelph for 16 years. He was then Executive Vice-President of the Ontario Corn Producers for 19 years. This position also involved tenures as President or Chair of the Canadian Renewable Fuels Association, the National Committee on Agriculture and Climate Change, and Ontario Agri-Food Technologies. He later served as Associate Dean – research and Innovation in the Ontario Agricultural College at the University of Guelph, and then as founding CEO of the Ontario BioAuto Council and an adviser to the Bioproduct Discovery and Development Centre, University of Guelph. He and his wife have farmed commercially in the Guelph area for 43 years. Daynard is a member of the Order of Ontario and the Ontario Agricultural Hall of Fame.

Dr. Art Schaafsma – Professor of Field Crop Protection, Department of Plant Agriculture, University of Guelph

Biography

Dr. Art Schaafsma is a Professor in the Department of Plant Agriculture and Past Director at the University of Guelph, Ridgetown Campus. He has twenty-nine years' experience in extension, research and teaching in field crop protection and agronomy at the Ridgetown Campus. He also has four years' work experience in the crop protection industry in Manitoba and Alberta. Dr. Schaafsma is the co-founder and past director of CARES (Centre for Agricultural Renewable Energy and Sustainability), a Fellow of the Canadian Society of Agronomy (since 2011) and current chair of the Canadian Corn Pest Coalition. He has been an invited speaker at numerous national and international scientific meetings and past consultant to the FAO of the UN on mycotoxins. Dr. Schaafsma has authored or co-authored over 75 peer reviewed scientific articles. Dr. Schaafsma's key research foci are: (1) working on integrated farm to fork strategies to manage mycotoxins in grains: agronomics, plant breeding, forecasting, grain harvest, storage, handling and grading; (2) integrated management of emerging and invasive field crop insect pests and related issues (most recently neonicotinoids and bees); and, (3) stewardship and deployment of transgenic crop pest resistance. Dr. Schaafsma holds a B.Sc. (Agr), M.Sc. in Plant Protection and Ph.D. in Crop Protection from the University of Guelph. He is a cash crop farmer.

–CROPLIFE STUDENT COMPETITION–

Student Oral Presentations:

OP-1 Carrot rust flies beware: Your natural enemies are thriving in the Holland Marsh. **Jason Lemay**, C. Scott-Dupree and M.R. McDonald.

OP-2 Distribution and control of glyphosate-resistant waterhemp (*Amaranthus tuberculatus* var. *rudis*) in soybean (*Glycine max*) in Ontario. **Mike Schryver**, D. Hooker, P. Tranel, D. Robinson and P. Sikkema.

OP-3 Seasonal dynamics of airborne inoculum and management of Stemphylium leaf blight on onions in Ontario. **Selasi Tayviah**, B.D. Gossen and M.R. McDonald.

OP-4 New trends in carrot weevil activity requires modification of IPM recommendations in Ontario. **Zachariah Telfer**, J. Lemay, M.R. McDonald and C. Scott-Dupree.

OP-5 Nicosulfuron as a suppressant in a living mulch of annual ryegrass (*Lolium multiflorum* Lam.) in corn (*Zea mays* L.). **Taïga Cholette**, D. Robinson, D. Hooker and P. Sikkema.

OP-6 Resistance to fungicides in the turfgrass pathogen *Microdochium nivale.* **Ryan Gourlie** and T. Hsiang.

OP-7 Management of giant hogweed with selective herbicides. **Meghan Grguric** and F. Tardif.

Judges: Michael Celetti - OMAFRA (Judging Supervisor)

1. Cary McCreary – OMAFRA
2. John Purdy – Abacus Consulting Services Limited
3. Rachel Riddle – University of Guelph
4. Scott Hodgins – BASF

-Student Poster Presentations-

GP-1 Identification of microRNAs modulated at low temperatures in Colorado potato beetles. **Mathieu Morin** and P.J. Morin. **(Time of judging 9:15-9:30 am**)

GP-2 Evaluation of weather-based forecasting models and cultivar resistance to manage leaf curl (*Colletotrichum fioriniae*) on celery crops in Ontario. **Stephen Reynolds**, M.R. McDonald and M. Celetti. **(Time of judging 9:45-10:00 am)**

GP-3 Determination of toxic reference standards for use in semi-field pesticide toxicity studies with *Bombus impatiens* (Cresson). **Tara Celetti**, A. Gradish, C. Cutler, P. Sibley, and C. Scott-Dupree. **(Time of judging 10:15-10:30 am)**

GP-4 Fatal attraction: the volatile influences that will lead whiteflies to deadly encounters and the dsRNA responsible. **Kaitlyn K. Ludba,** C. Donly, G.J. Thompson and I. Scott. **(Time of judging 1:00-1:15 pm)**

GP-5 The mechanism of spirodiclofen resistance in two-spotted spider mite. **Hooman H. Namin**, I. Scott, V. Grbic and M. Grbic. **(Time of judging 1:30-1:45 pm)**

GP-6 The cost and control of linuron resistant pigweed in carrots. **Tessa de Boer** and C. Swanton. **(Time of judging 9:30-9:45 am)**

GP-7 Relationship between boron tolerance and clubroot development in *Brassica napus* and *B. rapa,* 2015 and 2016. **Andrew McLean**, B.D. Gossen and M.R. McDonald. **(Time of judging 10:00-10:15 am)**

UP-8 Status of ambrosia beetles in high-density apple orchards in southwestern Ontario. **Ellen Richard**, H. Fraser, K. Grigg, M. Celetti and C. Scott-Dupree. (UNDERGRADUATE) **(Time of judging 11:45 am-12:00 pm)**

UP-9 Field evaluation of parasitic nematodes in seeded onions and insecticide tray drenches in transplanted onions for control of onion and seed corn maggot. **Taylor Lipsett**, K. Vander Kooi and M.R. McDonald. (UNDERGRADUATE) **(Time of judging 1:15-1:30 pm)**

UP-10 Are aphidophagous syrphids entering southern Ontario greenhouses? **Eli Bennett**, R. Labbé, and C. McCreary. (UNDERGRADUATE) **(Time of judging 1:45-2:00 pm)**

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

Judges: Michael Celetti – OMAFRA (Judging Supervisor)

1. Sara Jandricic - OMAFRA
2. Sean Westerveld - OMAFRA
3. Amy Fang Shi – Ontario Ginseng Growers Association
4. Jason Deveau – OMAFRA

-REGULAR POSTER PRESENTATIONS-

RP-1 Efficacy of insecticides for control of brown marmorated stink bug (*Halyomorpha halys* Stål) nymphs in Ontario. A. Gradish, H. Fraser, T. Gariepy, K. Hunter and **Cynthia Scott-Dupree**.

RP-2 Genetic variability of RNAi pest control. M.A. Nunes, **Nicolas Bensoussan**, P. Jin, V. Zhurov, T. Suzuki, M.U. España, M. Grbic and V. Grbic.

