



# **Production Systems Plants**

## **Entomology Projects**

**June 19 2012**



# Production Systems - Plants

1. **Plant protection**
  - ✓ IPM
  - ✓ Invasive species, emerging pests
  - ✓ Diagnostics
2. **Production Efficiency**
  - ✓ Improved technologies
  - ✓ Climate and demand driven efficiency
  - ✓ Harvest aids
  - ✓ Fertilizer efficiency
3. **Environmental Ecosystem Impact**
  - ✓ Water, soil and air quality
  - ✓ Plant impact on environmental health
  - ✓ Improve agricultural impact on natural pollinators
4. **Product Diversification**
  - ✓ New Crops and supporting production systems
  - ✓ Market research on products / packaging for new markets
5. **Product Quality**
  - ✓ Improved agronomy and production processes
  - ✓ Identify or improve quality traits
6. **Genetic Technologies**
  - ✓ Resistance to disease and pests
  - ✓ Evaluation of new cultivars/varieties

# Plant Protection – IPM

- 26810 - Management of foliar disease and insect pests in vegetable crops and sugar beet (2010-2013).
  - Cheryl Trueman (Rebecca Hallett)
- 26933- Optimizing Biological Control Strategies in Greenhouse Floriculture: Interactions, Integration and Implementation (2010-2013).
  - Cynthia Scott-Dupree

# Plant Protection – Invasive Species

- 26956- Western Bean Cutworm Monitoring and Management Strategies for Ontario and the Great Lakes Region. A Proactive and Coordinated Approach to Prepare and Respond to a Newly Emerging Corn and Dry Bean Pest in Ontario (2010-2013).
  - Art Schaafsma (Chris Gillard, Rebecca Hallett, Cheryl Trueman)
  - Also listed in Emergency Management

# Plant Protection – Emerging Pests

- 26721- Risk Assessment and Management of Invasive Pests of Field Crops in Current and Future Climates (2009-2012).
  - Rebecca Hallett (Jonathan Newman, Art Schaafsma)

# Plant Protection – Diagnostics

- 0 Projects

# Genetic Technologies – Resistance to Pests

- 200333 (27020) - Development of disease and insect resistant soybean varieties for food grade, functional food and specialty oil markets in Ontario
  - Istvan Rajcan

# Environmental Ecosystem Impact – Pollinators

- 26728 - Evaluation of the Entomopathogenic Fungi, *Beauveria bassiana*, *Clonostachys rosea*, and *Metarhizium anisopliae*, as Biocontrol Agents Against the Honey Bee Parasitic Mite, *Varroa destructor* (2009-2011).
  - Ernesto Guzman



## New Directions – Plants

- SR9222- The evaluation and development of a plant disease and insect warning system for strawberry growers in Ontario. (2009-2012)
  - Rishi Burlakoti (WIN)
- SR9220- Integrated approaches to honeybee health in Ontario: Induction of immune resistant, hive components, biocontrol, medicines, probiotics and passive...(2009-2012)
  - Ernesto Guzman
- SR932- Alternative management practices for the swede midge in organically produced cruciferous vegetables. (2010-2013)
  - Rebecca Hallett

## Plant research priorities

- Plant Protection 4
- Product Diversification
- Genetics 1
- Production Efficiency
- Product Quality Improvement
- Environmental Ecosystem Impact 1

# Project coverage

## Edible Hort - 1

Fruit	0
Vegetable	1

## Field Crops - 3

Beans	(1)
Canola	0
Corn	(1)
Multiple	1
Oats Barley	0
Soybeans	2
Wheat	0

## Non Edible and Other - 2

Floriculture	1
Turfgrass	0
Other	1 (Bees)

# Overview of Partnership Research

• Apples	0	• Biomass	0
• Asparagus	0	• Energy Crops	0
• Beans	1	• Bees	1
• Corn	1	• Canola	1
• Soybean	2	• Grapes	0
• Floriculture	1	• Oats / Barley	0
• Nuts	0	• Turf Grass	0
• Wheat / Barley	0	• Cole crops	1
• Raspberries	0	• Tomato	1
• Strawberries	0		
• Vegetable	1		

# Classification

<b>Edible Hort</b>		<b>Grains / Oilseeds</b>		<b>Non edible Hort</b>	
Vegetables	1	Corn	1	Floriculture	1
Tomatoes	1	Wheat	0	Turf grass	0
Grapes	0	Soybeans	2	Nuts	0
Cole crops	1	Beans	1	Biomass	0
Green beans	1	Barley	0	Energy	0
Sweet corn	1	Canola	0	Bees	1
		Oats	0		
<b>Total 1</b>		<b>Total</b>	<b>3</b>	<b>Total</b>	<b>2</b>

- C Gillard (1)
- E Guzman 1
- R Hallett 1 (2)
- J Newman (1)
- I Rajcan 1
- A Schaafsma 1 (1)
- C Scott-Dupree 1
- C Trueman 1 (1)
  
