13th Annual

Convergence of Food Security and Sustainable Pest Management

November 12, 2015

Victoria Park East Golf Course
1096 Victoria Road South
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Melanie Filotas, Ontario Ministry of Agriculture, Food and Rural Affairs
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: Sarah Jandricic, OMAFRA

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

9:15 am Halosulfuron tank mixes applied PPI and PRE in white bean. **Zhenyi Li**, R. Van Acker, D. Robinson, N. Soltani and P. Sikkema. (Student Competition)

9:30 am Management of bentgrass cultivars for activated resistance to *Microdochium nivale* under climate change conditions. **Sara Stricker** and T. Hsiang. (Student Competition).

9:45 am **Plenary Speaker:**

Dr. Chris Cutler

Associate Professor, Dept. of Environmental Sciences,
Dalhousie University – Truro Campus

"How far we've come: Appreciating our progress in integrated pest management"

10:25 am – 11:00 am Coffee Break and Poster Viewing

11:00 am Decline in resting spores of *Plasmodiophora brassicae* with cropping interval. **Jill Dalton**, B. D. Gossen, F. Al-Daoud, D. Pageau and M.R. McDonald. (Student Competition)

11:15 am Interaction between Xtendimax™ and Group 1 Herbicides for volunteer corn control. **Matthew Underwood**, P. Sikkema and D. Hooker. (Student Competition)

11:30 am RNAi as a next generation biotechnological method to control pests: Analysis of different dsRNA delivery methods for RNAi in spider mites. **María Urizarna España**, Postdoctoral Research Fellow, Department of Biology, University of Western Ontario. (Invited Speaker)

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

AFTERNOON SESSION

Afternoon Session Chair: Cara McCreary, OMAFRA

1:00 pm How to improve the consistency of glyphosate-resistant Canada fleabane (*Conyza canadensis* L. Cronq.) control with saflufenacil: an investigation of tank mix partners and optimal time of day application. **Christopher Budd**, P. Sikkema, D. Robinson, D. Hooker and R. Miller. (Student Competition)

1:15 pm Sulfentrazone tankmix partners for grass control in Ontario dry beans (*Phaseolus vulgaris*). **Allison Taziar** and P. Sikkema. (Student Competition)

1:30 pm IPM for the world's one billion subsistence farmers. **Manish Raizada**, Assoc. Professor and International Relations Officer, Department of Plant Agriculture, University of Guelph. (Invited Speaker)

2:00 pm Intego: *Pythium* and *Phytophthora* seed treatment. **Julie Schipper**, Valent Canada.

2:10 pm-2:40 pm Coffee Break and Poster Viewing

2:40 pm **Plenary Speaker:**

Dr. Peter Sikkema

Professor of Weed Management, University of Guelph-Ridgetown

"Impact of herbicide resistant Canada fleabane on agriculture sustainability"

3:20 pm Roundup Ready Xtend crop system. **Derek Freitag**, Monsanto Canada Inc.

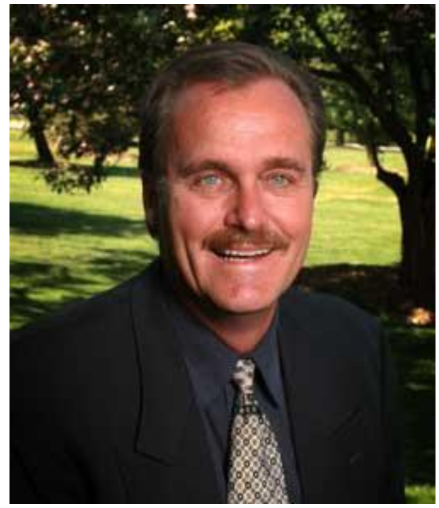
3:30 pm Presentation of Photo Contest Award Winners – **Cynthia Scott-Dupree**
Presentation of Student Competition Award Winners **– Ian Scott**

Closing Remarks and Adjourn

PLENARY SPEAKERS

Dr. Peter Sikkema – Professor, Field Crop Weed Management, Department of Plant Agriculture, University of Guelph – Ridgetown Campus

Biography



Peter received his B.Sc. (Agr) in 1981 and M.Sc. (Weed Physiology) in 1983 from the University of Guelph. In 2002, Peter received his PhD from the University of Western Ontario in Plant Sciences. Prior to his employment at the University of Guelph, Peter worked for Rhone Poulenc Canada from 1986-1988 as Product Development Manager for Canada and for Union Carbide Agricultural Products Company from 1983-1986 as a Product Development Representative. Peter conducts research on weed management in corn, soybean, cereals and edible beans. He teaches courses in Crop Diagnostics and Recommendations and Herbicide Activity. During his career, Peter has published more than 225 peer-reviewed manuscripts and was an author/co-author of more than 200 oral/poster presentations at scientific conferences. Peter has served on the boards of the Canadian Weed Science Society, the North Central Weed Science Society and the Weed Science Society of America. In addition he has won a number of regional, national and international awards for his research, teaching and extension endeavours.

Dr. G. Christopher Cutler – Associate Professor, Department of Environmental Sciences, Dalhousie University – Truro Campus

Biography

Chris was born and raised in Newfoundland and holds degrees from Memorial University, Simon Fraser University, and the University of Guelph. He has been at the Dalhousie University Faculty of Agriculture (formerly the Nova Scotia Agricultural College) since 2007, where he teaches and conducts research mainly in the areas of insect pest management and insect ecotoxicology. Dr. Cutler has received national awards for his research from the Entomological Society of Canada and the Agricultural Institute of Canada. He has published extensively on various aspects of insect pest management and pesticide risks to pollinators, and has delivered many invited talks in Canada, the United States, and Europe on this topic.

