Too Pretty for Biocontrol

How ornamental growers overcame pest management stereotypes

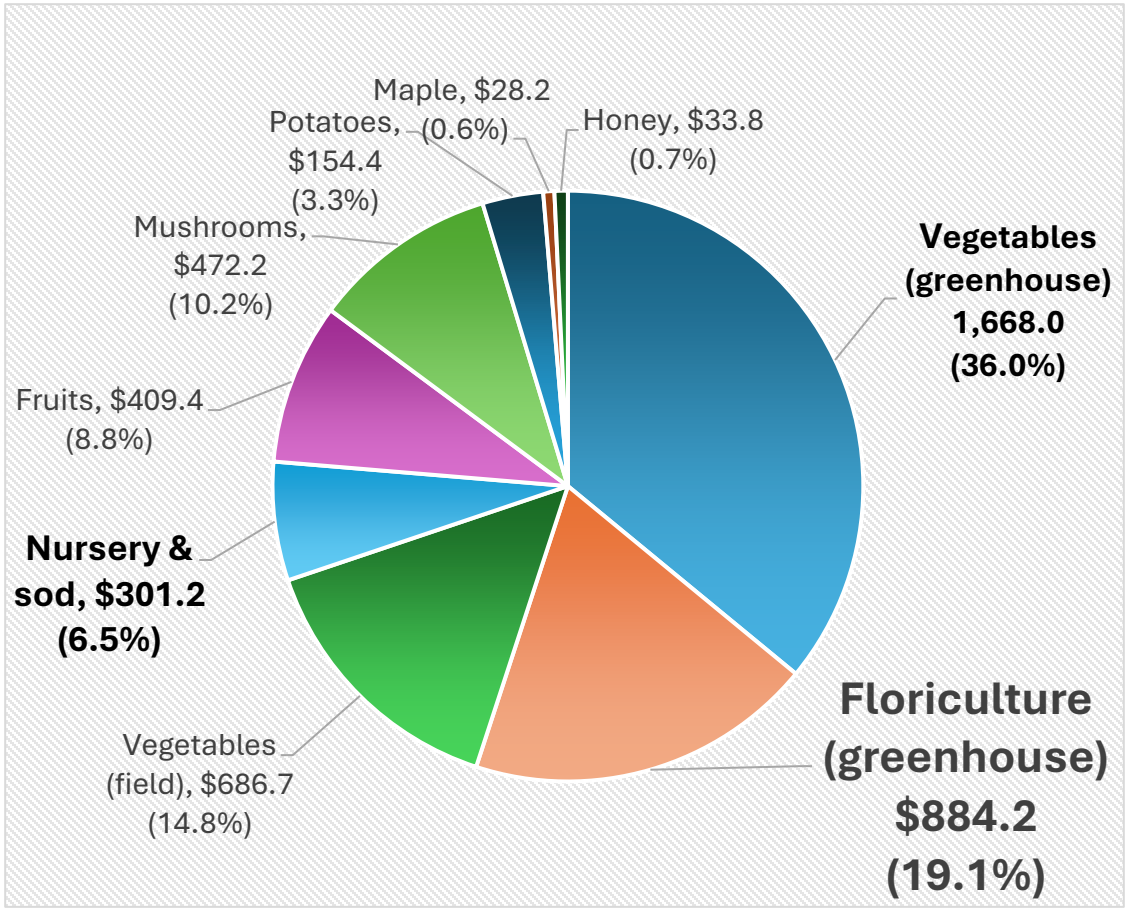
Dr. Sarah Jandricic
Greenhouse Floriculture IPM Specialist, OMAFA
OPMC/ESO 2025

Horticulture crops?

Intensive, high-value crops

Ontario

Ontario Horticulture, 2023 ($million)



- Non-edible horticulture accounts 26 per cent of the total

3 *Source: Ontario farm cash receipts - Dataset - Ontario Data*

The Curse of Being **Valued for Your Looks**

- Would you buy this…

Or this…

Pest Control in Flowers – Historically, Not Very Pretty (60s-80s)

Low tolerance for aesthetic damage means:

- Calendar sprays once the norm
- Limited monitoring to inform sprays
- Limited mass trapping

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Graeme Murphy, OMAFA

Bruce Broadbent, AAFC

Cynthia Scott-Dupree, UofG

Emerging Issue Identified

Limited knowledge of IPM tactics or biocontrol; resistance developing in key pests (spider mite, whitefly)

Iterative Research & Development – OMAFA/AAFC
- modelled off of GH veg

Product development – AAFC & Industry; handful of Products developed for GH veg

Knowledge Translation & Transfer - OMAFA

1980 1990 2000 2010 2019

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Emerging Issue Identified

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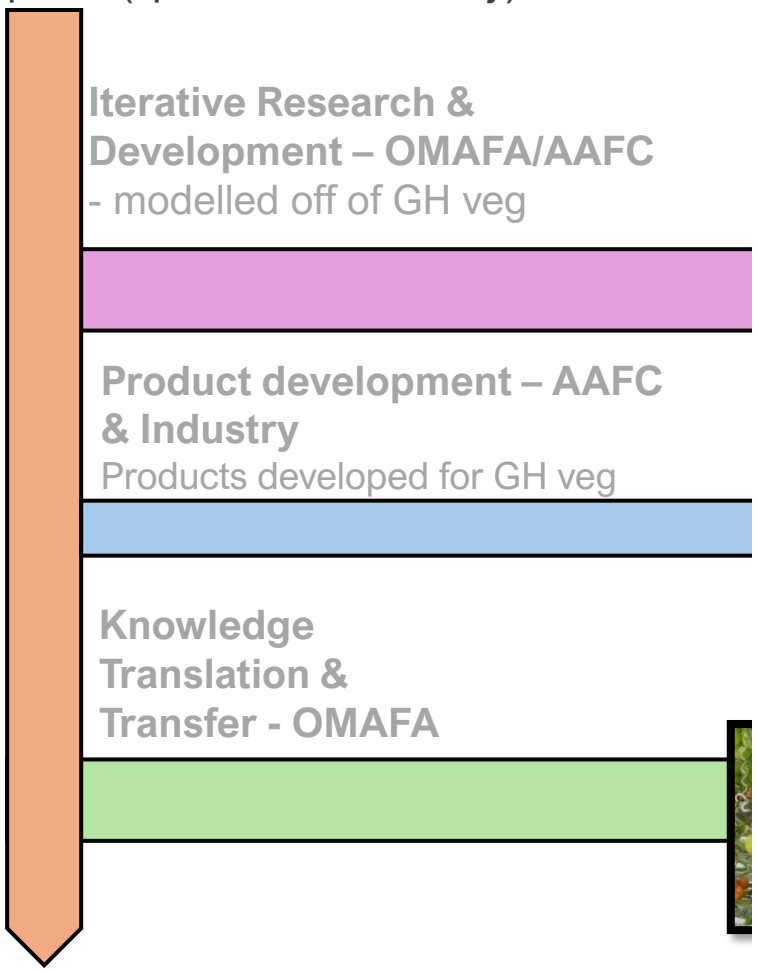

Work focused on pests that were:

- Easy to monitor
- Had existing biocontrol agents
- Contained to specific crops or areas

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Too Pretty for Biocontrol?

