Development and Implementation of Integrated Pest Management in Alberta Greenhouses

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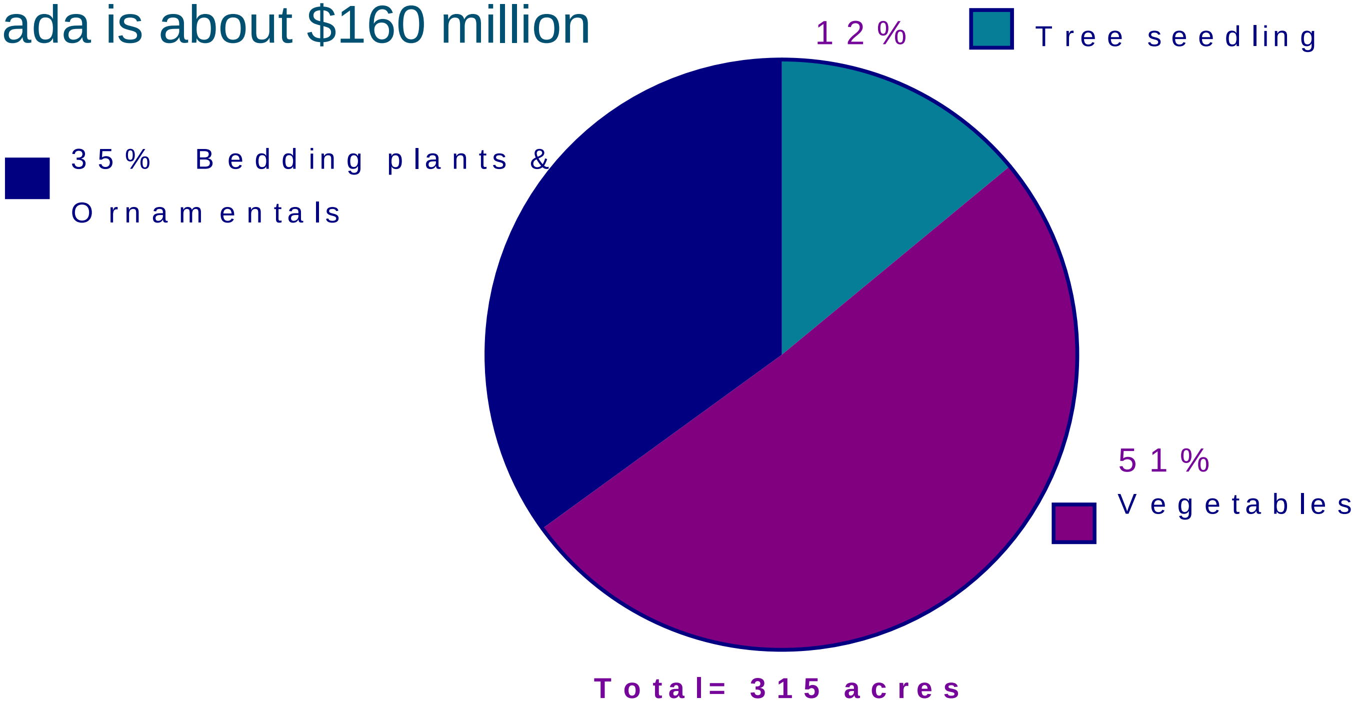
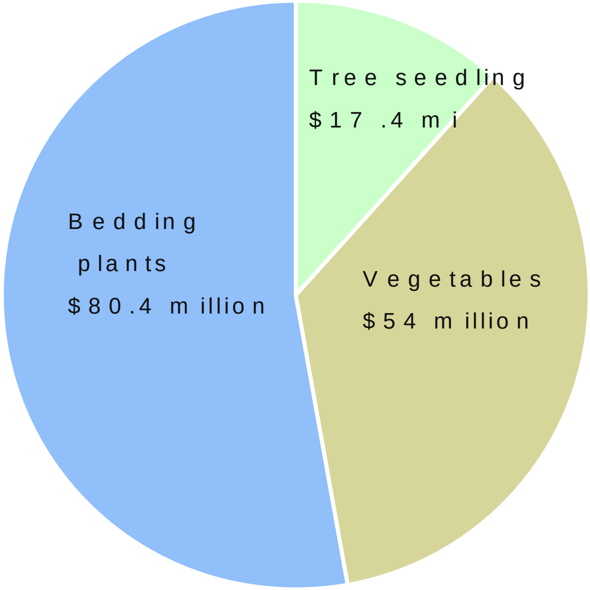
Alberta Agriculture Statistics

- % of Canadian Population 11.4%
- Labour Force in Agriculture 2.9%
- Farm Cash Receipts In 2013, $11.8 billion (21.5% of Canada).
- **Principal Field Crops**: Wheat, Oats, Barley, Fall Rye, Flaxseed, Canola, Dry Beans, Dry Peas, Mustard Seed, Triticale, Fodder Corn, Sugar Beets
- **Commercial Fresh Vegetables and Fruits** Beans, Carrots, Corn, Sweet Onions, Dry Peas, Raspberries, Strawberries

Greenhouse Industry

- 100 day frost free
- The Alberta greenhouse crops industry is estimated to be 315 acres. It employs over 1,500 full-time and over 3,000 part time people.
- Alberta’s share of the $2.5 billion greenhouse annual sales in Canada is about $160 million





Total Sales $152 million

Importance of pest in Alberta greenhouses

- Pest management in greenhouses is an on-going production constraint for growers. In a recent survey of the
- industry, 42% of growers indicated they have pest management problems.
- Some growers spend about $13,400 per acre on biological control per year.
- In some instances whole crops have been destroyed by growers and replanted when it is no more economical to control the pest.
- In 2012 the Canadian Horticultural Council initiated a study to establish an insurance program for plant pest in Canadian Greenhouse crops.