–CROP LIFE STUDENT COMPETITION–

Student Oral Presentations:

OP-1 Halosulfuron tank mixes applied PPI and PRE in white bean. **Zhenyi Li,** R. Van Acker, D. Robinson, N. Soltani and P. Sikkema.

OP-2 Management of bentgrass cultivars for activated resistance to *Microdochium nivale* under climate change conditions. **Sara M. Stricker** and T. Hsiang.

OP-3 Decline in resting spores of *Plasmodiophora brassicae* with cropping interval. **Jill Dalton**, B. D. Gossen, F. Al-Daoud, D. Pageau and M.R. McDonald.

OP-4 Interaction between XtendimaxTM and Group 1 Herbicides for volunteer corn control. **Matthew Underwood**, P. Sikkema and D. Hooker.

OP-5 How to improve the consistency of glyphosate-resistant Canada fleabane (*Conyza canadensis* L. Cronq.) control with saflufenacil: an investigation of tank mix partners and optimal time of day application. **Christopher Budd**, P. Sikkema, D. Robinson, D. Hooker and R. Miller.

OP-6 Sulfentrazone tankmix partners for grass control in Ontario dry beans (*Phaseolus vulgaris*). **Allison Taziar** and P. Sikkema.

Judges: Michael Celetti - OMAFRA (Judging Supervisor)

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

Student Poster Presentations:

PP-1 Neonicotinoid resistance in the Colorado potato beetle. **Emine Kaplanoglu**, P. Chapman, I. Scott, C. Donly. **(Time of judging 9:00-9:15 am**)

PP-2 Plant derived RNA interference of vacuolar ATPase to control two-spotted spider mite (*Tetranychus urticae* Koch). **Hooman Namin**, I. Scott, V. Grbic. **(Time of judging 11:15-11:30 am)**

PP-3 Carrot weevil lacking effective chemical control options in Ontario. **Zachariah Telfer,** M.R. McDonald, C. Scott-Dupree **(Time of judging 1:00-1:15 pm)**

PP-4 Species-specific primers based on comparative genomic analyses of several *Botrytis* species. **Craig Moore**, T. Hsiang. **(Time of judging 11:45 am-12:00 pm)**

PP-5 Comparison of three spray timing programs for management of Stemphylium leaf blight of onion. **Cyril Tayviah,** K. Vander Kooi, B.D. Gossen, M.R. McDonald **(Time of judging 9:15-9:30 am)**

PP-6 How can we improve chemical control of carrot rust fly? **Jason Lemay**, C. Scott-Dupree, M.R. McDonald. **(Time of judging 1:15-1:30 pm)**

PP-7 What you seed is what you get: Investigating *Bombus impatiens* colony development on three flowering plants: buckwheat, red clover, and *Phacelia tanacetefolia*. **Pam Loughran**, A. Gradish, L. Knopper, C. Cutler, C. Scott-Dupree. **(Time of judging 11:00-11:15 am).**

PP-8 The effect of a fungicide application on yield in population stressed corn (*Zea mays* L.). **Lauren Benoit** and C. Swanton. (UNDERGRADUATE) **(Time of judging 9:30-9:45 am)**

PP-9 Host specificity of *Colleltotrichum* isolates from apple, celery and strawberry in Ontario. **Stephen Reynolds** and M.R. McDonald. (UNDERGRADUATE) **(Time of judging 11:30-11:45 am)**

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

Judges: Michael Celetti – OMAFRA (Judging Supervisor)

1. Jamshid Ashigh – Dow AgroSciences
2. Rachel Riddle – University of Guelph
3. Amy Fang Shi – Ontario Ginseng Growers Association
4. Maryam Sultan – Bayer CropScience

-REGULAR POSTER PRESENTATIONS-

RP-1 Petrified pests: The mere presence of a predator affects survival of western flower thrips. D. Schmidt, **Sarah Jandricic** and S. Frank.

RP-2 Propidium monoazide-assisted PCR differentiates between viable and non-viable *Plasmodiophora brassicae* resting spores better than conventional qPCR . **Fadi Al-Daoud,** J. Robson, B.D. Gossen and M.R. McDonald.

RP-3 On the Move: 2015 Survey Results of Brown Marmorated Stink Bug in Ontario. **Kaelyn Hunter**, A. Gradish, H. Fraser, T. Gariepy, T. Baute and C. Scott-Dupree.

RP-4 Survey of Ginseng Fields Treated with Different Fumigants. **Mary Ellen Lawrance**, A. Fang Shi, R. Riddle and S. Westerveld.

ORAL PRESENTATION ABSTRACTS

MORNING SESSION

CROP LIFE STUDENT COMPETITION (OP-1):

Halosulfuron tank mixes applied PPI and PRE in white bean

Zhenyi Li [1], R. Van Acker[1], D. Robinson[2], N. Soltani[2] and P. Sikkema[2]
[1]University of Guelph, Guelph, ON, N1G 2W1
[2] University of Guelph-Ridgetown, Ridgetown, ON, N0P 2C0

Twelve field experiments were conducted over a two-year period (2013, 2014) to evaluate the tolerance of white bean and spectrum of weeds controlled with halosulfuron applied alone in combination with trifluralin, pendimethalin, EPTC, dimethenamid-p or s-metolachlor applied preplant incorporated (PPI) and pendimethalin, dimethenamid-p or s-metolachlor applied preemergence (PRE). Halosulfuron applied alone or in combination with trifluralin, pendimethalin, EPTC, dimethenamid-p or s-metolachlor caused 3% or less visible injury 1 and 4 weeks after emergence (WAE) in PPI and PRE. Halosulfuron applied both PPI and PRE provided greater than 90% control of lamb's-quarters, wild mustard, redroot pigweed and common ragweed and less than 60% control of green foxtail evaluated 4 and 8 WAE. Weed biomass and density followed a similar pattern. White bean yield with halosulfuron applied in combination with trifluralin, pendimethalin, EPTC, dimethenamid-p or s-metolachlor was equivalent to the weed-free control.