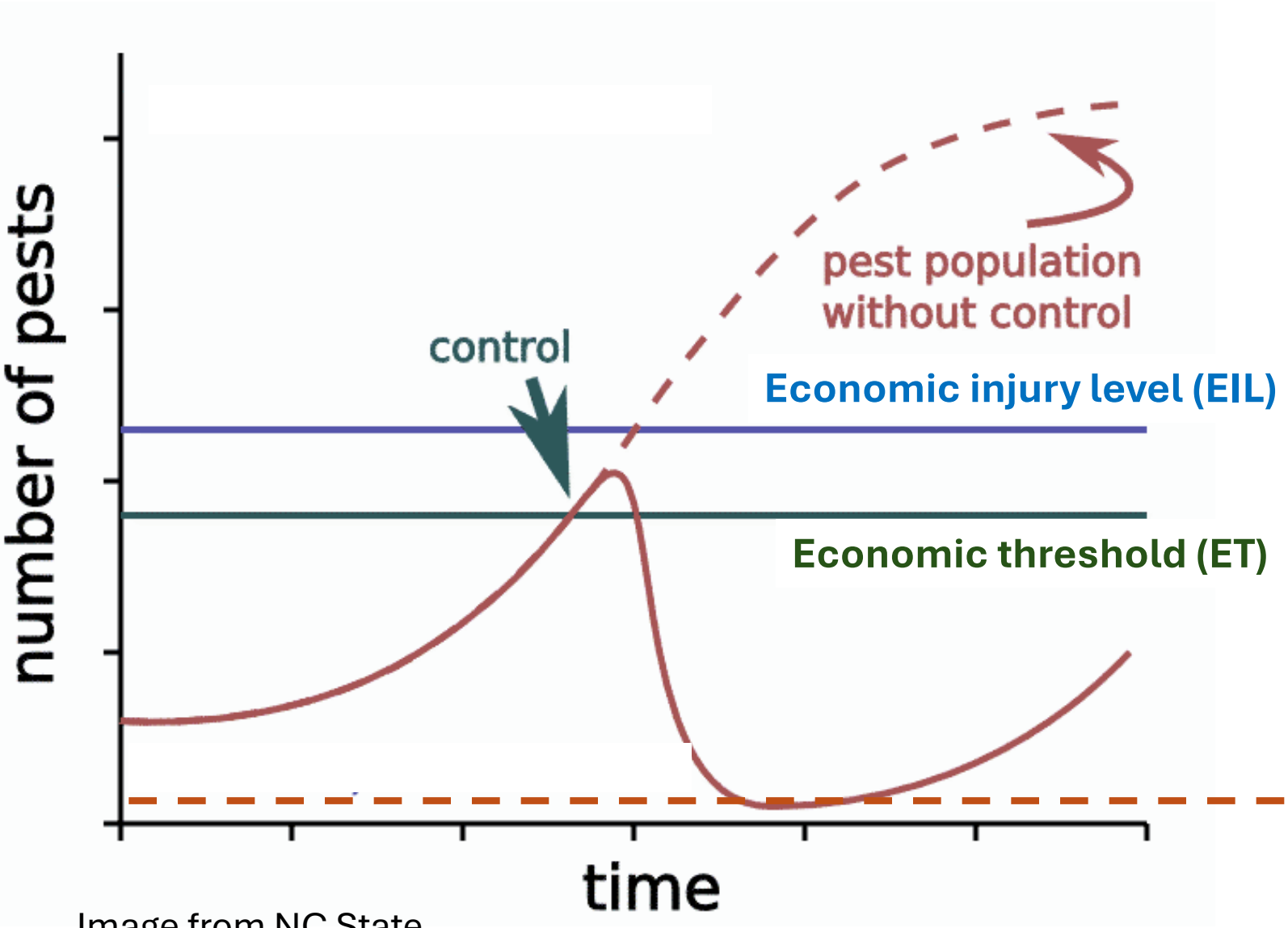

Image from NC State

Barriers to Biocontrol Adoption :

- **Doesn't work as well as pesticides**
- **Too expensive**
- More Work
- Too complicated

ET in flowers effectively 0

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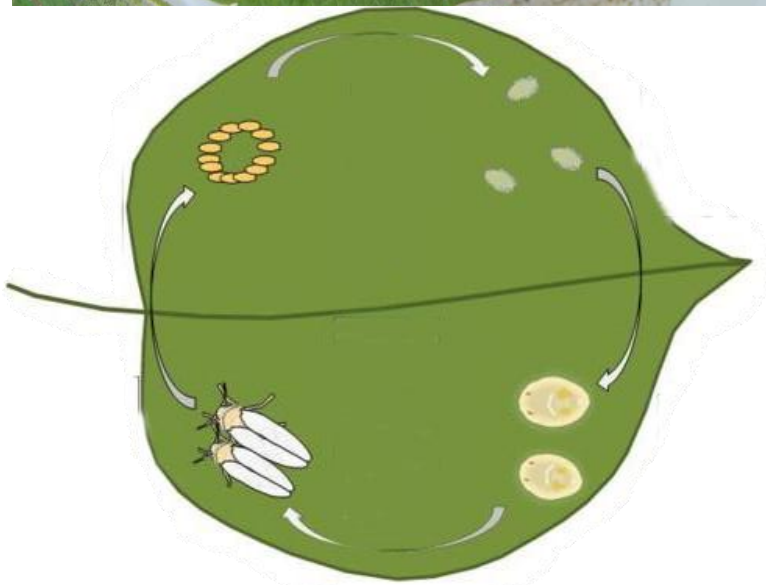
Example: *Bemisia tabaci* (whitefly) on Poinsettia