Cucumber Green Mottle Mosaic Virus (CGMMV)

- In January 2013 CGMMV was first reported in Alberta
- The disease has been previously found in the greenhouses in Ontario, British Columbia, The Netherlands, and on field cucumber crops in Asia, Europe, and Middle East

Cucumber Green Mottle Mosaic Virus (CGMMV)

- causes leaf mottling, blistering and distortion, and stunted growth. Fruits are usually unmarked,
- Depending on the time of infection of cucumber, yields are reduced by 10-15%
- 99% sequence of the Alberta isolate is identical to the CGMMV isolates identified in Asia
- CGMMV is a contagious disease, and easily transmitted through contact between leaves or by workers, recirculation of leachate, dust particles, plant residues, seeds and seedlings.

The IPM conundrum

- IPM has become the accepted strategy for plant protection over the last five decades.
- Attempts to get an IPM project funded since 2002.
- Some information related to IPM exists and there are technologies used throughout the world that could be adopted for use.
  - There is no active technology transfer in Alberta concerning the information.
  - Pest management gaps exist at the implementation level. For instance for the key greenhouse pest core IPM tools, such as monitoring methods, economic thresholds, reduced-risk biorational pesticides

Alberta Greenhouse IPM Project

- **Funded by**
  - **Alberta Crop Industry Development Fund Ltd. (ACIDF)**
  - **Alberta Innovates – Bio Solutions (AI-Bio)**
  - **Alberta Agriculture and Rural Development**

- **Team Members**
- <u>Researchers</u> Dr Kwesi Ampong-Nyarko, Dr Mohyuddin Mirza, Dr Ken Fry, Chris Kaulbars, Emmanuel Laate, Dr. John Zhang
- <u>Industry</u> Biobest, Koppert
- <u>Greenhouse operators</u>: Nadine Stielow, Jeff Stigter, Eric Doef

Needs assessment
IPM Survey

- To establish baseline knowledge, attitudes, satisfaction and aspirations related to IPM
- This survey will be repeated at the completion of the project will assess changes in knowledge, attitudes, satisfaction, aspirations

IPM Survey Methodology

- In Aug 2014 , 9-page survey was mailed out to 325 different addresses representing all known greenhouse operators in Alberta.
- Reminder note was placed in the AGGA Newsletter
- In the survey, growers were asked to rate their feelings and experiences with IPM

Growers often used the following IPM Practices

IPM Practice	Users (%)
Visually inspect plants for pest	90%
Identify pests in the crop	100%
Randomly select plants for examination	78%
Sanitize greenhouse floors, benches and greenhouse	88%
Inspect incoming plants and/or cuttings immediately upon arrival for insects, diseases	81%
Practices are altered to accommodate the use of biological control agents	85%

Growers often used the following IPM Practices

IPM Practice	**Users %**
Use sticky cards to monitor	65%
Commercial bio control agents are released into the crop	63%
Follow-up and evaluate pest management actions	64%
Optivisor, hand lens or microscope is used to inspect plants	56%
Use resistant cultivars	56%
Refer to economic thresholds when making control decisions	53%

Growers rarely used these IPM practices

IPM Practice	Users %
Install screening to prevent insects from entering the greenhouses	19%
Request and record pesticide use information from the suppliers of incoming plants	6%
Isolate incoming plants in a quarantine area until visual inspection can be completed	38%
Potato plugs are used to monitor for fungus gnat larvae	0%
Indicator plants detect thrips feeding of Impatiens Necrotic Spot Virus	25%

Growers rarely used these IPM practices

IPM Practice	Per Cent
Keep good written records of pest monitoring	31%
Adjust economic thresholds based on control method used	44%
Use pesticides as a part of an IPM Program	44 %
Drench applications are used	31%
Fogger applications are used	0%
Electrostatic technology is used	0%
Smoke treatments are used	6%

Growers have confidence in these skills

IPM Practice	Per Cent
Sanitize greenhouse floors, benches and greenhouse structures properly	70%
Scouting / monitoring for pests	73%
Visually inspect plants for pest infestation	87%
Use sticky cards to monitor insects	75%
Correctly identify pests (insects/diseases)	73%
Assess the potential risk that a pest poses	65%
Inspect incoming plants and/or cuttings immediately upon arrival for insects, diseases and other problems	60%

Growers are not confident in these skills

IPM Practice	Per Cent
Use Economic Thresholds in decision making	40%
Keep good written records of pest monitoring results	40%
Set up a monitoring program	39%
Follow-up and evaluate pest management actions	50%
Install screening to prevent insects from entering the greenhouses	20%
Apply biological control sprays	31%