CROP LIFE STUDENT COMPETITION (OP-2):

Management of bentgrass cultivars for activated resistance to *Microdochium nivale* under climate change conditions

Sarah M. Stricker and T. Hsiang
School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2W1

Microdochium nivale is a common pathogen of turfgrasses in temperate climates. Atmospheric CO^2 levels have been increasing and are projected to nearly double by the end of the century. Consequently Canada may experience a temperature increase of 1.5 to 4°C within the next 50 years. This climate change has the potential to increase plant disease severity. A potential alternative to traditional pesticide applications is resistance activators, which are non-toxic to plants and fungi, but can activate a plant's natural resistance responses. This project is examining the efficacy of a mineral oil-based product, Civitas/Harmonizer™, to control *M. nivale* on different turfgrass cultivars under various temperatures and two CO^2 concentrations. Eighteen cultivars were grown in temperature-controlled chambers, inoculated with *M. nivale*, and screened for naturally occurring resistance at 10°C and 20°C. Eight cultivars were selected and subsequently tested in growth chambers with CO^2 concentrations of 400 ppm and 800 ppm at 15°C. After 10 wk, the grass was treated with Civitas/Harmonizer™. A week later they were inoculated and yellowing was rated three times over two weeks. Five sets of tissue samples were collected over the three month trial to be used for future RNA-Seq analyses. The disease severity was higher at 400 ppm CO^2 than at 800 ppm, and Civitas/Harmonizer™ was able to decrease disease symptoms. This research will be useful to provide recommendations on the selection of turfgrass cultivars for golf courses and on sustainable management practices to face the challenges of climate change.

PLENARY PRESENTATION:

"How far we've come: Appreciating our progress in integrated pest management"

Dr. Chris Cutler
Associate Professor, Department of Environmental Sciences, Dalhousie University – Truro, Truro, NS, B2N 5E3

Insect pests, weeds, and plant diseases continue to wreak havoc on our crops locally and internationally. Consequently, as our global population pushes towards 10 billion, management of agricultural pests will continue to play a key in role in ensuring food security. Enormous progress has been made in pest management over the millennia, yet various facets of pest management are subject to significant criticism and scepticism. Careful critique of pest management practices and avoiding complacency are a must, but often it seems we've forgotten how far we've come. Using examples from my own research and that of others, I will highlight some of the tremendous strides we've made in pest management, while cautioning that there is still much room for improvement.

CROP LIFE STUDENT COMPETITION (OP-3):

Decline in resting spores of *Plasmodiophora brassicae* with cropping interval

Jill Dalton[1], B.D. Gossen[2], F. Al-Daoud[1], D. Pageau[3], and M.R. McDonald[1]
[1]Department of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1
[2]Agriculture and Agri-Food Canada, Saskatoon, SK, S7N 0X2
[3] Agriculture and Agri-Food Canada, Normandin, QC, G8M 4K3

The concentration of resting spores of *Plasmodiophora brassicae* Woronin in soil increases rapidly when susceptible crops are grown in short rotation. Some of these spores survive for many years, but the pattern of decline is unknown. Resting spore populations at Normandin, Québec, were quantified after continuous canola and break intervals of 1, 2, 3, 5, and 6 years. Compared to continuous canola (1.3x108 ± 1.2x108 spores g^{-1} soil), the concentration of resting spores declined by 96% after a 1-yr break and 99% after a 2-yr break, but then declined very slowly. This indicates that a portion of the resting spore population is long-lived, but that most spores survive for 1-2 years. Also, three clubroot-resistant and one susceptible canola (*Brassica napus* L.) cultivars were planted at the Muck Crops Research Station, Holland Marsh, Ontario to compare the growth response of clubroot-resistant canola to *P. brassicae* spore load. In 2014, severe clubroot developed in the susceptible cultivar. At 8 weeks after planting, the resistant cultivars at a site where spore concentration was high (7x106 ± 2.1x106 spores g^{-1}) were 46 ± 3.9% taller than the susceptible cultivar. At an adjacent site with lower spore concentration (7x105 ± 2.1x105spores g^{-1}), the resistant cultivars were much taller (12 4± 4.5% of the susceptible cultivar). Preliminary results from 2015 show a similar trend; the height of the resistant cultivar was reduced at the site with the high spore concentration. These field results support observations from controlled environment trials that high concentrations of resting spores of *P. brassicae* result in reduced growth of clubroot-resistant canola cultivars.

CROP LIFE STUDENT COMPETITION (OP-4):

Interaction between Xtendimax™ and Group 1 Herbicides for volunteer corn control

Matthew G. Underwood, P. Sikkema and D. Hooker
Dept. of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON, N0P 2C0

Weed control is an ongoing challenge for farmers. Since the introduction of glyphosate resistant crops in 1996, several weeds have developed resistance to glyphosate, the most used herbicide worldwide, further increasing the difficulty of achieving acceptable weed control. A transgenic soybean cultivar has been developed with resistance to both glyphosate and dicamba (RR Xtend Soybean). Applying glyphosate plus dicamba reduces soybean yield losses caused by glyphosate-resistant weeds. However, there is a risk of herbicide antagonism reducing control of monocot weeds when Group 1 herbicides are co-applied with dicamba. Six field experiments were conducted over two years at three sites in south-western Ontario to determine the effect of tank-mixes of dicamba with Group 1 herbicides for controlling volunteer corn. Two rates of dicamba (300 and 600 g ha^{-1}), using the Xtendimax™ herbicide formulation, were co-applied with quizalofop-p-ethyl (24, 30, and 36 g ha^{-1}) and clethodim (30, 37.5, or 45 g ha^{-1}), when volunteer corn reached the V4 growth stage. Weed control and crop yield were evaluated. Reduced volunteer corn control and yield were greatest in tank-mixes containing the high rate of dicamba and low rate of the Group 1 herbicide. The high rate of dicamba and low rate of quizalofop-p-ethyl resulted in yield losses above 1.25 Mg ha^{-1}. The addition of dicamba to quizalofop-p-ethyl resulted in greater antagonism than when co-applied with clethodim. This research indicates that farmers wishing to control volunteer corn and glyphosate-resistant weeds, may need to increase their Group 1 herbicide rate or apply the two herbicides sequentially.