The problem:

- Very visible insects
- Produce honeydew
  - Promotes mold
- Bemisia are resistant to most pesticides

What makes them good biocontrol targets:

- Easy to monitor
- One infestation source (cuttings)
  - Can't overwinter outside
- ONLY attack Poinsettia (seasonal crop)

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Diagram adapted from Jen White, University of Kentucky College of Agriculture

Translating biocontrol from GH Veg to GH Floriculture:

Pest: Greenhouse whitefly – *Trialeurodes vaporariorum*
Biocontrols: *Encarsia Formosa, Eretmocerus eremicus*

Considerations:

Species

Thresholds

Rates

Application

Role of pesticides

Pest: Bemisia whitefly – *Bemisia tabaci*

Challenging Assumptions: **Bios aren't as good as pesticides**

raeme Murphy, OMAFRA Specialist
989-2014)

Sometimes they AREN'T, but they don't NEED TO BE

- It's the threshold of ZERO that's the stereotype we needed to change
  - If < **20%** of the crop is infested, it's SALEABLE
  - Based on years of research with growers
  - Easy to determine with presence-absence sampling

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Ontario *Bemisia* IPM Program

Biocontrol is a tool to help reduce chance of pesticide resistance!

SCOUT

Initiate **Biological Control**

DELAYED clean-up with pesticides IF plants are over 20% infested

Stick cuttings | potting | pinch | space | bract initiation | Sale begins

July | Aug | Sept | Oct | Nov | Dec

Planning: source, varieties, program tweaks

Post mortem

Rates: Poinsettia – 8 wasps/m²/wk

Rates: Tomato: 1.5 wasps/m²/wk

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Bios aren't as good as pesticide – or ARE they??

Survey of > 350 poinsettia plants, T.X. retailers:

Year	Retailer	Avg. Immatures	Avg. Adults	Median rating (out of 10)
2016	Big Box	4 ± 1	0.2	8
	Grocery Florist	36 ± 4	0.8	7
	Garden Centre	16 ± 6	2.5	8
	Florist	9 ± 4	0.8	10
2018	Big Box	25 ± 3	1.2	10
	Grocery Florist	34 ± 9	2.8	9
	Garden Centre	41 ± 22	9	9
	Florist	73 ± 22	6	10

Reproduced from Vafaie et al. 2020: HortTech, Volume 30: Issue 4

- **U.S. growers still spray for Bemisia whitefly**
  - Have more pesticides available
  - 10 y behind us in biocontrol
- STILL found 35-100% of plants to be infested
- 4-40 WF nymphs per 6-inch plant seems acceptable

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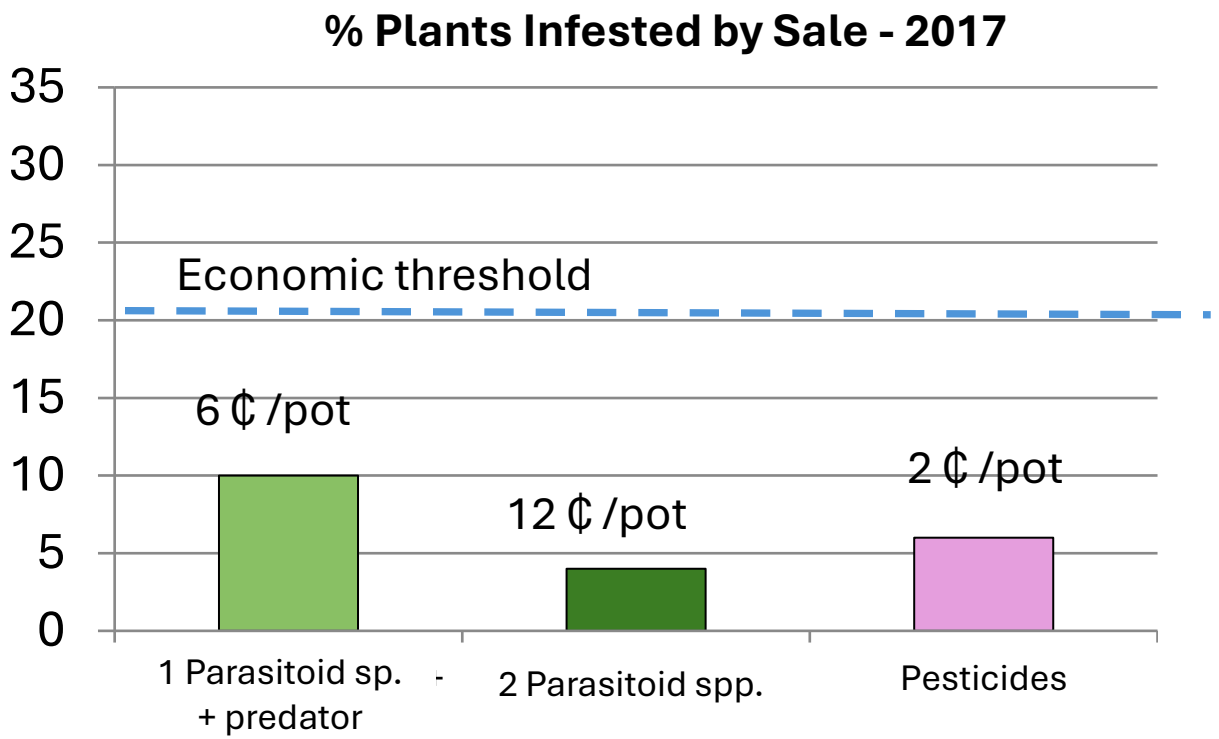
Challenging assumptions: Biocontrol is too expensive