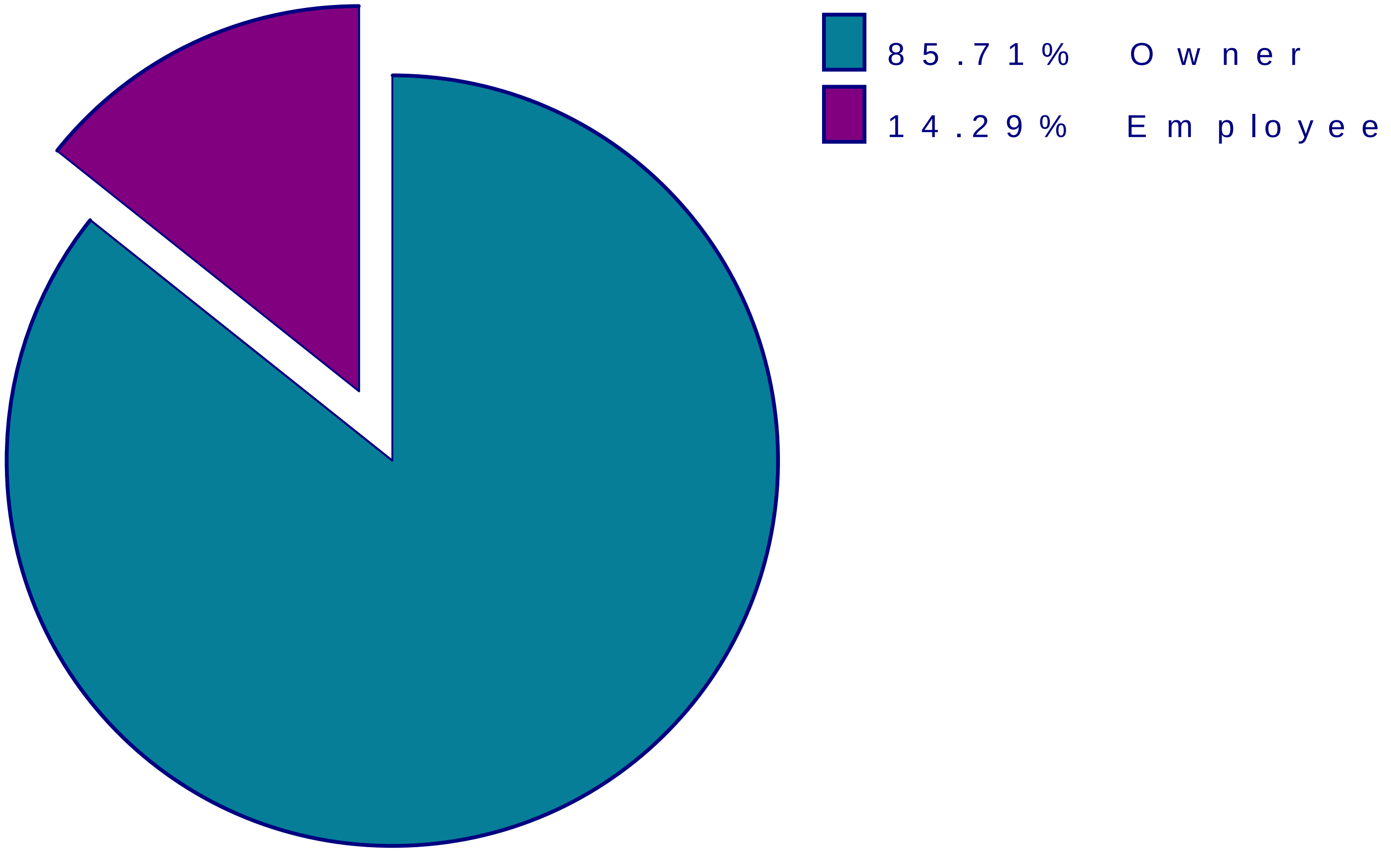
Growers Views of IPM

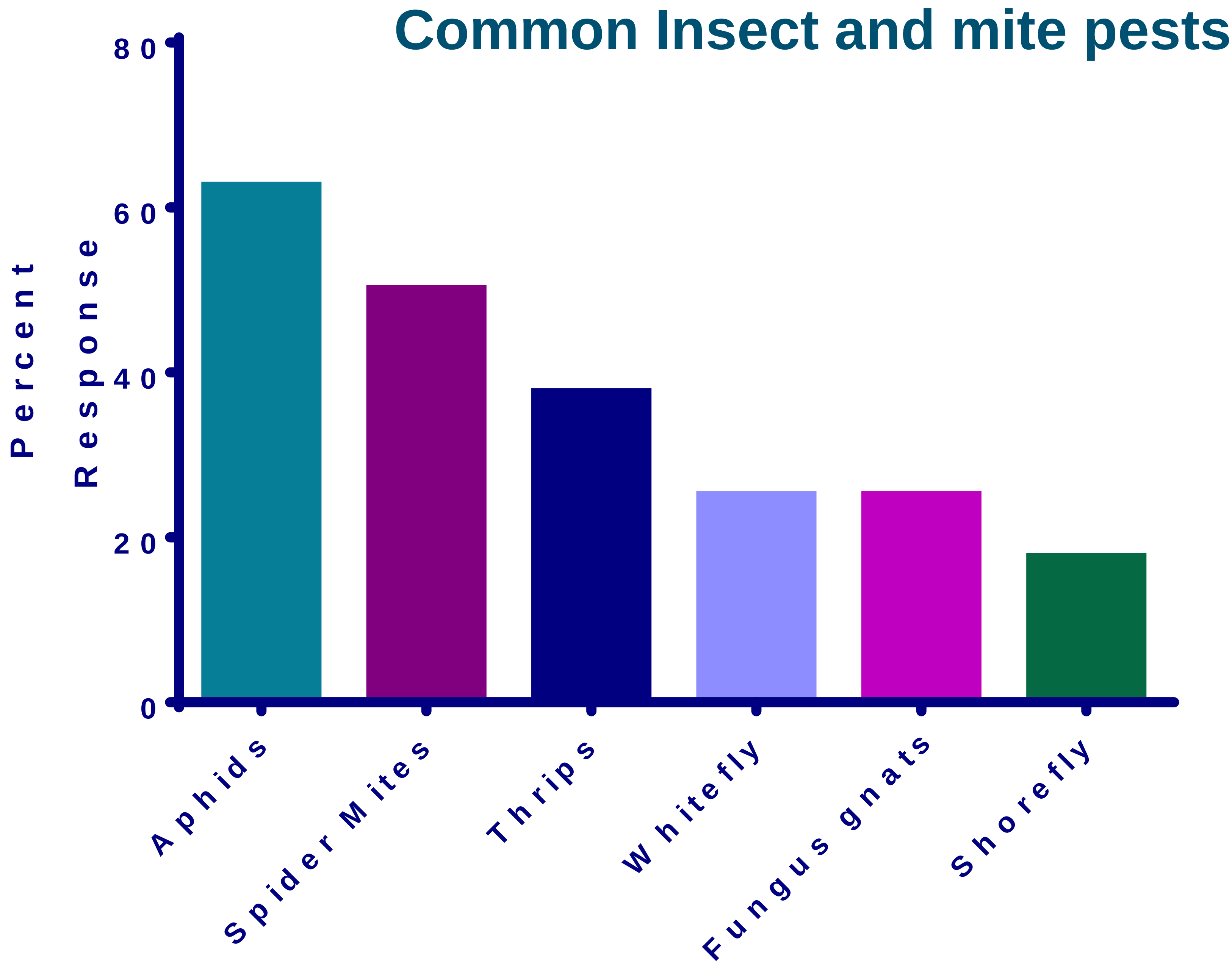
IPM Practice	Per Cent
Using IPM to manage pests is important	86%
Planning an IPM program is a priority	88%
Use of IPM increases management time	56%
Use of IPM improves relations with neighbours	66%
IPM leads to decreased pesticide use	80%