INVITED ORAL PRESENTATION:

RNAi as a next generation biotechnological method to control pests: Analysis of different dsRNA delivery methods for RNAi in spider mites

María Urizarna España[1], T. Suzuki[2], MA Nunes[1], V. Grbic[1] and M. Grbic[1]
[1]Department of Biology, University of Western Ontario, London, ON, N6A 5B7
[2]Tokyo University of Agriculture and Technology, Tokyo, Japan

The two-spotted spider mite (TSSM), *Tetranychus urticae*, is one of the most polyphagous arthropods and important pests in agriculture. It feeds on over 1100 plant species including more than 150 agricultural crops. It is a major pest of greenhouse crops and ornamentals, annual field crops and perennial cultures. Its pest status is augmented by climate change and unpresidented ability to develop pesticide resistance. TSSM typically develop resistance to a new pesticide within 2-4 years upon its release on the market. The importance of spider mites as pests is increasing significantly in Canada and worldwide, and will increase dramatically over the next decades, making it a high-risk pest for global crop production. RNAi is a regulatory mechanism of gene silencing that was established as a method to manipulate the expression of endogenous genes in many organisms. We have previously demonstrated that RNAi-based gene silencing operates in *T. urtica*. Thus, the whole-genome sequence of *T. urticae* can provide an opportunity to develop novel methods of pest control with an independent mode of action that will exploit new target sites using RNAi gene silencing. The RNAi method of gene silencing will have an independent mode of action relative to the existing pesticides, and thus, will be an additional tool available for farmers to use against TSSM. The RNAi method is expected to have specificity for TSSM with zero residue and be environmentally friendly compared to currently used chemical pesticides.

AFTERNOON SESSION

CROP LIFE STUDENT COMPETITION (OP-5):

How to improve the consistency of glyphosate-resistant Canada fleabane (*Conyza canadensis* L. Cronq.) control with saflufenacil: an investigation of tank mix partners and optimal time of day application

Christopher Budd[1], P. Sikkema[1], D. Robinson[1], D. Hooker[1] and R. Miller[2]
[1]University of Guelph-Ridgetown, Ridgetown, ON, N0P 2C0
[2]BASF Canada, Mississauga, ON, L5R 4H1

Saflufenacil previously provided excellent control of glyphosate-resistant (GR) Canada fleabane in soybean, however recent research has shown unexplained variation in control. To improve consistency of GR Canada fleabane control, the effects of tank mix compatible herbicides with saflufenacil, the time of day (TOD) at application, as well as a biologically effective rate of metribuzin with saflufenacil, were investigated in a two-year study conducted on three farms in Ontario. These sites were previously confirmed with GR Canada fleabane. The TOD treatments were applied in three hour intervals starting at 06hr to 24hr and Canada fleabane control ratings were completed at recorded 1, 2, 3, 4 and 8 weeks after application for all trials. The 15hr TOD treatment provided the greatest control with 91%. The best tank mix partner compounds were dicamba (300, 600 g a.i. ha^{-1}) and amitrole (2000 g a.i. ha^{-1}) which provided 97, 100 and 99% Canada fleabane control, respectively; followed by paraquat (1100 g a.i ha^{-1}) and metribuzin (400 g a.i. ha^{-1}) at 97 and 98% control, respectively ($P<0.05$). Also, at least 100 and 800 (g a.i. ha-1) of metribuzin was required with saflufenacil to provide 90 and 99% control, respectively. Overall, the time of application appears to have an effect on the control of GR Canada fleabane with saflufenacil. Also, metribuzin can be an effective tank mix partner to improve GR Canada fleabane control. Investigation of variable control with saflufenacil and ways to improve consistency will provide Ontario growers with a reliable control option.

CROP LIFE STUDENT COMPETITION (OP-6):

Sulfentrazone tankmix partners for grass control in Ontario dry beans (*Phaseolus vulgaris*)

Allison Taziar and P. Sikkema
Dept. of Plant Agriculture, University of Guelph-Ridgetown, Ridgetown, ON, N0P 2C0

Soil applied herbicides for dry bean (*Phaseolus vulgaris*) crops in Ontario are limited. Sulfentrazone is an effective broadleaf herbicide with some grass activity, currently used in some pulse crops in Western Canada. If registered in Ontario, sulfentrazone will provide dry bean growers with another mode of action for broadleaf weed control. Twenty-six field studies were conducted over a two-year period (2014, 2015) to determine the tolerance of dry beans to sulfentrazone and to develop weed management programs in white beans with sulfentrazone. Sulfentrazone at 140 and 210 g ai ha^{-1} was mixed with pendimethalin, dimethenamid-p, s-metolachlor or pyroxasulfone. Crop injury was visually assessed at 2 and 4 weeks after emergence (WAE). Weed control was evaluated at 4 and 8 weeks after herbicide application (WAA). Weed stand counts and dry weights were taken at 8 WAA and yields were determined at maturity. All the tankmixes evaluated provided good control of large crabgrass (*Digitaria sanguinalis* L.), barnyard grass (*Echinocloa crusgalli* L.) green foxtail (*Setaria viridis* L.) and green pigweed (*Amaranthus powelli* L.), but only sulfentrazone+pendimethalin had an adequate margin of crop safety. Based on this study, although sulfentrazone combined with a grass herbicide provides acceptable control of some grass and broadleaf weed species, further research is required to determine if there is an adequate margin of crop safety for its use for weed management in Ontario dry beans.