- Let's compare programs for both EFFICACY and COST



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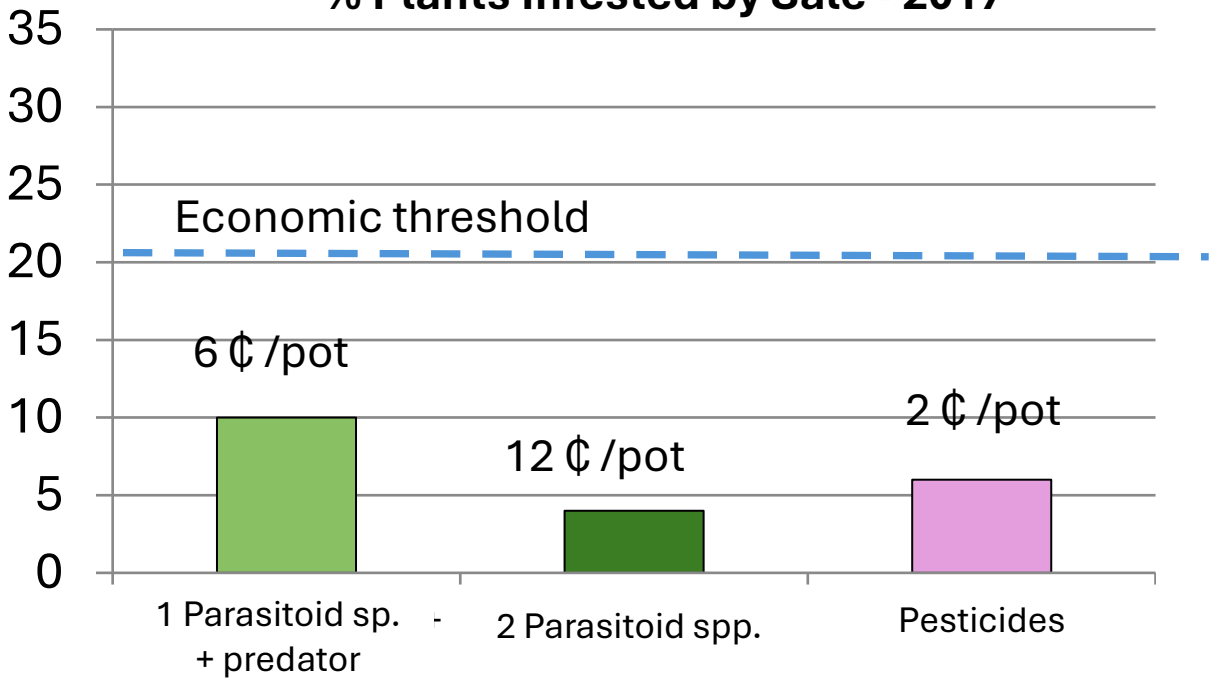