RP-3 Half-life estimation for *Plasmodiophora brassicae* resting spores in a six-year crop rotation study using propidium monoazide-assisted PCR. **Fadi Al-Daoud**, B.D. gossen, J. Robson, D. Pageau and M.R. Mcdonald

RP-4 An economic analysis of biological control programs for white grubs and chinch bugs in Ontario's lawn care sector. **Longfeng Weng**, C. Schmidt and M. Brownbridge.

RP-5 Assessing the effects of insect exclusion netting on insect pests in high tunnel greenhouse organic production systems in southern Ontario. **Mackenzie Plommer**, M.R. McDonald and C. Scott-Dupree.

RP-6 Stripe rust in Ontario winter wheat in 2016. **Ljiljana (Lily) Tamburic-Ilincic** and S. Barcellos Rosa..

RP-7 Effects of fumigants and biofumigants on ginseng replant disease. **Amy Fang Shi**, S. Westerveld and R. Riddle

RP-8 Comparison of methods for extracting plant-parasitic nematodes from field soils to accurately estimate populations. **Tyler Blauel**, T. Wallace, D. VanDyk, M. Celetti, M.R. McDonald and K.S. Jordan.

RP-9 Comparing different methods of field application of bacterial endophytes as biocontrol agents to combat gibberella ear rot in maize. **Charles Shearer**, V. Limay-Rios and M. N. Raizada.

ORAL PRESENTATION ABSTRACTS
MORNING SESSION

CROPLIFE STUDENT COMPETITION (OP-1):

Carrot rust flies beware: your natural enemies are thriving in the Holland Marsh.

Jason Lemay[1], C. Scott-Dupree[2] and M. R. McDonald[1]
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON
[2]School of Environmental Sciences, University of Guelph, Guelph, ON

Carrots are one of the most important field vegetables in Ontario, with more than 180,000 tonnes produced in 2015. Carrot rust fly (*Psila rosae* Fab.) (CRF) is a significant pest of carrots and other apiaceous crops. There is a very low tolerance for CRF damage, and >5% damage to the crop can result in 100% yield loss to the grower. Historically, damage from this pest has been sporadic and difficult to predict. Trials to evaluate the effectiveness of insecticides and application methods have been unsuccessful in identifying a management strategy to provide consistent CRF control. However, the influence of natural enemies to control CRF populations has largely gone unstudied. In 2015 and 2016, four commercial carrot fields and research plots were sampled via pitfall traps to study the diversity of natural enemies in the Holland Marsh agroecosystem. In 2015, a total 1,117 beetles representing 23 species of carabid beetles (Carabidae: Coleoptera), and two species of rove beetles (Staphylinidae: Coleoptera) were identified. Of these 25 species only three (*Pterostichus melanarius, Bembidion quadrimaculatum,* and *Aleocharinae* sp.) were confirmed predators of CRF. Furthermore, 8 species represented >95% of the beetles recovered. These results suggest that while many predators were recovered, few species represent a large proportion of the CRF predator abundance. Furthermore, since CRF natural enemies have been confirmed in the Holland Marsh, future studies can be developed to examine their impact on CRF populations, and how to promote their populations. Results from 2016 will also be discussed.

CROPLIFE STUDENT COMPETITION (OP-2):

Distribution and control of glyphosate-resistant waterhemp (*Amaranthus tuberculatus* var. *rudis*) in soybean (*Glycine max*) in Ontario

Mike Schryver[1], D. Hooker[1], P. Tranel[2], D. Robinson[1] and P. Sikkema[1]
[1]Department of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON
[2]Department of Crop Sciences, University of Illinois, Champaign, IL

Glyphosate-resistant (GR) waterhemp (Amaranthus tuberculatus var. rudis) (WH) was first confirmed in Lambton County, Ontario in 2014. This small-seeded, summer annual, broadleaf weed has an extended emergence pattern, has high genetic diversity, is a prolific seed producer, and is very competitive. In Ontario, WH interference has been documented to reduce soybean yield by 73%. The focus of this research was to determine the distribution of GR WH in Ontario and to develop strategies for its control in soybean. Forty-eight WH seed samples were collected in the fall of 2015, and screened for resistance to: Group 9 (glyphosate), Group 5 (atrazine) and Group 2 (imazethapyr). Survey results conclude there are 39 sites with GR WH populations (81% of all samples) found in Essex, Chatham-Kent and Lambton counties. In addition, 100% of the samples surveyed were resistant to imazethapyr (Group 2) and 75% to atrazine (Group 5). At 84 days after application (DAA), pyroxasulfone/flumioxazin, pyroxasulfone/sulfentrazone and s-metolachlor/metribuzin provided 95, 91 and 85% GR WH control, respectively. At 84 DAA, in Liberty Link soybean, a sequential application of pyroxasulfone/flumioxazin, pyroxasulfone/sulfentrazone or s-metolachlor/metribuzin applied PRE

followed glufosinate applied POST provided 98, 96, and 94% GR WH control, respectively. This research provides valuable information for growers by documenting the distribution of GR WH in Ontario and developing control programs in soybean.

CROPLIFE STUDENT COMPETITION (OP-3):

Seasonal dynamics of airborne inoculum and management of Stemphylium leaf blight on onions in Ontario

S.C. Tayviah[1], B.D. Gossen[2] and M.R. McDonald[1]
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON
[2]Agriculture and Agri-Food Canada, Saskatoon, SK

Research on Stemphylium leaf blight on onion, caused by *Stemphylium vesicarium* Wallr Simmons (telemorph; *Pleospora allii* (Rabenh) Ces.&deNot.), was conducted at the Holland Marsh in 2015 and 2016. Symptoms were observed from late June to mid-July (4–6 leaf stage) through early fall. Final incidence was 97% in 2015 and 65% in 2016. There were no correlations between blight levels (incidence or severity) with rainfall, temperature, leaf wetness duration and relative humidity 10 days before assessments in either year. Air-borne spore concentrations were higher in 2015 (total 470 ascospores, 3903 conidia) and was positively correlated with total rainfall 10 days before capture. Concentration of air-borne spores showed a diurnal pattern with the majority captured between 0600–1800 h. Most of the ascospores (98%) were captured before disease onset, but ≥70% of conidia were captured during disease development. An abundance of conidia during disease development indicate that conidial inoculum is important for disease development. Early application of protective fungicides, mancozeb 75% and fluopyram 12.5%, pyrimethanil 37.5% before disease onset reduced diseased incidence. Under high disease pressure, fungicide applications according to TOMCAST DSV 15 saved two spray applications compared to BOTCAST, STEMCAST and routine calendar application without affecting disease levels. However, fungicide applications only reduced disease severity by 20%. Modification of spray timing programs to include rainfall, temperature ≥ 15 °C and leaf wetness duration ≥ 6 h would improve disease forecasting and management of the disease in the Holland Marsh.