INVITED ORAL PRESENTATION:

IPM for the world's one billion subsistence farmers

Manish Raizada
Dept. of Plant Agriculture, University of Guelph, Guelph, ON, N1G 2W1

The world has ~1 billion smallholder farmers who make a living on <2 Ha of land, primarily in Asia and Africa. Many of these farmers cannot afford synthetic chemical pesticides, do not have access to them, and/or do not have the literacy or training required for their proper use. I will provide an overview of the challenges of subsistence farming, and focus on some of the high priority needs that experts in North America can assist with. I will give examples of appropriate, low cost IPM strategies that have been successful in Africa, and describe our current work in Nepal (www.SAKNepal.org) with the use of picture books to communicate simple IPM strategies to remote farmers.

INDUSTRY PRESENTATION:

Intego: Pythium and Phytophthora seed treatment

Julie Schipper
Valent Canada, Guelph ON, N1L 1C6

Many species of Pythium and Phytophthora are able to cause seedling disease in row crops. INTEGO Solo is the first seed treatment since the introduction of metalaxyl to provide effective protection against *Pythium* spp. and *Phytophthora* spp. INTEGO Solo, containing the active ingredient ethaboxam, is a Group 22 Fungicide with systemic activity above and below ground. Intego protects against the most prevalent strains of *Pythium* and *Phytophthora*, and complements metalaxyl. INTEGO Solo is now registered on a wide range of crops including cereals, pulses, corn, soybean and canola.

PLENARY PRESENTATION:

"Impact of herbicide resistant Canada fleabane on agriculture sustainability"

Dr. Peter Sikkema
Professor of Weed Management, University of Guelph – Ridgetown Campus, Ridgetown, ON, N0P 2C0

Glyphosate resistant Canada fleabane was first confirmed in Ontario in 2010 when it was found at 8 locations in Essex County. Four years later, it has now been confirmed in 25 counties from Essex County on the Michigan border to Glengarry County on the Quebec border. Canada fleabane is a winter/summer annual that produces up to 200 000 windblown seeds per plant. Although greater than 90% of the seeds fall within 100 m of the mother plant, seed has been documented to move greater than 500 km. In studies conducted on Ontario farms, Canada fleabane interference has reduced corn and soybean up to 99%. Glyphosate resistant Canada fleabane can be effectively controlled in corn (Banvel, Battalion, Callisto + atrazine, Distinct, Integrity, Marksman, Pardner + atrazine) and winter wheat (2,4-D, Infinity and Target), Control in soybean has been very variable in Ontario studies. A preplant application of Roundup + Eragon + Sencor has provided quite good control but adds substantially to the cost of production. In addition, uncontrolled glyphosate resistant Canada fleabane can result in substantial yield losses in soybean. The total financial loss to the Ontario farm economy will be presented. It is important that Ontario farmers implement weed management practices that limit the selection of additional glyphosate-resistant weeds. This will ensure the usefulness of glyphosate and glyphosate-resistant crops for many years in the future.

INDUSTRY PRESENTATION:

Roundup Ready Xtend crop system

Derek Freitag
Monsanto Canada Inc., Guelph ON, N1G 0B4

Roundup Ready 2 Xtend™ soybeans are tolerant to both glyphosate and dicamba herbicides and will provide growers with a new weed management tool for the control of glyphosate-resistant and other tough to control weeds. Since 2008, glyphosate-resistant (GR) weeds have been confirmed in Ontario, Manitoba, Saskatchewan and Alberta. Giant ragweed (*Ambrosia trifida*) was the first confirmed GR weed, followed by Canada fleabane (*Conyza Canadensis*), common ragweed (*Ambrosia artemisiifolia*) and kochia (*Kochia scoparia* L. Schrad.). Glyphosate-resistant weeds have shown to be troublesome and competitive in soybean. For example, GR giant ragweed interference may reduce soybean yields by greater than 90% in Ontario. In Canada, growers will soon have access to new herbicide-tolerant technologies in soybean. The use of dicamba in Roundup Ready 2 Xtend soybean will be a new weed management tool, and should be integrated into a total weed management system that includes crop diversity, herbicide rotations and sequences and other residual herbicide treatments to maintain stewardship of the technology.

POSTER PRESENTATION ABSTRACTS

STUDENT POSTER COMPETITION

PP-1:

Neonicotinoid resistance in the Colorado potato beetle

Emine Kaplanoglu[1], P. Chapman[1], I. Scott[1,2] and C. Donly[1,2]
[1]Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, ON, N5V 4T3
[2]Department of Biology, Western University, London, ON, N6A 5B7

The Colorado potato beetle (*Leptinotarsa decemlineata*) is a significant pest of potatoes in most potato-growing areas of the world. Left unmanaged, the beetle is capable of completely defoliating potato plants and reducing the yield by up to fifty percent. Currently, the management of *L. decemlineata* heavily relies on use of insecticides, neonicotinoids in particular. However, emergence of insecticide resistance is a major concern. In insects, the most common cause of insecticide resistance is elevated detoxification, mainly caused by quantitative changes in protein levels of detoxifying enzymes such as cytochrome P450s, uridine 5'-diphospho-glucuronosyl transferases, esterases, glutathione S-transferases and ATP-binding cassette (ABC) transporters. Therefore, we hypothesize that elevated detoxification is the mechanism for neonicotinoid resistance in *L. decemlineata*. In order to address our hypothesis, we conducted RNA-seq and qPCR analyses and identified several detoxifying enzyme and ABC transporter genes which are transcriptionally upregulated in a neonicotinoid resistant strain of *L. decemlineata* compared to a sensitive strain. To demonstrate the function of these upregulated genes in neonicotinoid resistance, RNA interference (RNAi) will be used to silence their expression. This will be accomplished by producing double-stranded RNA specific for the upregulated genes in bacteria and feeding the bacteria to resistant insects. We will then evaluate the phenotypic effects of RNAi-based silencing of the upregulated genes on neonicotinoid resistance using bioassays. This work is significant as the results will lead to a better understanding of insecticide resistance in *L. decemlineata*, which may ultimately assist in developing novel strategies for its control.