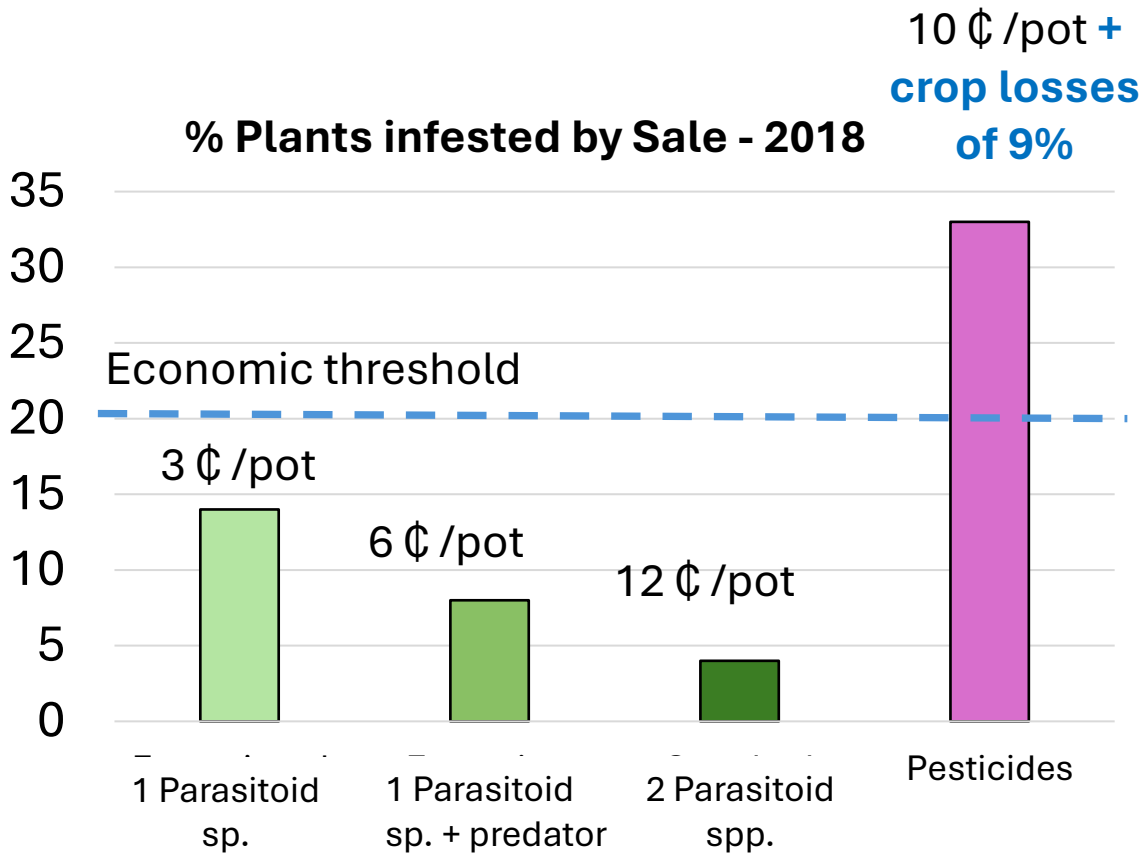

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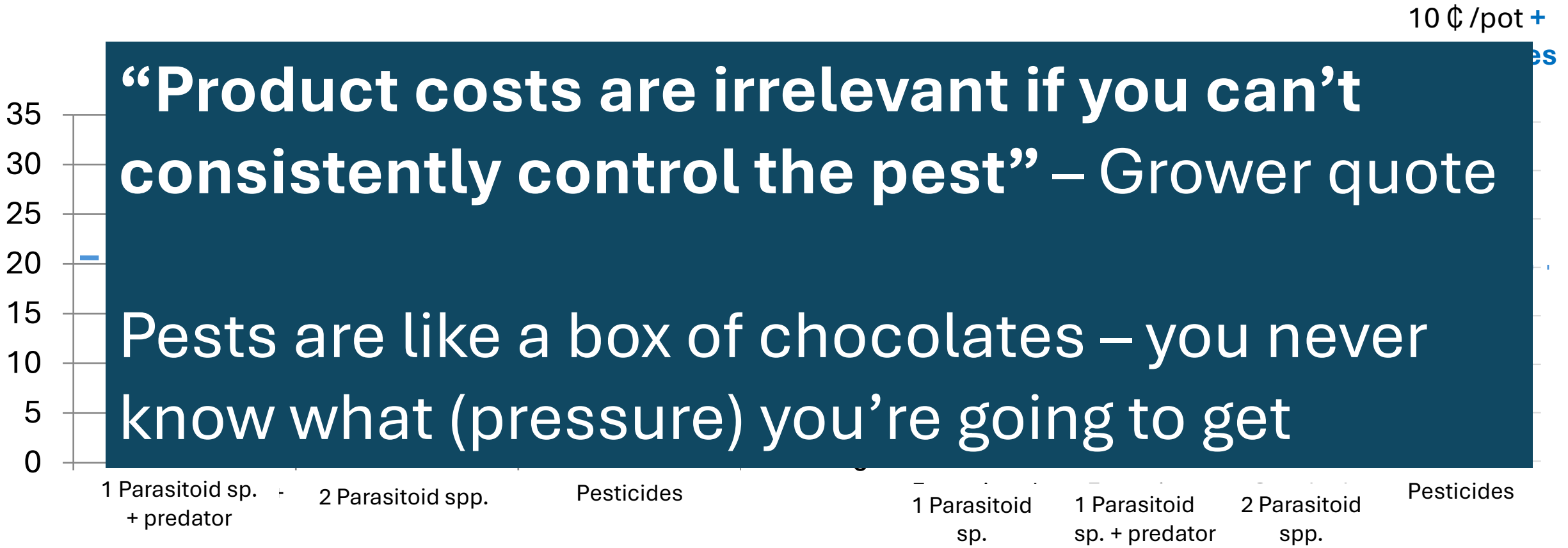
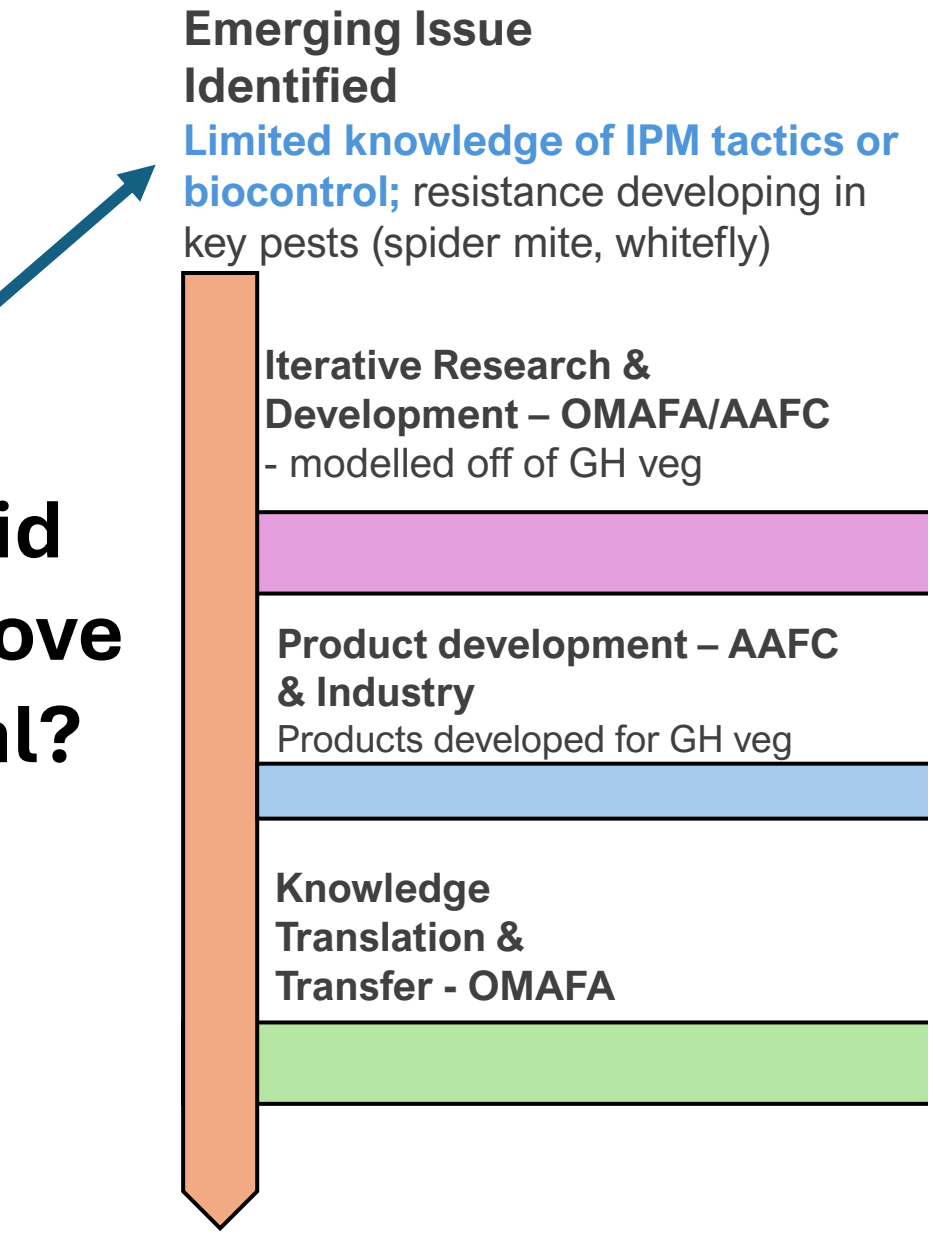


“Product costs are irrelevant if you can’t consistently control the pest” – Grower quote

Pests are like a box of chocolates – you never know what (pressure) you’re going to get

How did this move the dial?