Growers Views of IPM

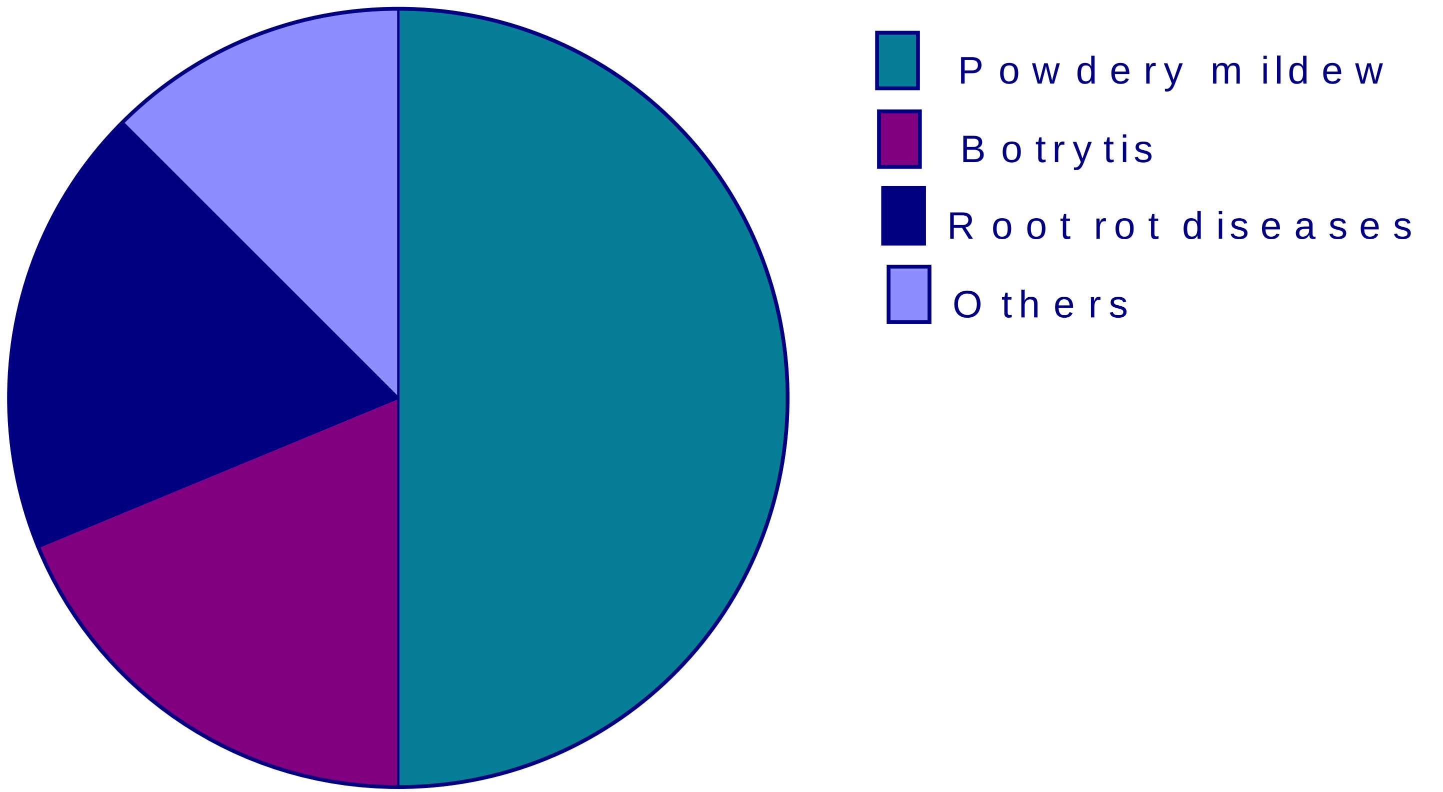
IPM Practice	Per Cent
• Use of IPM attracts more customers	44%
• Use of IPM increases the costs of pest management	40%
• Use of IPM decreases the quality of the product	0%
• I am uncertain about how effective IPM will be	27%
• I feel IPM is too costly to implement	6%