INVITED ORAL PRESENTATION:

Welcome to a new era of agri-food policy setting: Science no longer rules!

Dr. Terry Daynard
Professor-Retired, Department of Plant Agriculture, University of Guelph, Guelph ON

Agriculture continues to seek better ways of communicating with the general public, especially on issues related to new technologies. The challenges include: new generations of urbanites with no connections to farmers or farming; limited understanding of (and respect for) science; distrust of “experts” and authority; social media; mainstream media struggling for relevancy; distrust of big businesses including big agriculture and food; an abundant, cheap food supply; widely divergent personal views about risks and benefits; increasingly sophisticated NGOs; and more. Although NGO fund raising is a factor, its significance as a “driver” is often over-stated. A small number of dedicated, media-savvy activists can have a huge influence on public policy. Single incidents which get prominent media attention can be decisive. Developing-world needs for food are, unfortunately, of margin significance to most Canadians. We saw with the neonicotinoid issue in Ontario what happens when agriculture handles public communications poorly and activists do it well. But we also have examples of where agriculture has done it well. A major battle for public opinion is now underway over the use of genetically enhanced crops. The same with some pesticides. All of animal agriculture is under attack. The future of Canadian agriculture is so dependent on how these issues are managed.

PLENARY PRESENTATION:

Glyphosate – understanding the issues: resolving the controversy

Dr. Len Ritter
Professor Emeritus, School of Environmental Sciences, University of Guelph, Guelph, ON

Glyphosate is the most widely used herbicide in the world, with reported use of 283 million pounds in 2012 in the US alone, and significant recent increased use due to the introduction of various engineered glyphosate resistant crops. Glyphosate was first registered in Canada and the US in the mid '70s and underwent its first major re-evaluation of its safety by the US EPA in 1993. Glyphosate is registered for use in over 100 countries and applied to over 125 food crops. Owing to its very prominent place in the global market, various aspects of its safety have been reviewed by numerous agencies and authorities world wide, as well as attracting the attention of independent scientists, culminating with the declaration in March 2015 by the WHO International Agency for Research on Cancer (IARC) that glyphosate is a "probable human carcinogen". International reaction to the IARC designation has been swift, broadly based and controversial with confirmation by the world's leading regulatory and health authorities that the IARC conclusion is not relevant to real life use and that glyphosate continues to be safe for use when applied in accordance with the product label. The presentation will review the events leading up to the IARC designation, the reaction to it and the current status in Canada and internationally.

CROPLIFE STUDENT COMPETITION (OP-4):

New trends in carrot weevil activity require modification of IPM recommendations in Ontario.

Zachariah Telfer[1], J. Lemay[2], M.R. McDonald[2], and C. Scott-Dupree[1]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON
[2] Department of Plant Agriculture, University of Guelph, Guelph, ON

The carrot weevil (CW), *Listronotus oregonensis* (LeConte), is a primary insect pest of carrot production in Ontario. Yield loss due to CW larval feeding can exceed 40% but is highly variable. In Ontario, the CW has historically been univoltine and IPM recommendations consist of insecticide applications at the 2nd and 3rd true leaf stage, based on action thresholds. Imidan 70 WP (phosmet) was the only registered product for CW control in Canada until recently and is still the primary product used despite concerns of resistance. This study re-examined the CW IPM program in Ontario to provide consistent and improved CW control. In laboratory assays using a 1/9th scale Potter spray tower, CW were found to be generally tolerant to five of eight insecticides tested and an Ontario strain of CW had an increased tolerance to phosmet compared to a susceptible strain. In 2015, field trials at the University of Guelph Muck Crop Research Station found all six foliar insecticides, including phosmet, and four seed treatments tested failed to effectively control CW. During the 2015 field season, new evidence emerged suggesting CW attack can cause mortality of young carrots plants and may also be developing a second generation in Ontario. Preliminary data from 2016 suggests two novel foliar insecticides can reduce CW damage by ~50%, while two seed treatments reduced carrot death due to CW attack but failed to reduce total CW damage. Overall, it appears CW activity in Ontario is changing and as such IPM recommendations must be modified.

AFTERNOON SESSION

CROPLIFE STUDENT COMPETITION (OP-5):

Nicosulfuron as a suppressant in a living mulch of annual ryegrass (*Lolium multiflorum* Lam.) in corn (*Zea mays* L.).

Taïga Cholette, D. Robinson, D. Hooker and P. Sikkema
Department of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON

Living mulches are seeded at the same time, or after establishment of, a cash-generating crop to reduce nitrate leaching, sequester nutrients, reduce erosion, and improve soil health. However, a living mulch can compete with the main crop for limited resources resulting in reduced grain yield. It is hypothesized that using nicosulfuron at a fraction of its labeled rate could suppress an annual ryegrass living mulch thereby reducing competition between the living mulch and the corn crop. To investigate the hypothesis, annual ryegrass was seeded at the same time as corn at three sites in May 2016 near Ridgetown, ON. Nicosulfuron was applied at eight rates (0.8, 1.6, 3.1, 6.3, 12.5, 25 and 50 g ai ha^{-1}) at the 2-3 leaf stage or 4-5 leaf stage. Annual ryegrass control was assessed 7, 14, 28 and 56 days after application (DAA) and biomass was determined 28 DAA. Control of annual ryegrass at 28 DAA ranged from 8 to 94% as the rate of nicosulfuron increased from 0.8 to 50 g ai ha^{-1}, regardless of whether the herbicide was applied at either the 2-3 or 4-5 leaf stage. Nicosulfuron at 0.8, 1.6, 3.1, 6.3, 12.5, 25 and 50 g ai ha^{-1} applied at the 2-3 leaf stage reduced annual ryegrass biomass 30, 16, 31, 59, 79, 87 and 96%, respectively and 22, 49, 67, 76, 90, 97 and 98%, respectively when applied at the 4-5 leaf stage.

CROPLIFE STUDENT COMPETITION (OP-6):

Resistance to fungicides in the turfgrass pathogen *Microdochium nivale*

Ryan Gourlie and T. Hsiang
School of Environmental Sciences, University of Guelph, Guelph, Ontario

Microdochium nivale is a serious pathogen of turfgrass particularly in cool wet climates. To control *M. nivale* and other turfgrass pathogens, turfgrass managers often make several fungicide applications per year. Iprodione and propiconazole are two frequently used fungicides for the control of *M. nivale*. In this study, samples were collected from golf courses in British Columbia and, along with over 100 reference isolates (mainly from Ontario), they were assessed for their sensitivity to iprodione and propiconazole. Many of these isolates were found to have reduced sensitivity to both fungicides with resistance factors (resistant EC_{50} / sensitive EC_{50}) above 10. This is the first lab confirmation of reduced sensitivity towards iprodione and propiconazole in this pathogen in Canada. Additionally, isolates were screened for sensitivity to the new fungicide penthiopyrad, with most B.C isolates showing a high degree of sensitivity to this new compound. Field testing of insensitive isolates will be necessary to establish whether the level of insensitivity seen in the lab corresponds to full blown field resistance. Representative isolates from each sensitivity category (all four combinations of iprodione and propiconazole sensitivity) were selected for fitness testing. Isolates with insensitivity to either iprodione (11) or propiconazole (21) exhibited significantly reduced mycelial growth on unamended growth media. However isolates with insensitivity to both iprodione and propiconazole (32) surprisingly showed no signs of mycelial growth reduction. Further research into resistance-related fitness costs such as reduced pathogenicity or sporulation capacity is needed to assess pleiotropic effects of fungicide resistance mutations.