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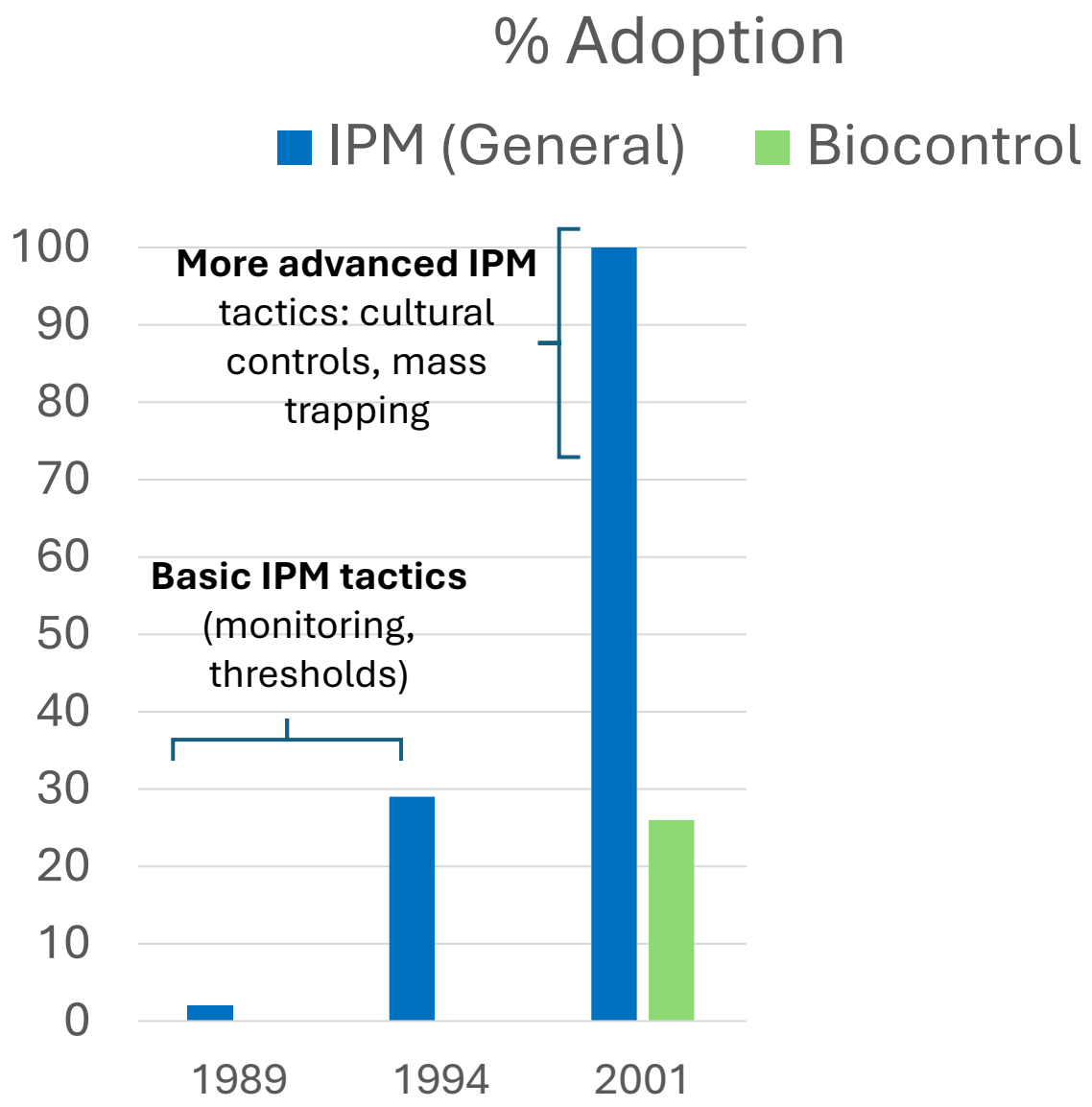
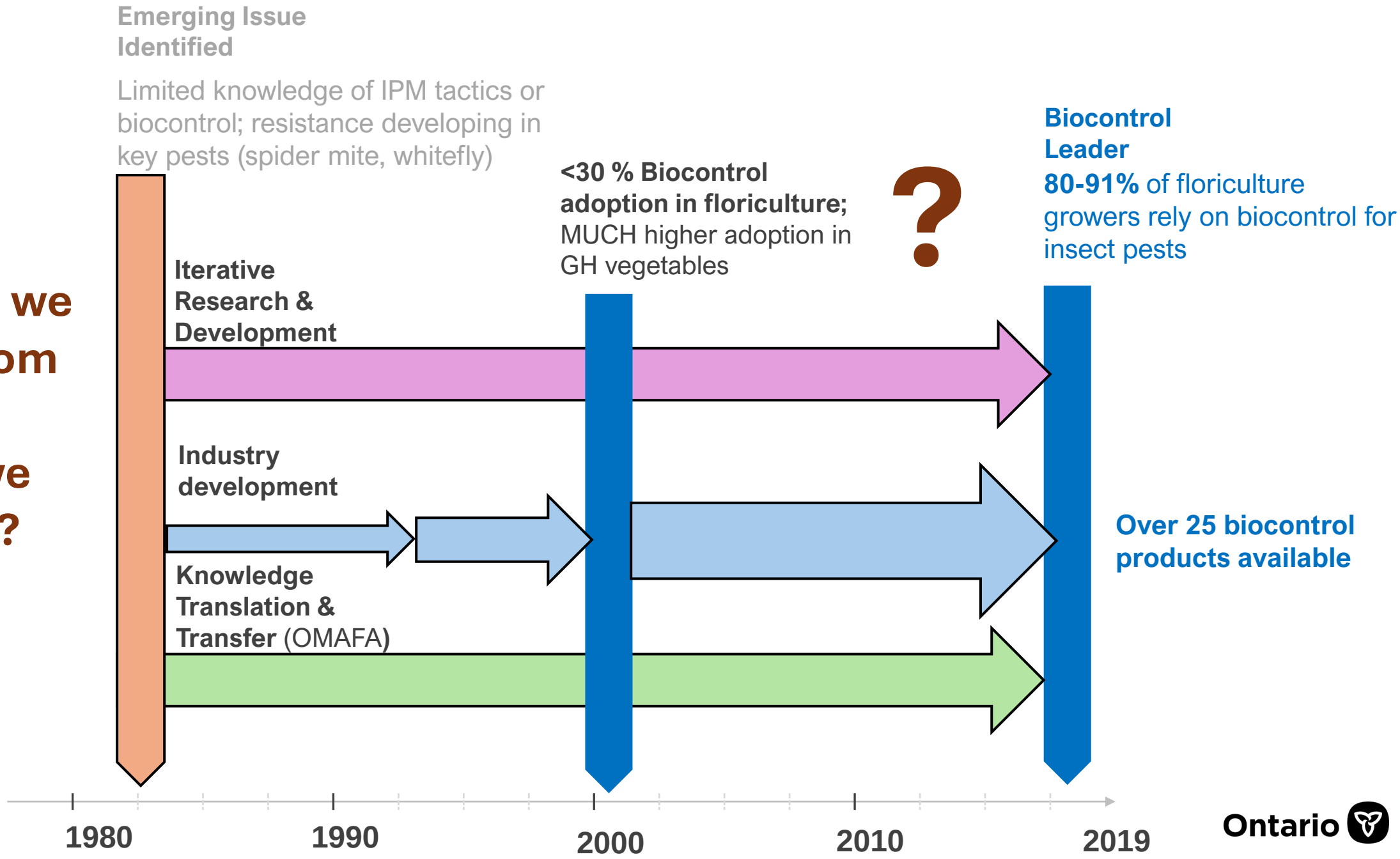
Adoption Rates of Biocontrol (Greenhouse Floriculture):



How did we get to from here to where we are now?