Who most often performs IPM duties in Greenhouse

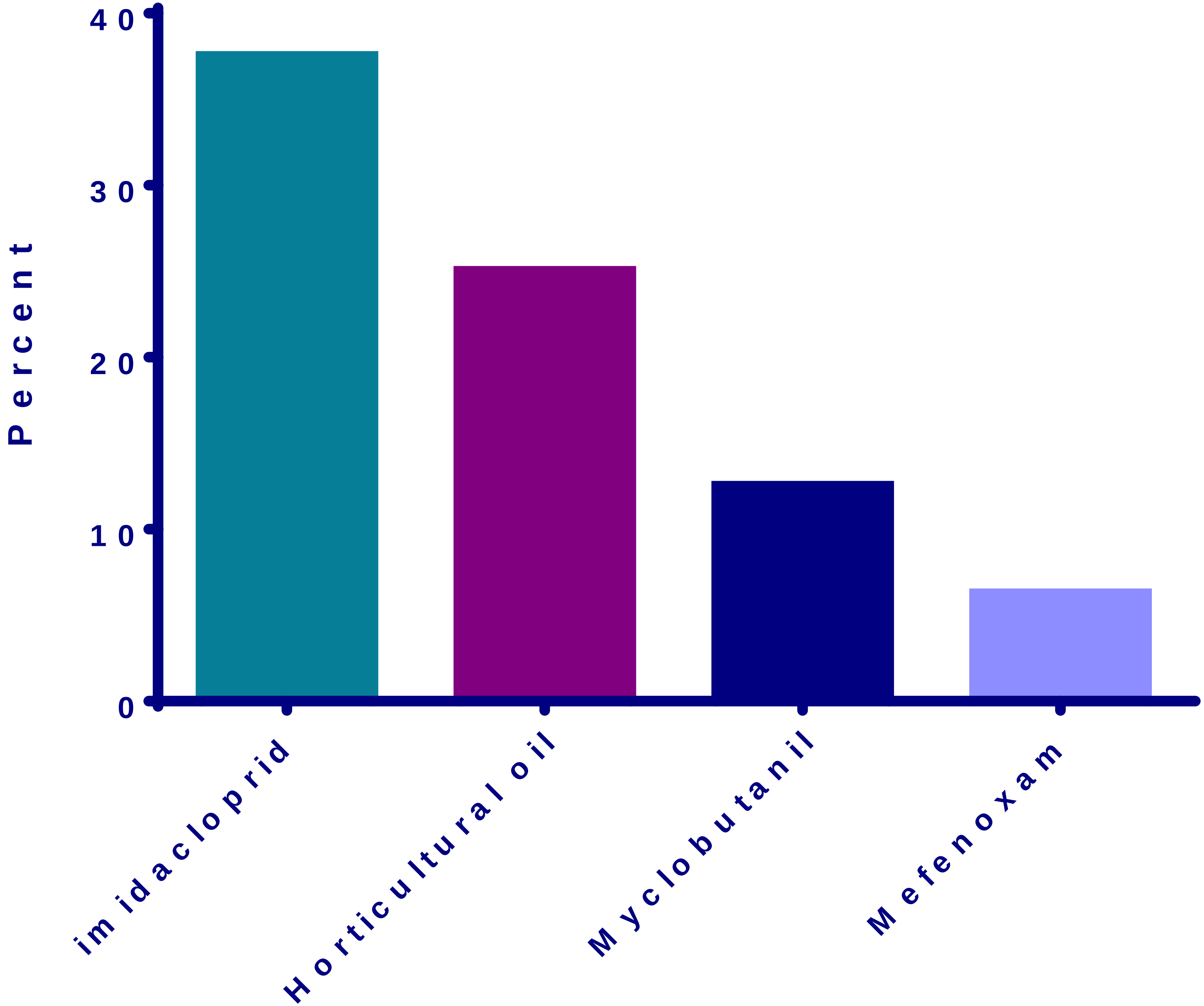



Common Insect and mite pests
Percent Response
80
60
40
20
0
Aphids
Spider Mites
Thrips
Whitefly
Fungus gnats
Shorefly

Common disease problems



Pesticides used most often



IPM Practice

- **70% Practice IPM**
- Global G.A.P requires Evidence of implementation

- The European Parliament adopted eight general principles for IPM as (European Commission 2009)

(1) Measures for prevention and/or suppression of harmful organisms

(2) Tools for monitoring

(3) Threshold values as basis for decision-making

(4) Non-chemical methods to be preferred

(5) Target-specificity and minimization of side effects

(6) Reduction of use to necessary levels

(7) Application of anti-resistance strategies

(8) Records, monitoring, documentation and check of success

Evidence of IPM Adoption – IPM continuum

- Stage1 (1-3 criteria practiced) 52%
- Stage 2 (4 practices) 32%
- Stage 3 (5 practises) 16%

What needs to be done for the Alberta Greenhouse Industry?