CROPLIFE STUDENT COMPETITION (OP-7):

Management of giant hogweed with selective herbicides

Meghan Grguric and F. Tardif
Department of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON

Giant hogweed (*Heracleum mantegazzianum*) is highly toxic to humans and invasive in North America and parts of Europe, causing environmental, economic and public health concerns. Its persistence and ability to spread rapidly make it hard to manage. Glyphosate is an efficient herbicide for the control of this weed, but its lack of selectivity and soil persistence allow for seedlings to emerge later on in the season and establish an overwintering root system. We hypothesize that residual selective herbicides exist that can provide adequate, immediate and lasting control over giant hogweed. Four trials were conducted at three locations within Southwestern Ontario in the summer of 2016. There were seven herbicides: Milestone (aminopyralid), Clearview (aminopyralid + metsulfuron), Sightline (aminopyralid + metsulfuron + furoxipyr), Lontrel (clopyralid), Garlon (triclopyr), Tordon (picloram), and Ally (metsulfuron-methyl). They were compared to Roundup (glyphosate) and Truvist (aminocyclopyrachlor + chlorsulfuron) applied as known positive control. Treatments were applied in May 2016 to two growth stages, young and older seedlings, relative to height, leaf number and average leaf diameter. Data recorded were visual injury ratings, seedling re-emergence counts as well as broadleaf and grass establishment. Results to date indicate that the three following herbicides, Sightline, Garlon, and Tordon provide as good giant hogweed control as Roundup and Truvist while leaving the grass cover intact and preventing seedling recruitment.

INDUSTRY PRESENTATION:

Inscalis, a new insecticide for the Canadian horticulture sector

Lindsey Goudis
BASF Canada Inc.

Inscalis is a new insecticide from BASF belonging to a novel chemical class, the pyropenes. The active ingredient afidopyropen targets piercing and sucking pests such as aphids and whiteflies, and has a low acute toxicity on beneficial arthropods. This product will provide horticulture producers with a selective product to incorporate into their IPM programs. Registration, as a joint submission with the USA, was submitted for use on vegetable, fruit, and row crops, and is currently pending regulatory approval.

PLENARY PRESENTATION:

Developing public trust in agricultural technologies

Dr. Kevin Folta
Professor and Chair, Horticultural Sciences Department & Graduate Program in
Plant Molecular and Cellular Biology
University of Florida

Genetic engineering (familiarly "GMO") has been a great benefit in medicine, food, and agriculture, central to production of insulin, cheese making enzymes, and major agronomic crop plants. The technologies stand to correct deficiencies in high-value specialty crops and also serve the world's malnourished and poverty stricken. Despite a perfect safety record and manageable environmental downsides that are well recognized by an overwhelming scientific consensus, the public perception of these technologies is generally negative. The reason for this is simple. Farmers, scientists, and the agricultural industry as a whole are not participating in the dialog. This creates an asymmetric discussion dominated by TV doctors, food babes, activists, and the internet's many charlatans that profit from fearmongering over communicating real science. The effects are many, and threaten choices for ag producers as well as development of new technologies to meet emerging challenges. However, the solution is simple. Agriculture professionals need to step into the discussion and share their knowledge with a curious public. Scientists, ag producers, and others need to earn the public's trust through transparent and values-based discussion. Our participation in the discussion ensures access to the best crop technology, and hastens the deployment of these products into places of need.

REGULAR PRESENTATION:

Bacterial leaf spot – an emerging disease of squash and pumpkin

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Bacterial leaf spot of pumpkin and squash was first identified in Kent County, Ontario in August 2012. Pumpkins leaves were observed with 1-4 mm irregular-shaped, light brown to tan lesions, often with a chlorotic halo. Mature fruit had 2-4 mm light brown to tan sunken lesions with dark borders and later developed severe soft rot (Trueman, Roddy and Goodwin, 2014, New Disease Reports 30:8). Prior to this discovery, bacterial leaf spot was known to be well established across the mid-western United States including, Illinois, Indiana, Michigan and Ohio. Field surveys during 2009-2013 showed that the disease occurred in more than 80% of pumpkin fields in Illinois, causing up to 90% yield losses in some fields (Babadoost and Ravanlou 2012, Phytopathology 102:S4.8; Ravanlou and Babadoost 2015, HortScience 50: 714-720). Field surveys to determine the extent of bacterial leaf spot in Ontario were conducted from 2014-2015. Collaborative research between the University of Guelph, Ridgetown Campus, OMAFRA and the University of Guelph has included the confirmation of the identity of X. cucurbitae in the affected samples through gyrB sequencing; field screening of various cucurbit species to determine relative tolerance/susceptibility; pest control efficacy trials; and varietal response trials.

REGULAR PRESENTATION:

Progress towards the development of standardized pesticide risk assessment methodology for *Megachile rotundata*

Andrew Frewin, C. Scott-Dupree and A. Gradish
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In recent years there has been a growing concern about the potential negative effects pesticides may have on wild and managed non-*Apis* bee species. In a regulatory context, risk assessment data collected on the European honey bee (*Apis mellifera*) has been used to estimate risk to non-*Apis* bees more generally. However, because of pronounced differences in behaviour and physiology among bee species, honey bee data may not accurately reflect the risk posed to non-*Apis* bees. Due to its prominence as a managed pollinator and its well understood biology, the alfalfa leafcutter bee (*Megachile rotundata*) may be a more appropriate species for estimating pesticide risk to other solitary non-*Apis* bees. Presently, standardized and validated tier I (laboratory) and tier II (semi-field) methods for assessing the effects of pesticides to *M. rotundata* are lacking. In 2016, we evaluated the two release rates and two surrogate crops, alfalfa and buckwheat, for their suitability in semi-field experiments with *M. rotundata*. We also discuss logistics of conducting semi-field studies with *M. rotundata*, as well as our progress on improving laboratory methods for assessing acute effects of pesticides to *M. rotundata*.

INVITED ORAL PRESENTATION:

"Of neonics, corn, dust and pollinators, what did we learn?"