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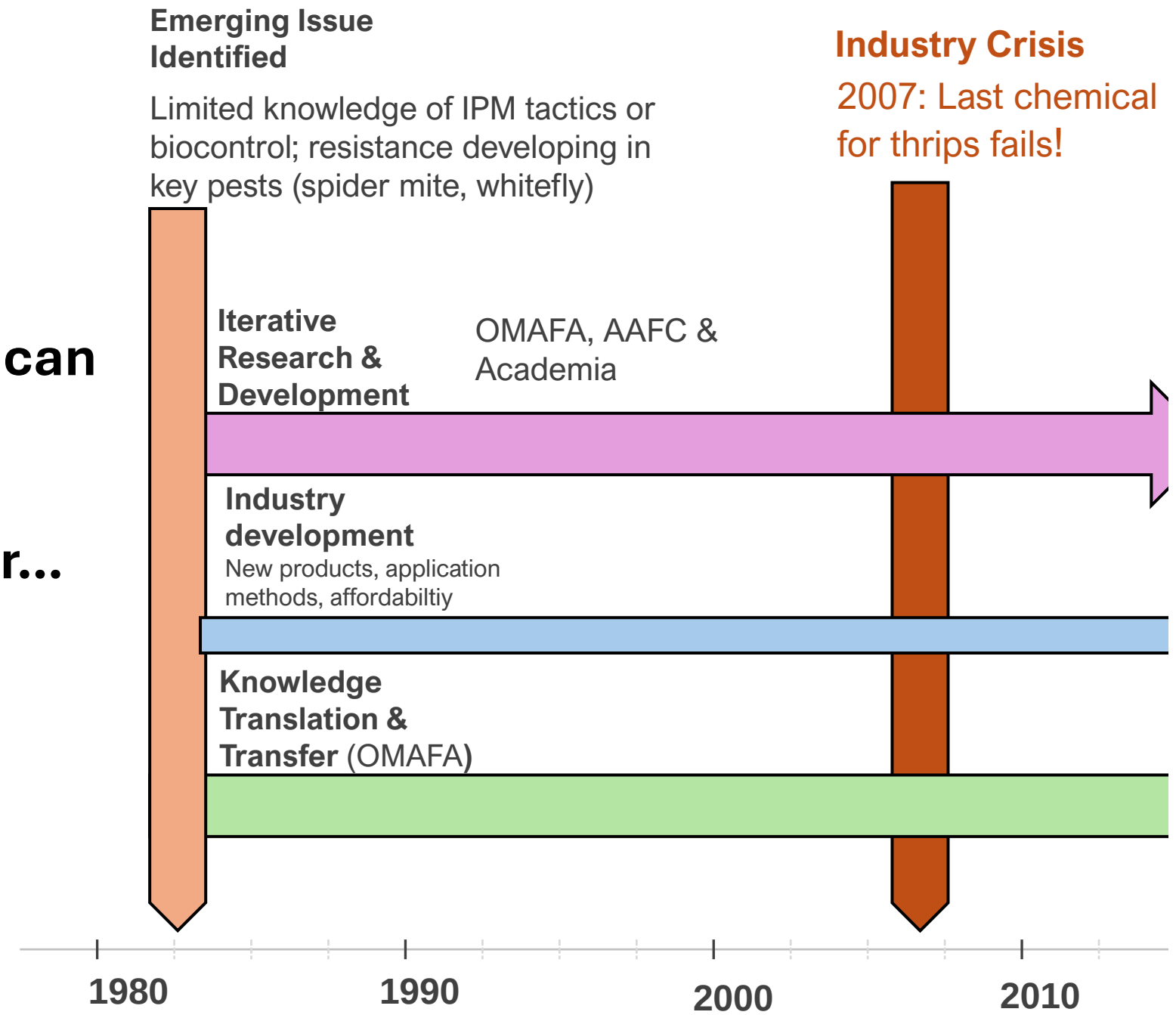
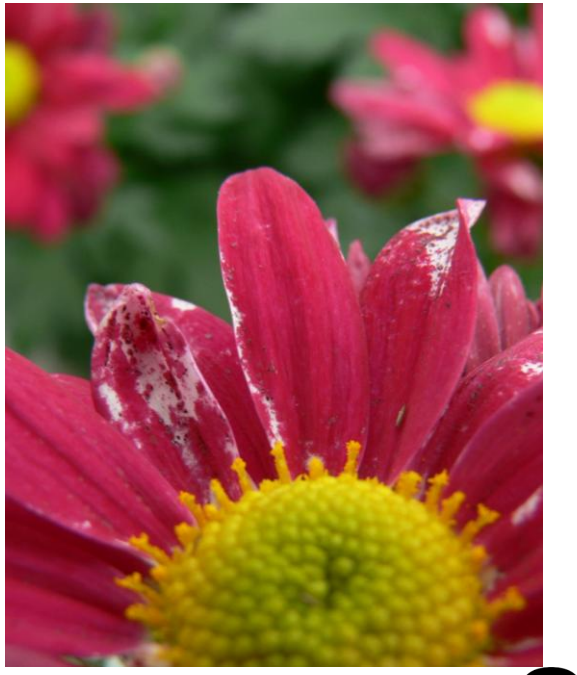
A crisis can bring people together…



Western flower thrips



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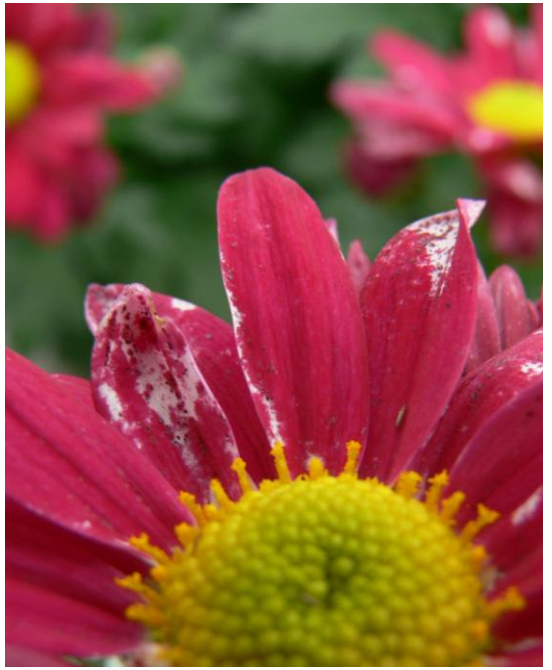
Thrips as the new “big bad”