- We need to promote the use of IPM and stimulate continuous improvement of producers' crop protection practices.
- We need to develop new IPM tools, recommendations, and best-practices guidelines
- We need to train growers in IPM principles and practices. Organized annual IPM training Workshop for Growers on
  - IPM Principles
  - Pest Identification
  - Biological control

Filling IPM knowledge gaps

Greenhouse pest core IPM tools gaps exist at the implementation

- monitoring methods
- economic thresholds
- reduced-risk bio-rational pesticides

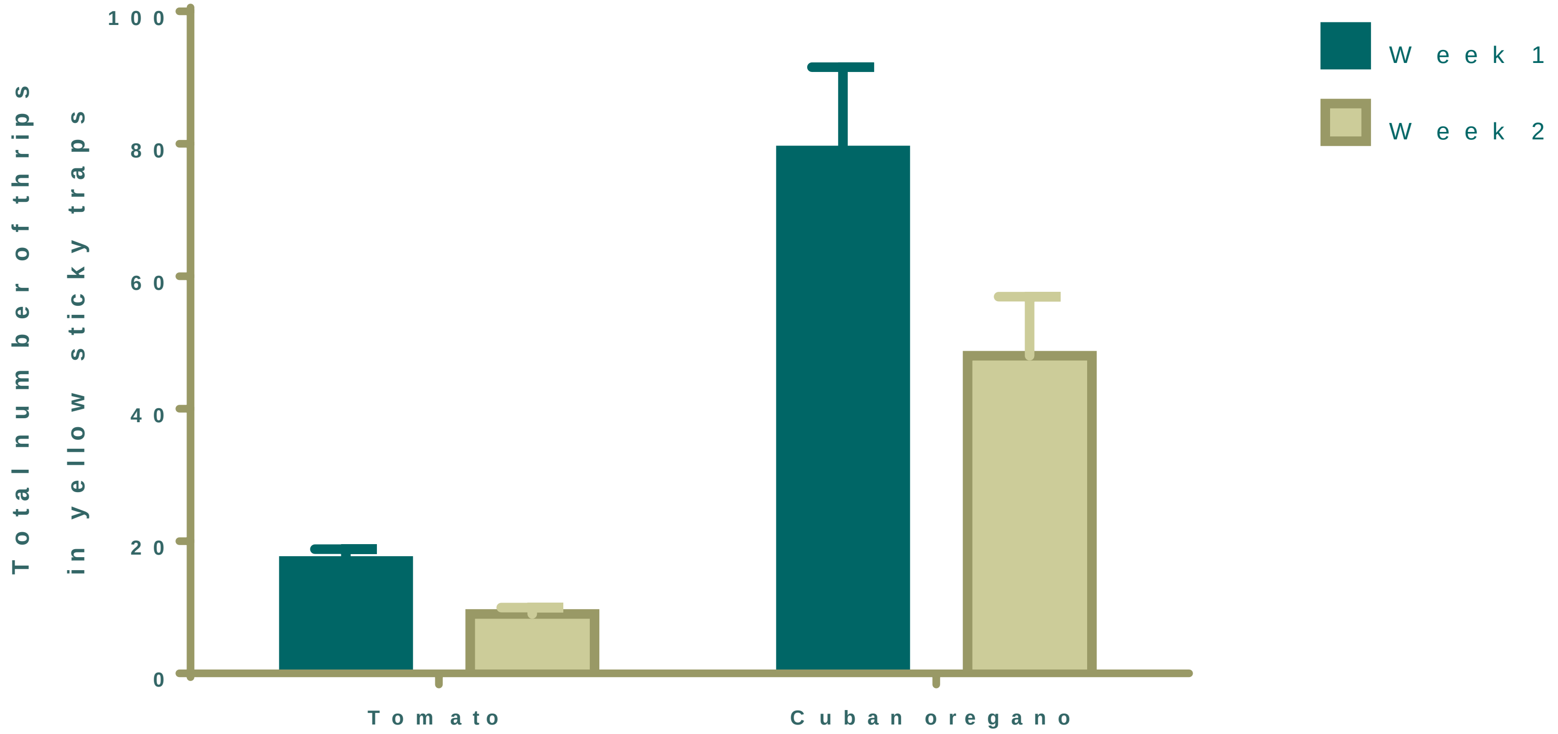
Design improved traps for controlling thrips

- Push-pull strategies involve the behavioral manipulation
- Lures them toward an attractive source (pull) from where the pests are subsequently removed
- The plant chemistry responsible for control involves release of attractive volatiles from the plants