- IPM – 4
- Bees – 1
- Ecology – 1
- Plant Breeding & Agronomy – 2

# Success Stories – Plant Protection

- **26721- Risk Assessment and Management of Invasive Pests of Field Crops in Current and Future Climates**
  - Rebecca Hallett, Jonathan Newman, Art Schaafsma
- Better understanding of the life cycle and impact of Bean Leaf Beetle will improve management recommendations, and soybean yield and quality for Ontario growers under current and future climates.
  - **Determine the life cycle of BLB across Ontario**
  - **Determine the impact of environmental factors on BLB development and success**
  - **Determine the impact of pod feeding by BLB on seed quality and yield and establish**
  - **Develop revised recommendations for management of BLB.**

# Success Stories – Plant Protection

- 26721- cont'd

## **Determine the life cycle of BLB across Ontario**

- Patterns of BLB presence in Ontario soybean fields in 2009, 2010 and 2011 suggest that only one complete generation of BLB occurs in Ontario during the year.
  - adults feed on pods late in the season reducing yield and impacting seed quality.
- A new degree-day model developed which will be a useful predictive tool for BLB occurrence in the field.
- Ontario soybean growers now know that they only need to manage one generation of BLB per year, and that at least under current climates, two generations do not occur in Ontario.



# Success Stories – Plant Protection

- 26721- cont'd

## **Determine the impact of environmental factors on BLB development and success**

- Beetles in overwintering experiments with heated pots emerged ~2 weeks earlier in the spring, but there were no differences in survival.
- There was a trend for fewer eggs produced at higher CO<sub>2</sub> concentrations; needs to be confirmed with additional experiments.
- Determination of changes in the number of generations of BLB with climate change will have important management implications, as different tactics are important in targeting each generation.
- Knowledge of the likelihood of 2 generations occurring under future climates allows product research and registration in advance, so growers have tools needed when the time comes.

# Success Stories – Plant Protection

- 26721- cont'd

## **Determine the impact of pod feeding by BLB on seed quality and yield and establish**

- Results show yield impacts due to BLB feeding, and that pod injury increased with increasing numbers of beetles per plant and R-stage
- An action threshold based on beetle numbers should be an effective means of evaluating the need for, and timing, insecticide applications.
- Quality assessments on seed showed that percent seeds in poor and immature categories differed significantly with beetle number during different R-stages; with highest percentages occurring with 8 beetles/plant.
- Impact of bean leaf beetle on seed quality and yield during different R-stages will be used to revise the current late season threshold, which does not take seed quality or R-stage into consideration and has not effectively protected high value IP food grade and seed soybean production in Ontario.

# Success Stories – Plant Protection

- **26956- Western Bean Cutworm Monitoring and Management Strategies...**
  - Art Schaafsma, Chris Gillard, Rebecca Hallett, Cheryl Trueman
- This project aims to determine the significance and management of an emerging pest species, Western bean cutworm, in multiple agricultural commodities in Ontario including field and sweet corn, dry beans and key vegetable crops.
  - **Determine the distribution and overwintering success of WBC.**
  - **Determine the phenology of WBC in the Great Lakes Region.**
  - **Determine the host range of WBC.**
  - **Evaluate the efficacy of foliar insecticides in corn, dry beans, vegetable crops and transgenic corn for WBC control.**
  - **Establish economic thresholds for WBC in dry beans and corn.**
  - **Develop comprehensive best management practices for WBC in Ontario.**

# Success Stories – Plant Protection

- 26956- cont'd

**Determine the distribution and overwintering success of WBC.**

**Determine the phenology of WBC in the Great Lakes Region.**

- Results of pheromone trap monitoring for WBC in 2011 revealed a substantial (3x) increase in moth counts from 2010 in Ontario and Quebec.
- The results of this project have confirmed that WBC are overwintering in some Ontario regions and have provided information on their current and expanding distribution in Canada.
- Valuable information on pest range expansion, feeding activity and phenology were also documented.

# Success Stories – Plant Protection

- 26956- cont'd

## **Determine the host range of WBC.**

- Preliminary host range studies indicate that in addition to corn and dry beans; peas, cucumbers, squash, lamb's quarters, red root pigweed and eastern black nightshade may be acceptable hosts for WBC larval development in Ontario.
- Laboratory bioassays to investigate female oviposition preferences on a range of dry bean classes are underway.

# Success Stories – Plant Protection

- 26956- cont'd

## **Evaluate the efficacy of foliar insecticides in corn, dry beans, vegetable crops and transgenic corn for WBC control**

- Two field trials of foliar insecticides conducted in field corn in 2011 found reduced WBC feeding in all insecticide-treated plots compared to untreated or fungicide only treatments.
- Transgenic corn expressing the Vip3A toxin provided 100% control of WBC. Larvae were recovered from corn expressing Cry 1A.104 + Cry 2Ab2 + Cry 1F and Cry 1F alone, however no differences in yield were measured among transgenic and non-transgenic corn.

# Success Stories – Plant Protection

- 26956- cont'd

**Establish economic thresholds for WBC in dry beans and corn.**

**Develop comprehensive best management practices for WBC in Ontario.**

# Conclusions

- Plant Protection-oriented research
- Small, but active, group of well-linked entomological researchers
  - 4 IPM
  - 1 Pollinators
- Increasing number of pest issues to deal with
- A wide variety of crops need attention