PP-2:

Plant derived RNA interference of vacuolar ATPase to control two-spotted spider mite (*Tetranychus urticae* Koch)

Hooman Hosseinzadeh Namin[1], I. Scott[2] and V. Grbic[1]
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[2]Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, ON, N5V 4T3

Two-spotted spider mite, *Tetranychus urticae* (Koch) is a cosmopolitan agricultural pest belonging to a group of web-spinning mites of the subphylum Chelicerata. *T. urticae* feeds on over 1100 plant species including 150 crops and causes considerable yield losses in field and greenhouse crops. *T. urticae* has a high fecundity rate (100 eggs per female) and a low generation time (10 days), which results in rapid development and build-up of the population under optimal conditions. Additionally, this arthropod develops resistance against a novel pesticide within two to four years, urging a need to develop new control strategies in crop protection with an independent mode of action. RNA interference (RNAi) is a post-transcriptional gene regulation mechanism resulting in down-regulation of a target gene at the RNA level. Thus, RNAi can be developed as a potential method to control pests by silencing genes encoding proteins with essential functions for their survival and reproduction. Vacuolar ATPase is a multi-subunit proton pump, involves in many important physiological processes such as intracellular trafficking, endocytosis, and protein degradation. V-ATPase has been reported as a target gene for developing transgenic RNAi plants against several pests. The objective of this research was to evaluate the effect of the in planta v-ATPase RNAi constructs on spider mite development, fecundity and mortality. Our data demonstrate that ingestion of plant-derived v-ATPase RNAi resulted in significant decrease of mite fecundity, indicating that this technique may be a promising alternative pest management strategy against *T. urticae*.

PP-3:

Carrot Weevil Lacking Effective Chemical Control Options in Ontario

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The carrot weevil (CW), *Listronotus oregonensis* (LeConte), is a primary insect pest of carrot production in Canada. Carrot roots are rendered unmarketable from CW larval feeding damage. Yield loss from CW attack can exceed 40% in Canada but is highly variable. Imidan 50 WP was the only registered product for CW control until recently and is still the primary product used despite concerns of resistance. To help control CW, Matador 120 EC was registered in 2014 and Rimon was registered in 2015. This project aims to identify products which can provide consistent CW control. Adult CW were screened for their susceptibility to the formulated insecticides: Admire, Clutch, Coragen, Delegate, Exirel, Imidan 50 WP, Matador 120 EC in a direct-contact toxicity bioassay using a 1/9th scale Potter spray tower. Imidan and Clutch were the most toxic followed by Matador. The other screened insecticides produced negligible mortality. In 2015, field trials at the University of Guelph Muck Crop Research Station (Bradford, ON) examined the efficacy of foliar sprays (Matador 120 EC, Imidan 50 WP, Exirel, Clutch, Sivanto Prime and Delegate) and seed treatments (Sepresto 75 WS, Sivanto FS 480, HGW86, Governor 50 WP) for CW management. Rimon was registered too late into the 2015 season to be included in these trials. Results of a mid-season (August) assessment indicate that no insecticide provided effective CW control. However, the harvest assessment (mid-October) will be a much better indicator of product efficacy in terms of CW management. Results of the harvest assessment will be discussed.

PP-4:

Species-specific primers based on comparative genomic analyses of several *Botrytis* species.

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Botrytis cinerea and *B. pseudocinerea* from the ascomycetous class Leotiomycete are pathogenic fungi causing disease on several plant species such as grapes. *B. pseudocinerea* is a recently reported pathogen which shares morphological features and host ranges with *B. cinerea,* but is considered genetically distinct on the basis of fungicide sensitivity. To verify their species distinction, the genomes of *B. cinerea* and *B. pseudocinerea* we sequenced and assembled in this study. To identify shared genes and their level of homology, a reciprocal BLAST (Basic Local Alignment Search Tool) comparison between the predicted genes of these isolates was done, which revealed that 79% of the genes were highly conserved (>95% homology), which demonstrated that these are indeed different species. Primers were then designed based on moderately conserved genes between *Botrytis* species for the purpose of species distinction and rapid identification. With this set of primers, it was possible to distinguish *B. cinerea* from *B. pseudocinerea, B. tulipae* or *B. elliptica*, and their use will allow for rapid identification of *B. cinerea*, and eventually allow for more accurate pest control applications.