Art Schaafsma
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Responding to honey bee losses during planting in 2011 and 2012, and a dearth of data collected in commercial conditions, we were asked in 2013 to determine the source, movement and exposure levels for neonics in a maize/soybean/wheat-dominated ecosystem. We are reporting on significant findings following 3 years of detailed study using 9 apiaries, paired with 9 modern commercial farm operations, each contributing 2, ±40 ha-fields for study. We focused on fields planted with neonic-treated maize seed, and that had detailed agronomic history records. Numerous samples and observations were taken from each field before, during and after maize planting: e.g. soil, soil surface dust, air and dust, water in and around fields, pollen/nectar forage in and around fields, samples of blooming plants, soil that plants were growing in and honey bees foraging on these plants. Thousands of samples were analyzed for neonic residues using high performance LC-ms-ms with sub ppb LOQ and LOD, using soil atrazine as a marker. Simultaneously four hives near each pair of fields were sampled for dead bees and bee-collected pollen, with pollen taxa and pesticide content of bees and pollen, determined. Over 95% of the exposure to non -target organisms for neonicotinoid insecticide seed treatment originated from planter exhaust during planting. Most of the residues reaching plant surfaces, found in air, soil surfaces and water, in and around fields planted with neonic-treated seed could be traced back to what comes out of the planter exhaust, not from treated seed after planting.

POSTER PRESENTATION ABSTRACTS

STUDENT POSTER COMPETITION

GP-1:

Identification of microRNAs modulated at low temperatures in Colorado potato beetles

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Cold-hardy insects, such as the Colorado potato beetle *Leptinotarsa decemlineata*, are capable of confronting sub-zero temperatures during the winter months. Overwintering is associated with a plethora of physiological and molecular changes including entrance into a deep hypometabolic state. MicroRNAs (miRNAs) are small non-coding molecules that are well-characterized and that have been shown to be differentially expressed in various models of cold adaptation. We thus hypothesize that miRNAs could play a role in the overwintering survival of *L. decemlineata* and that miRNA modulation could interfere with cold adaptation. The current study thus aims at identifying miRNAs essential for cold tolerance and devising an RNAi-based pest management strategy that targets these miRNAs in *L. decemlineata*. Amplification and quantification of miRNAs modulated in +15 °C versus -5 °C-exposed beetles was performed using next-generation sequencing and revealed differential expression of 40 miRNAs including miR-1, miR-122 and miR-133. Differential expression of selected members of this signature of miRNAs were subsequently validated by qRT-PCR. RNAi-based approaches are now being investigated in adult beetles, either via feeding or injecting, to assess the efficiency of target knockdown as well as to evaluate the impact of such knockdown on *L. decemlineata* cold hardiness. Overall, characterization of a miRNA signature essential for low temperatures insect survival in this species as well as evaluation of the impact of modulating the levels of these molecules prior to overwintering in the targeted pests will provide the appropriate starting points for the development of RNAi-based biopesticides in *L. decemlineata* as well as for additional insect pests relevant to the Canadian forestry and agricultural industries.

GP-2:

Evaluation of weather-based forecasting models and cultivar resistance to manage leaf curl (*Colletotrichum fioriniae*) on celery crops in Ontario

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Colletotrichum fioriniae (formerly *C. acutatum*) causes leaf curl disease on celery crops in Ontario, which renders the crop unmarketable when the stalks become twisted and lesions develop along the stem. The objectives of this study were to: (i) evaluate disease forecasting programs to reduce the number of fungicide sprays while maintaining disease control, and (ii) to screen for cultivar resistance. For the forecasting trial, the fungicide Quadris (azoxystrobin 25%) was alternated with Switch 62.5WG (cyprodinil 37.5% and fludioxonil 25.0%) and were applied to celery cv. TZ 6200, with spray timing determined using: TOMCAST with a threshold of 15 DSV (disease severity value), and BOTCAST at a cumulative disease severity index of 21. A calendar spray and a non-treated control were included. Initial results show that the TOMCAST treatment had lower disease than the non-sprayed treatments, but triggered the same number of sprays as the calendar application. The DSV for TOMCAST accumulated quickly because of the hot and dry weather, while BOTCAST was not suitable to control the disease as the threshold was not reached until September. For the cultivar trial, twelve cultivars were evaluated for their resistance to *C. fioriniae*. Initial results show that cv. Merengo was the most resistant with disease incidence less than 20%, while cv. TZ 9779 was the most susceptible with over 80% diseased and high disease severity. Knowledge on disease forecasting models, and cultivars that are the most resistant is needed to effectively manage leaf curl.

GP-3:

Determination of toxic reference standards for use in semi-field pesticide toxicity studies with *Bombus impatiens* (Cresson)

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Data from tiered risk assessments on bumble bees are currently not required by regulatory agencies for pesticide registration and re-registration, yet both managed and unmanaged bumble bees may be exposed to pesticides while foraging. As such, risk assessment protocols for bumble bees are needed. The purpose of this experiment was to identify whether two insecticides, dimethoate and diflubenzuron are suitable toxic standards in future toxicological testing. This was done by characterizing the effects of the insecticides on the foraging activity and development of *Bombus impatiens* (Cresson) under semi-field conditions. In this study, 30 screened tents (10 per insecticide treatment, plus 10 controls) were set up in a field of buckwheat. *B. impatiens* colonies, containing approximately 45 bees, were placed inside the tents when 20% of the buckwheat was flowering. When 95% of the buckwheat was flowering, colonies were removed, and plots were sprayed with diflubenzuron, dimethoate, or water. Following insecticide application, colonies were returned to their tents where they continued to forage on the treated buckwheat. In total the colonies remained inside the tents for 2 weeks, during which forager activity and colony weight were assessed. After the exposure period, colonies were moved to an area of natural forage where they continued their development for 4 weeks before being transported to the University of Guelph for another 4 weeks. Colonies were then dissected, and the number of new queens, males, workers, pupae, larvae and honey pots were recorded. Results of forager assessments and development endpoints will be presented and discussed.

GP-4:

Fatal attraction: the volatile influences that will lead whiteflies to deadly encounters and the dsRNA responsible

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With global food security becoming increasingly important, and insecticide resistance on the rise, new insect pest management strategies need to be considered. One technology that is becoming increasingly utilized in pest management research is RNA interference (RNAi), which exploits the cellular mechanism for gene regulation; exogenous double-stranded RNA (dsRNA) introduced to cells silences the complementary endogenous messenger RNA of a target. This can result in development delays, decreases in insecticide resistance, and lethality to pests. Other alternatives to chemical insecticides are pest-specific trap crops, which attract target pest species using either visual or olfactory cues. By targeting the olfactory senses in insects, an attractant or arrestant effect, depending on the insect species, can be observed. This has been seen in transgenic Micro-Tom tomatoes (*Solanum lycopersicum*), which have enhanced carotenoid cleaving deoxygenase gene activity, resulting in an increased release of volatile organic compounds (VOCs). As a result of these enhanced genes, the VOC profile in transgenic Micro-Tom tomatoes has increased oviposition preference by *Trialeurodes vaporariorum* (Westwood) compared to wild-type tomato. By combining these attractive plants with RNA interference, a novel lethal trap crop model, which first lures, and

then kills by silencing vital gene targets, can be developed. This model can be used in future research in lethal trap crop development, which can benefit greenhouse production by decreasing chemical insecticide use and decreasing destructive pest populations, thereby increasing crop yield.