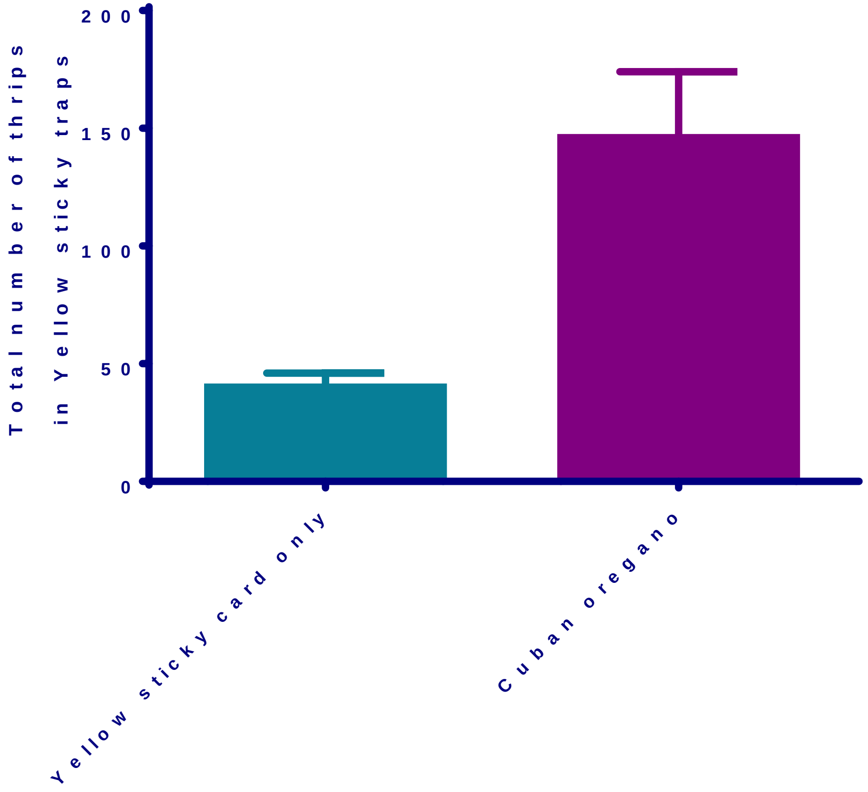
Plectranthus amboinicus (Cuban oregano) Family: Lamiaceae

- Carvacrol (23.0 %), camphor (22.2 %), Δ-3-carene (15.0 %), λ-terpinene (8.4 %), O-cymene (7.7 %) and α-terpinene (4.8 %) the major constituents of the oil.

Cuban oregano improves thrips catches

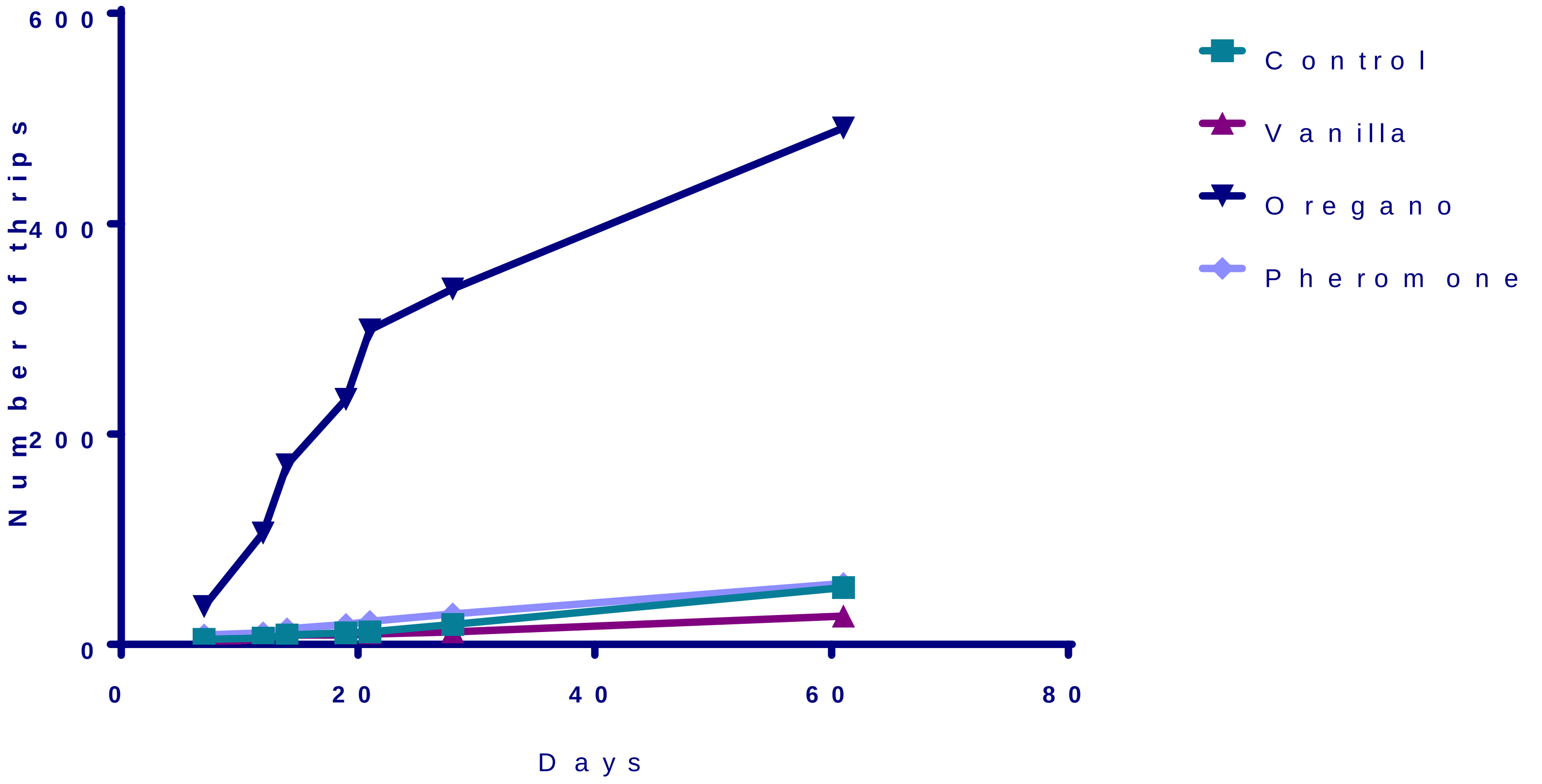


Choice test



Total number of thrips in Yellow sticky traps
200
150
100
50
0
Yellow sticky card only
Cuban oregano