PP-5:

Comparison of three spray timing programs for management of Stemphylium leaf blight of onion

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Stemphylium leaf blight, caused by the fungal pathogen *Stemphylium vesicarium* (telemorph: *Pleospora* spp.), causes extensive tip die back, early lodging, and yield losses of onion crops. Our objective was to compare three fungicide spray timing models for management of stemphylium leaf blight at the Holland Marsh, Ontario. A foliar fungicide (fluopyram 12.5%, pyrimethanil 37.5%) was applied on onion cv. La Salle following label recommendations, with timing determined using i) TOMCAST, DSV 15, ii) BOTCAST, Threshold I, and iii) STEMCAST following two successive sporulation and infection periods. Treatments based on iv) calendar application, v) spore trapping data, and vi) a nontreated control, were also included. The trial was arranged in a RCBD with four replicates. TOMCAST prompted six fungicide applications, resulting in a 40% reduction in the number of applications compared with the spore trapping treatment and 25% reduction compared with the other treatments. When leaf blight symptoms were first observed, the mean number of lesions per leaves was lowest in the TOMCAST and spore trapping treatments. Disease incidence was 98% in the control, compared to 74% for spore trapping and 79% for TOMCAST. Each treatment significantly reduced severity compared to the control. Disease severity was lowest in TOMCAST, 42.4 ± 3.04 and highest in the control, 64.7 ± 3.04. There was no correlation between the initial number of lesions and subsequent disease severity. Using TOMCAST provided cost reduction in fungicide of between \$266-\$532 ha^{-1}.

PP-6:

How can we improve chemical control of carrot rust fly?

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Carrot rust fly (*Psila rosae* Fab.) (CRF) is a serious pest of carrots and other apiaceous crops worldwide. In Ontario, it is a particularly devastating pest of carrots at the Holland Marsh where >5% damage could result in a field being rejected by the packer. With up to three generations annually, effective control of this pest is vital for carrot growers. Foliar applications of insecticides have resulted in variable levels of control. Three field trials were conducted in 2015 to determine how to provide greater control for CRFs. The first field trial examined the effectiveness of the IPM program by comparing insecticide free plots to plots following the IPM recommendations. Unfortunately no CRF damage was found. The second trial examined the effectiveness of seed treatments to control the CRF. Treatments consisted of Sivanto Prime 480FS, Governor 75WP, HGW86, and Sepresto 75S. No significant difference were found between the treatments. The second trial consisted of an in-furrow application at seeding and foliar applications were applied as determined by the IPM program to control subsequent generations of CRF. In-furrow applications consisted of Admire 240FS and Minecto-Duo 40WG, while foliar applications consisted of Sivanto Prime 200SL and Exirel. Again, no significant differences were found between treatments. While no trials produced significant results for the 1st generation, this damage is typically lower than 2nd generation. Therefore, a second harvest will be conducted in October, after the 2nd generation, and results from this will also be discussed.

PP-7:

What you seed is what you get: Investigating *Bombus impatiens* colony development on three flowering plants: buckwheat, red clover, and *Phacelia tanacetefolia*

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The bumble bee, *Bombus impatiens*, is indigenous to North America, and is a significant pollinator of natural and agricultural ecosystems. Pesticides used in agriculture may be hazardous to bumble bees, and in response, regulatory agencies have created more stringent testing requirements for registration and re-registration of pesticides, in order to provide a decrease in risk to pollinators. Many pesticide toxicity studies focus on honey bees, yet non-*Apis* pollinators should be of equal priority in the risk assessment process. Currently, methods for testing bumble bees in regulatory assessments are not available and there is an imperative need to develop protocols for routine toxicity studies. My research focuses on generating data to aid in the production of standardized methods for assessing the risk of pesticide exposure to *Bombus impatiens*. I conducted a Tier II semi-field experiment to investigate *B. impatiens* colony development on buckwheat, red clover, and *Phacelia tanacetefolia*. Colony weight, the number of bees foraging on bloom, and the number of bees entering and leaving the colony were observed for two weeks. The colonies were then kept in a growth chamber until queen production. Comparison of colony development (weight and queen production) and bee activity will help determine a suitable surrogate plant to be used in the standardized methods.

PP-8 (UNDERGRADUATE):

The effect of a fungicide application on yield in population stressed corn (*Zea mays* L.)

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A field study was conducted in 2015 to compare the effects of picoxystrobin and pyraclostrobin/fluxapyroxad on different populations of corn. Three populations of 75 000 seeds/ha, 100 000 seeds/ha and 125 000 seeds/ha were planted and two different fungicide treatments were applied at full tassel. An untreated check for each population was also included for a total of nine treatments. Plant height measurements were taken throughout the summer to compare growth rate of the populations, no differences were found. Senescence ratings were taking at weekly intervals beginning September 18th, yield data will be recorded at harvest.

PP-9 (UNDERGRADUATE):

Host specificity of *Colletotrichum* isolates from apple, celery and strawberry in Ontario

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Fungal pathogens *Colletotrichum fioriniae* and *C. simmondsii* have been causing bitter rot on apple, leaf curl on celery, and anthracnose on strawberry crops in Ontario, resulting in economic losses. Due to its recent emergence, the pathogen's cross-infection potential and the relative susceptibility among the main apple cultivars are unknown. To determine this, four isolates from *C. fioriniae* infected apples and celery, and one isolate from *C. simmondsii* infected strawberry were inoculated on apples (cv. Ambrosia, Empire, Gala, HoneyCrisp and McIntosh) and celery plants (cv. Plato) in the lab. Apples were wounded and non-wounded and were inoculated using a micropipette, while the celery plants were inoculated using a spray bottle. The results showed that all isolates were pathogenic on the apples but infections only occurred on the wounded apples. Significant differences between cultivars occurred: Empire was the most susceptible while Gala was the least ($p<0.005$). Moreover, the isolates varied in virulence, with the strawberry isolate being the most aggressive and the celery isolates being the least. However, cultivar × isolate interactions occurred ($p<0.005$), where the behaviour of certain isolates depended on the cultivar it infected. As for the celery, all isolates were pathogenic, however, differences between the isolates were not significant ($p>0.05$). Although not significant, plants inoculated with the celery isolate were the most diseased while the strawberry inoculated plants were the least. Since all *Colletotrichum* isolates were able to infect apples and celery, extra care needs to be taken to avoid the spread of the pathogen from one host to another.