GP-5:

The mechanism of spirodiclofen resistance in two-spotted spider mite

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Two-spotted spider mite, *Tetranychus urticae* (Koch) is a highly polyphagous herbivore and an important pest in many horticultural, ornamental, and agricultural crops worldwide. The application of synthetic acaricides is the most widely used method to control this pest in many crops. However, *T. urticae* is one of the most resistant arthropod pests and has developed resistance towards many registered acaricides (currently 93 acaricides). Intensive research efforts in recent years have focused on determining of the mechanisms of acaricide resistance as a strategy in resistance management. Spirodiclofen is a tetronic/tetramic acid derivative that targets lipid biosynthesis by blocking the enzyme acetyl coenzyme A carboxylase (ACCase), and disrupts the formation of important fatty acids in *T. urticae*. Spirodiclofen is effective against eggs and all developmental stages of spider mites with a strong effect on female fecundity and fertility. Resistance to Spirodiclofen has been documented and may be caused by insensitivity at the target site due to point mutations, or increased activity of major detoxification enzymes including esterases, P450 monooxygenases and glutathione-S-transferases. The objective of this research is to investigate the key enzymes in detoxification pathways of Spirodiclofen, and to identify the genes involved in Spirodiclofen resistance in Ontario greenhouse populations of *T. urticae*.

GP-6:

The cost and control of linuron resistant pigweed in carrots

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Linuron resistant pigweed is a major problem for carrot growers in the Holland Marsh. Few herbicides are registered for use in carrots leaving farmers with limited options to control resistant pigweed. Currently hand weeding is one of the only means to control linuron resistant pigweed. At a cost of 2000-2500 dollars per hectare in labour it is very expensive. During the summer of 2016 numerous field trials were established to determine the effectiveness of alternative weed control strategies for carrots. Wick weeding was evaluated as an alternative strategy for control of established pigweed. Initial studies suggest that wick weeding can be an effective strategy, costing less than twelve dollars per hectare. The implementation of this approach could save growers 1988-2400 dollars per hectare. Additionally, linuron free herbicide trials were established to test the effectiveness of weed control for various combinations of alternative herbicides. Differences in weed control were evident, and no significant damage to carrots was observed. In combination with wick weeding a comprehensive weed management strategy can be created to help carrot growers cost effectively manage linuron resistant pigweed.

GP-7:

Relationship between boron tolerance and clubroot development in *Brassica napus* and *B. rapa,* 2015 and 2016

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Plasmodiophora brassicae Wor. is the causal organism of clubroot in *Brassica napus* L. and *B. rapa* L. Previous studies have shown that application of boron (B) reduces clubroot severity, but rates ≥ 4 kg B ha^{-1} result in phytotoxicity. In 2015, 3-week-old seedlings were transplanted into a muck soil (70% organic matter) site naturally infested *with P. brassicae*. Solubor (20.5% B) was applied at 8 kg B ha^{-1} in 1500 L ha^{-1} of water 5 days after transplanting. Heavy rainfall and subsequent lack of phytotoxicity prompted a second B application 5 days later. Toxicity was assessed 31 days after seeding (DAS). Ten highly B-tolerant lines and nine B-sensitive lines were identified, and clubroot severity (0-3 scale) was assessed in each of these lines at 63-65 DAS. Clubroot severity decreased and water content increased in response to added B in the B-tolerant group, but not in the B-sensitive group. When the trial was repeated in 2016, no differences in severity were observed. This may have been due to high levels of resting spore inoculum at the site and favourable weather conditions for clubroot, which substantially increased the disease pressure in the trial. A growth room study supported the observation of a reduction in clubbing severity with added B for B-tolerant lines.

UP-8 (UNDERGRADUATE):

Status of ambrosia beetles in high-density apple orchards in southwestern Ontario

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Ambrosia beetles are a wood boring beetle that attack woody plants. They have been reported as an issue in the United States in high density apple orchards causing substantial damage and great concern among growers. These beetles typically attack trees under physiological stress but also can attack apparently healthy trees that are releasing stress volatiles. Mated females bore into the trunk or branches of trees to create tunnels and branched chambers called galleries. This is where oviposition occurs. Ambrosia beetles have an obligate mutualistic relationship with a group of ectosymbiotic fungi called ambrosia. The fungal mycelium is the food source for the adult female and the developing brood. The ambrosia fungi alone do not kill a tree, however the combination of high beetle density and fungal activity can cause wilting and eventually tree death. The secondary entrance of other pathogens into these galleries can also cause tree decline. The objective of the project was to determine the range, abundance and diversity of ambrosia beetles in southern Ontario high density apple orchards. A survey for ambrosia beetles was conducted in13 high density apple orchards. Six species of ambrosia beetle were identified including *Anisandrus dispar*, *A. sayi*, *X. germanus*, *Xyleborus obesus*, *Monarthrum mali*, and *Xyleborinus saxesenii*. Beetle numbers in 2016 were low relative to those reported in other jurisdictions in 2015. A survey should be conducted for ambrosia beetles in 2017 to compare abundances, confirm flight periods and monitor for explosive population growths.

UP-9 (UNDERGRADUATE):

Field evaluation of parasitic nematodes in seeded onions and insecticide tray drenches in transplanted onions for control of onion and seed corn maggot

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Onion maggot (*Delia antigua*) and seed corn maggot (*Delia platura*) are serious pests in commercial onion fields and can kill over 70% of onion seedlings and transplants, if not controlled with insecticides. Seed treatments and in-furrow insecticide applications in seeded onions and transplant plug trays drenched with chlorpyrifos (Lorsban) are the standard means of controlling these onion pests. Parasitic nematodes (*Steinernema feltiae*) which parasitize fly maggots, and are registered for use on greenhouse crops, may be effective for controlling maggots in onions. Similarly, insecticides cyantraniliprole (Verimark) and spinetoram (Delegate), when used as a tray drench, may be useful in controlling maggots in transplanted onions. In 2016, a field trial was established to test various rates of parasitic nematodes in seeded onions and a separate trial tested insecticide plug tray drenches for maggot control in transplanted onions. First generation onion maggot damage varied between the seeded and transplanted onion trials. The seeded onion trial had first generation losses ranging from 0.5 to 5% with no significant differences found among the treatments. The transplanted onion trial had higher total losses ranging from 2 to 34%. In transplants, cyantraniliprole and spinetorma treatments had significantly lower maggot losses (2%) compared to the Lorsban treatment (13%) and check (34%).

UP-10 (UNDERGRADUATE):

Are aphidophagous syrphids entering southern Ontario greenhouses?