Yellow sticky monitoring using various attractants



Use of Plants in IPM Systems

Eggplant indicator plant for whiteflies in poinsettias. Plants more attractive to pests

Trap plants are similar to indicator plants. Bean trap plant for spider mites

Aggregation plants

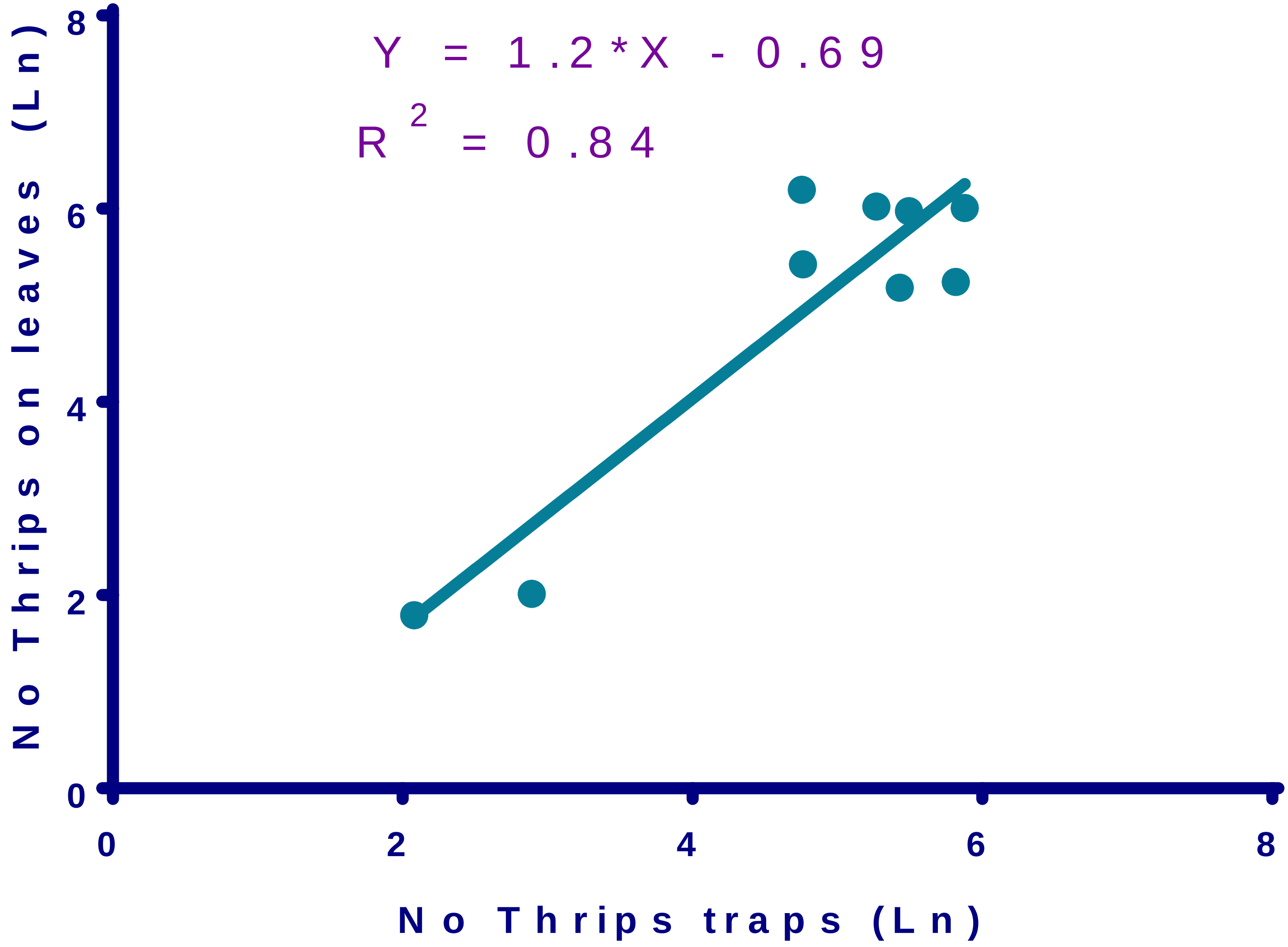
Cuban oregano

Piss-off plant (Plectranthus caninus)

Validation of economic Injury levels

We are involving growers to collect data that will help establish their individual economic threshold

- Pest numbers recorded from sticky card counts and foliar inspections and fruit yield and quality assessment will be used for the calculations.
- We will collect data from vegetable crops, bedding plants and poinsettia greenhouses throughout 2014, 2015, 2016



Y = 1.2*X - 0.69
R 2 = 0.84
No Thrips on leaves (Ln)
No Thrips traps (Ln)
0
2
4
6
8
0
2
4
6
8

Activities: Develop IPM Tools

1. Population management of western flower thrips in cucumber and pepper (e.g. pheromones, plants)
2. Establish economic thresholds western flower thrips in cucumber and pepper
3. Evaluate bio rational insecticides
4. Evaluate Carbon dioxide enrichment as a tool for managing pest
5. Quantify the overall benefits resulting from the adoption of IPM

Knowledge and Technology Transfer

1. Produce an IPM Best Management Practices Manual
2. Train growers in IPM principles and practices

Landmark 20-Year Study Finds Pesticides Linked to Depression In Farmers

By Dan Nosowitz on November 7, 2014