REGULAR POSTERS

RP-1:

Petrified pests: The mere presence of a predator affects survival of western flower thrips

Danielle Schmidt[1], **Sarah Jandricic[2]** and Steve Frank[1]
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The effectiveness of biological control agents used in agricultural or horticultural crops has traditionally been measured in terms of prey consumption rate. However, the mere presence of predators has been repeatedly shown to reduce prey fitness in natural ecosystems. Thus, non-consumptive predator effects (NCPEs) may play a larger role in biological control programs than previously thought. Here, we assessed NCPEs of a commonly used predatory mite (*Neoseiulus cucmeris*) on Western Flower Thrips (*Frankliniella occidentalis*), a significant greenhouse pest. Effects of mite presence on thrips survival and development were studied in the Frank lab at North Carolina State University, using 100 leaf cup arenas divided into three predator treatments (control, 2 mite predators, and 4 mite predators). Mites were added when thrips developed into 2nd instars. This prey stage is repeatedly attacked by mites, but are too large for the mites to successfully kill. Thrips were exposed to the predation threat until they began to pupate. No significant difference was found between treatments in terms of larval-to-adult development time, or for pupal or adult size. However, larval thrips under predation threat had significantly higher mortality than the control treatment: 55-71% mortality vs. 21%, respectively. Our work suggests that predatory mites successfully control thrips through a combination of consumptive effects on 1st instar larvae and increased mortality of 2nd instar thrips through NCPEs. Few fitness consequences seem to exist for thrips that survive mite harassment, though further investigation is necessary to confirm this.

RP-2:

Propidium monoazide-assisted PCR differentiates between viable and non-viable *Plasmodiophora brassicae* resting spores better than conventional qPCR

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Clubroot of canola (*Brassica napus* L.) caused by *Plasmodiophora brassicae* Woronin (Pb) is a major threat to canola production in the Canadian prairies and worldwide. This is partly due to the ability of Pb resting spores to remain viable in soil for years. Soil-borne spores can be quantified using qPCR, however qPCR amplifies DNA from viable and non-viable spores. Propidium monoazide (PMA) has been used in conjunction with qPCR (PMA-PCR) to prevent amplification of DNA from non-viable microorganisms. The objective of this study was to assess the potential for using PMA-PCR to quantify viable Pb spores while excluding non-viable spores. Naturally-infested muck soil and resting spores isolated from clubbed roots were heat-treated (80 °C for 10 to 60 min) to produce a mixture of viable and non-viable spores. Extracted spores were then treated with different PMA concentrations (40-120 µM) followed by qPCR analysis. Heat treatment did not affect spore numbers obtained from qPCR with no PMA. In contrast, PMA-PCR detected a reduction in the number of spores after heat treatment: up to 99% for spores extracted from clubs and 79% for spores extracted from soil. Furthermore, heat treatment reduced the ability of spores to produce clubroot symptoms in a bioassay on susceptible canola plants, suggesting that PMA-PCR was able to differentiate between

viable and non-viable Pb spores better than qPCR. Current research is comparing different manual extraction protocols for use with PMA-PCR.

RP-3:

On the Move: 2015 Survey Results of Brown Marmorated Stink Bug in Ontario

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The brown marmorated stink bug (BMSB), *Halyomorpha halys* (Stål), is an invasive pest species native to East Asia. First identified in Pennsylvania in 2001, BMSB has spread throughout 41 US states, causing serious economic damage to valuable fruit, vegetable and fruit crops, as well as ornamental trees and shrubs in the northeastern US. BMSB was detected in Ontario in 2010 and an established population was first identified in Hamilton in 2012. Homeowner reports during the 2013 and 2014 surveys of BMSB in Ontario revealed that BMSB in urban dwellings created a risk to nearby agricultural areas. These surveys also found BMSB present in close proximity to tree fruit orchards, warranting the survey to continue into 2015. The objectives of this survey were to assess the abundance and distribution of this pest in Ontario, assess the patterns of its host plant use, and identify agricultural areas in southern Ontario at high risk from BMSB. Surveys were conducted at a variety of site types in Southern Ontario, each containing either preferred or potential host plants. Sites were assigned one of four possible designations: Natural/Rural, Urban/Industrial, Agricultural or Transportation Corridor. Surveys consisted of visual sampling, pheromone monitoring, and the use of sweep nets and tapping trays. As a result of the 2013, 2014 and 2015 surveys, BMSB has now been found in over 30 locations, with established (breeding) populations observed in Hamilton, St. Catharines, London, Windsor, and Newboro. These results warrant continued surveillance of this pest in Ontario.

RP-4:

Survey of Ginseng Fields Treated with Different Fumigants

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Ginseng is the most valuable field grown horticultural crop in Ontario. Due to the three to four year life of a ginseng garden, roots are affected by numerous soil fungi, oomycetes and nematodes. It is standard practice for growers to fumigate land before seeding to reduce populations of soilborne pathogens and weeds. In 2011, the industry standard fumigant Telone C-17 (1,3-dichloropropene + chloropicrin) was pulled from the Canadian market. As a result, in 2012 growers switched to either metam sodium (Busan/Vapam) or chloropicrin (Pic Plus) fumigants. In summer 2014 and 2015 we conducted a survey of four fields treated with metam-sodium and three fields treated with chloropicrin compared to two fields treated with Telone C-17. Stand was monitored over the two summers and six 1.6 m^2 sample areas per field were harvested September 2015. Average total yields were 87 and 77% of the Telone C-17 fields for metam-sodium and chloropicrin, respectively. However, there was high variability among sites and at least one field treated with each fumigant had high yields with low nematode and disease damage. This suggests that specific pathogen populations and fumigant application procedures play an important role in the efficacy of a fumigant on a particular field.

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**