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Greenhouse vegetable and flower production is extensive in southwestern Ontario, both of which utilize biological control in integrated pest management (IPM) programs. Additionally, greenhouse tomato and many pepper producers utilize *Bombus* sp. for pollination. Though greenhouse structures are mostly enclosed, during warmer weather open vents allow for visitation from external pests and beneficial insects. Syrphid adults feed exclusively on nectar, honeydew and pollen, while predacious larvae primarily eat aphids. In this study, weekly observations were made in southern Ontario greenhouses to confirm presence of aphidophagous syrphids and identify potential for its use as biological control. Greenhouse tomato, pepper, cucumber and chrysanthemums were sampled for presence of pests and exogenous pollinators. Among vegetable crops, syrphids were observed mainly in peppers; however, higher volumes of pollinator visitations were observed in chrysanthemum greenhouses. Pepper crops also had the highest density of aphids, though no correlation with syrphid density was observed. Syrphid larvae were observed in aphid colonies at one pepper location. Further research is required to determine the syrphid species best suited for IPM in southwestern Ontario greenhouse production.

REGULAR POSTERS

RP-1:

Efficacy of insecticides for control of brown marmorated stink bug (*Halyomorpha halys* Stål) nymphs in Ontario

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Since its detection in Ontario, Canada in 2010, brown marmorated stink bug (*Halyomorpha halys* Stål) (BMSB) has spread across the province into many agricultural regions. As a pest of numerous vegetable, fruit, and row crops, as well as ornamentals, BMSB is certain to become a significant pest in the Ontario agricultural sector. It is essential that sustainable pest management options for BMSB be identified to prevent crop damage and significant economic loss for Ontario growers. The application of older, broad-spectrum insecticides appears to be most effective for managing BMSB but may be undesirable due to non-target impacts. Furthermore, many insecticides in these classes are no longer registered for use in Canada. Additional research on chemical controls is warranted as many insecticides, including novel formulations, have yet to be tested for their efficacy against BMSB nymphs. Our objective was to evaluate the efficacy of insecticides on BMSB nymphs using direct contact toxicity tests. Twelve insecticides from a variety of classes were tested, including novel formulations and mixes. Direct contact toxicity was determined using a mini spray tower which is a 1/9th scale version of a Potter spray tower. Results of studies conducted in 2015 and 2016 will be presented.

RP-2:

Genetic variability of RNAi pest control

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RNA interference (RNAi) is a reverse genetics tool that may also be used for protection against agricultural pests by silencing genes required for pest fitness. To assess the potential of RNAi approaches in two-spotted spider mite, *Tetranychus urticae*, we developed mite soaking in the solution containing dsRNA as a method for the delivery of double-stranded RNA (dsRNA). The gene targeted for method validation was the *Vacuolar-type* H^+*-ATPase* (*TuVATPase*), encoding a constitutively expressed ATP-driven proton pump located in the tonoplast. Application of dsRNA-*TuVATPase* by soaking resulted in the phenotypic change of mite body color that correlated with the reduced mite fitness (survivorship, fecundity) and the silencing of the endogenous *TuVATPase* gene. However, these RNAi effects were observed only in a portion of the treated mites. Such partial penetrance of the RNAi-induced phenotypes may be explained in two ways: a) it is an intrinsic property of the delivery methods; or b) genetic factors control the RNAi response and are variable in the London mite population. Our results indicate that RNAi penetrance is an intrinsic property of the delivery method. Consequences of the incomplete RNAi penetrance for experimental functional genomics work and for potential application of dsRNA as a pest control agent are discussed.

RP-3:

Half-life estimation for *Plasmodiophora brassicae* resting spores in a six-year crop rotation study using propidium monoazide-assisted PCR

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Resting spores of *Plasmodiophora brassicae* Wor., cause of clubroot in canola (*Brassica napus* L.), can remain viable in soil for many years. Quantitative PCR (qPCR) is routinely used to quantify resting spores of *P. brassicae*, but it amplifies DNA from both viable and non-viable spores. However, pre-treatment with propidium monoazide (PMA) suppresses amplification of DNA from non-viable spores in qPCR (PMA-PCR) by penetrating non-viable cells and binding to the DNA when photo-activated. The objectives of this research were: 1) to assess protocols for extracting spores from soil, and 2) to compare qPCR and PMA-PCR analyses of soil samples from a 6-year crop rotation field trial at Normandin, Québec. Replicated and repeated studies demonstrated that a simple dilution technique retained up to 916-fold more spores than the standard sucrose solution-based techniques for resting spore extraction from soil. Therefore, the dilution technique was used in conjunction with PMA-PCR to analyze samples from the crop rotation study. Estimates of spores g^{-1} soil in spring following a susceptible canola crop were $2.0 \times 10^6 \pm 1.3 \times 10^6$ for qPCR and $7.4 \times 10^5 \pm 2.6 \times 10^5$ for PMA-PCR. QPCR showed a quadratic decrease over time, with an 83% reduction in total spores after 2 years. PMA-PCR showed a linear decrease, with a 73% reduction in viable spores after 3 years. The half-life of spores at this site was estimated at 1.2 years by qPCR and 2.9 years by PMA-PCR. PMA-PCR reduces the need for resource-intensive bioassays to quantify viable resting spores.

RP-4:

An economic analysis of biological control programs for white grubs and chinch bugs in Ontario’s lawn care sector

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Ontario’s Cosmetic Pesticides Ban (enacted in April 2009), prohibits the sale and use of pesticides for cosmetic purposes and includes many herbicides, fungicides and insecticides. The act severely limits pest control options for lawn-care companies and homeowners. As a result, alternative options are now required to mitigate pests; options include the use of pest-tolerant grasses, better lawn maintenance practices and applications of bio-pesticides. While the efficacy of these biological control practices has been demonstrated, their economic feasibility has not been extensively evaluated. In addition, as biological control practices are often implemented concurrently, there is a need to assess the economic feasibility of an integrated pest management approach before making recommendations. This project is filling this gap by examining the costs and efficacy of bio-control practices for white grubs and chinch bugs, two of the most destructive pests in Ontario’s lawns. A simulation model was developed to estimate changes in the percentage of healthy turf coverage on an annual basis over five years under a base and different intervention scenarios. Cost schedules and cost-effectiveness analyses were used to compare the relative costs and benefits of different strategies in order to develop recommendations for lawn-care practitioners and homeowners. The results suggest that the intervention bundles, which include combinations of lawn maintenance practices, bio-pesticides, and insect-tolerant grasses, can improve grass coverage to >95% over 5 years. The estimated program costs are consistent with the costs of non-chemical IPM programs from previous studies, and highlight the long-term value of investing in preventative strategies.

RP-5:

Assessing the effects of insect exclusion netting on insect pests in high tunnel greenhouse organic production systems in southern Ontario

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High tunnel greenhouses can provide growing season extension, temperature control, and reduction of insect pests and plant pathogens in a more economical format than traditional glass greenhouses. This production system is not yet widely adopted in Canada but is more common in the U.S. The objective of this research was to determine the effects of insect exclusion netting in high tunnels on crop yield and insect pest pressure in southern Ontario. The high tunnels were established at the University of Guelph for the production of high value organic tomatoes, bitter melon, edible chrysanthemum and pea shoots. The study involved 3 treatments: 1) high tunnels with netting inside plastic cover, 2) high tunnels with no netting, and 3) field plantings with no high tunnel structures. There were 3 tunnels for each treatment. All crops mentioned above were grown in each of the treatment tunnels. Various insect traps, including: pitfall traps, sticky traps, and pan traps, were installed to assess abundance and diversity of insect pests. Insect damage was assessed throughout the growing season of all crops. Excluding insect pests is expected to have benefits but disadvantages could involve the exclusion of natural pollinators. Results of pest prevalence and activity assessments in comparison to high tunnels with insect exclusion netting and those without will be presented and discussed. Pest management recommendations will be developed for insect pests identified on the organic crops grown in high tunnel production systems in Ontario growing conditions.

RP-6:

Stripe rust in Ontario winter wheat in 2016

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University of Guelph-Ridgetown, Ridgetown, ON

Wheat rusts have been threatening the wheat production for thousands of years and are still responsible for frequent yield losses in wheat. Stripe rust or yellow rust (*Puccinia striiformis* f. sp. *tritici* Erikss.) was the most important disease in Ontario winter wheat in 2016. The disease was not an issue in Ontario for a couple of decades. Yield losses due to stripe rust were reported as high as 40 percent. Stripe rust was usually related with cooler temperatures, but has increased in prevalence even in warmer conditions. Breeding resistant cultivars and fungicides application are considered the most effective ways to control the disease. Susceptible and resistant cultivars were identified in Ontario Performance trials in 2016. We planted a soft red winter wheat doubled haploid population derived from Freedom and Pioneer 25R51 at Centralia in October of 2015 and recorded disease severity in 2016 using a 0 to 9 scale. Both parents showed moderate resistance to stripe rust: Freedom (4) and Pioneer 25R51 (6). Yield was the same for both parents (3.8 T/ha). The population showed an average stripe rust rating of 5 (range 1 to 8), averagea yield of 3.3 T/ha (range 0.6 to 6.0 T/ha), continuous distribution pattern and transgressive segregation of progeny. A significant negative correlation was found between stripe rust and yield (r = -0.58). Additional genetic studies are needed to better understand stripe rust and identify QTL associated with stripe rust resistance in winter wheat in Ontario.

RP-7:

Effects of fumigants and biofumigants on ginseng replant disease

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Ginseng replant disease, which has been attributed in part to the soil-borne fungus *Cylindrocarpon destructans* (*Ilyonectria spp*.), prevents growing ginseng on the same land twice and threatens the survival of the industry. Research was initiated in 2013 to test the effects of different fumigants and biofumigants on the development of replant disease symptoms in a commercial ginseng site near Delhi, Ontario. The site was seeded in the year after a previous ginseng crop had been harvested. The treatments included tarped and untarped metam-sodium (Busan 1236) fumigant, tarped chloropicrin (Pic Plus) fumigant, untarped modified mustard meal (Mustgrow), untarped capsaicin/mustard extract (Dazitol) and tarped and untarped controls. Plant stand was tracked over the three years of the crop and a final harvest assessment was conducted in August 2016. The untarped control and the untarped biofumigant treatments had nearly complete loss of stand by the spring of 2015 as a result of Cylindrocarpon root rot and no marketable yield by harvest. Tarping either of the commercial fumigants maximized marketable yield which was about two thirds of the yield of a commercial ginseng yield on new ground. Untarped metam-sodium and the tarped control had slightly lower yield but were not significantly different from each other. The results suggest that tarping alone caused a significant reduction in disease severity over the three year period, possibly due to solarisation effects over the three weeks the tarp was over the plots. Future work should focus on this as a viable alternative to fumigation for the control of ginseng replant disease.

RP-8:

Comparison of methods for extracting plant-parasitic nematodes from field soils to accurately estimate populations

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Estimations of plant-parasitic nematode (PPN) populations in field soils are essential for the proper management of these pests. Established threshold levels provide growers with a reference to help them decide if they should take management action. However, differences in soil extraction methods by laboratories lead to inconsistencies in PPN population estimates and do not allow for the accurate use of published threshold levels. The goal of this study was to identify a fast and accurate method for extracting nematodes from soil that can be used as a standard. Two main soil extraction techniques, Baermann pan (BP) and sugar centrifugal floatation (SCF), were compared to determine which method better represents PPN populations in turfgrass (sandy soil), carrot (muck soil), and tomato (fine-textured soil) fields. For turfgrass soils, a total of 12 samples were selected for comparison. For crop soils, samples from 5 different carrot fields and 10 different tomato fields were compared. In the turfgrass samples, the SCF method extracted more of all PPN genera (cyst, root-knot, ring, spiral and stunt). In the carrot soil samples, the SCF method extracted significantly more cyst nematodes but significantly fewer pin nematodes. Both methods extracted root-knot and lesion equally well. In the tomato soils, the SCF method extracted significantly more spiral and lance nematodes. The results from this study verify the effectiveness of the SCF method as a fast and accurate method for extracting most plant-parasitic nematode genera from soil.

RP-9:

Comparing different methods of field application of bacterial endophytes as biocontrol agents to combat gibberella ear rot in maize

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Onion maggot (*Delia antigua*) and seed corn maggot (*Delia platura*) are serious pests in commercial onion fields and can kill over 70% of onion seedlings and transplants, if not controlled with insecticides. Seed treatments and in-furrow insecticide applications in seeded onions and transplant plug trays drenched with chlorpyrifos (Lorsban) are the standard means of controlling these onion pests. Parasitic nematodes (*Steinernema feltiae*) which parasitize fly maggots, and are registered for use on greenhouse crops, may be effective for controlling maggots in onions. Similarly, insecticides cyantraniliprole (Verimark) and spinetoram (Delegate), when used as a tray drench, may be useful in controlling maggots in transplanted onions. In 2016, a field trial was established to test various rates of parasitic nematodes in seeded onions and a separate trial tested insecticide plug tray drenches for maggot control in transplanted onions. First generation onion maggot damage varied between the seeded and transplanted onion trials. The seeded onion trial had first generation losses ranging from 0.5 to 5% with no significant differences found among the treatments. The transplanted onion trial had higher total losses ranging from 2 to 34%. In transplants, cyantraniliprole and spinetorma treatments had significantly lower maggot losses (2%) compared to the Lorsban treatment (13%) and check (34%).

NOTES

Post Event Evaluation – Ontario Pest Management Conference

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
The registration process was convenient and easy to use.	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. If you would like to be included in a draw to thank you for completing the survey, please fill out your name and contact information below, then detach it from this form and place it in the container provided.

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OPMC Survey Draw

NAME **EMAIL/PHONE NUMBER**