Western flower thrips

Western flower thrips (*Frankliniella occidentalis*)

- **Resistant** to all major chemical classes available in Canada
- **Hard to target**
  - Life stages on foliage (adults, larvae), embedded in leaf tissue (eggs) and hidden in soil (pupae)
- **WIDE crop range**
  - Attacks most of the major potted and cut flower crops in Ontario
- Arrives on imported cuttings and other plant material
  - Already pesticide resistant
  - **Suspected to be able to overwinter in Ontario sometime in early 2000s**



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Thrips Control Then and Now

1990s+: "Kitchen Sink"

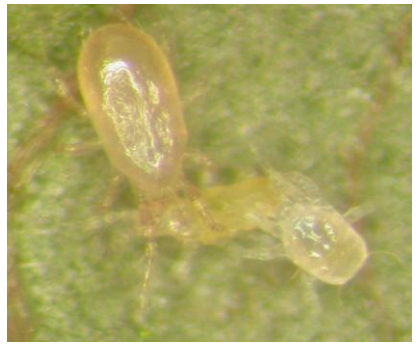
Physical controls:
- Mass trapping
- Exclusion screening

Predatory Mites
- *Strateiolaelaps scimitus (soil)*
- *Amblyseius swirskii (foliage)*
- *Neoseilus sucumeris (foliage)*

Pathogens
- *Beauveria bassiana (foliage)*
- *Metarhizium brunneum (soil/foliage)*
- Nematodes (soil)

"Big Bios"
- *Dalotia coriaria (soil)*
- *Orius insidiosus (foliage)*

2018: "Boiled Down"



Foliar Predatory mites
(Family: Phytoseiidae)

Entomopathogenic fungi:
Beauveria, Metarhizium

Entomopathogenic nematodes:
Steinernema feltiae, S. carpocapsae

How to Start a Biocontrol Program for Thrips

- **Starr with natural enemies in propagation**
  - Smaller area, tight together
  - Can treat with **bulk product** (lower cost) by **broadcast** (lower labour)
- **Then built trust/capacity in production**

VS

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Challenging assumptions: Biocontrol is More Work

- Eased by development of biocontrol products specialized for greenhouse:
  - Applied easily, OR; Release over time

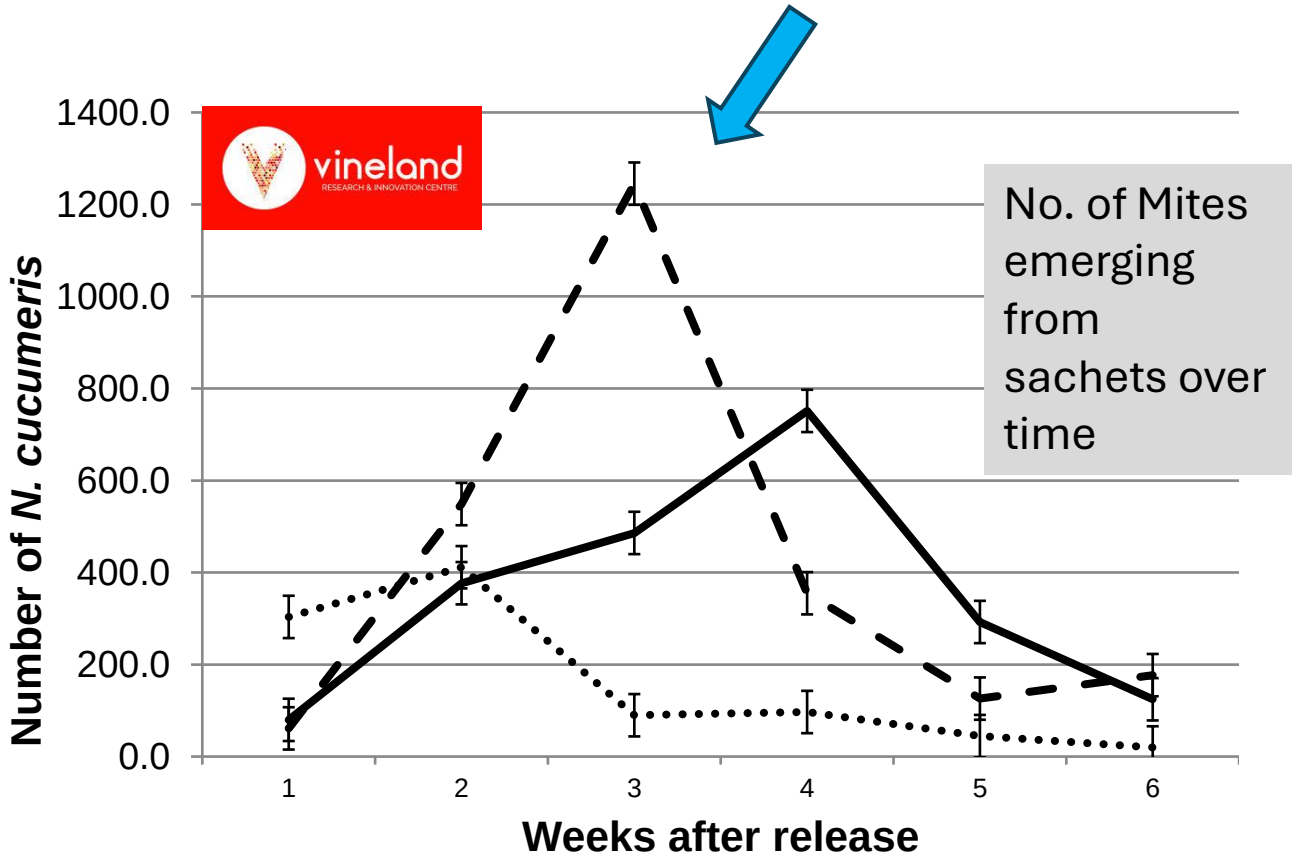
Slow release mite sachets

Parasitoid pupae on hanging cards

Product Innovation for Greenhouses: Breeding Sachets for Predatory Mites

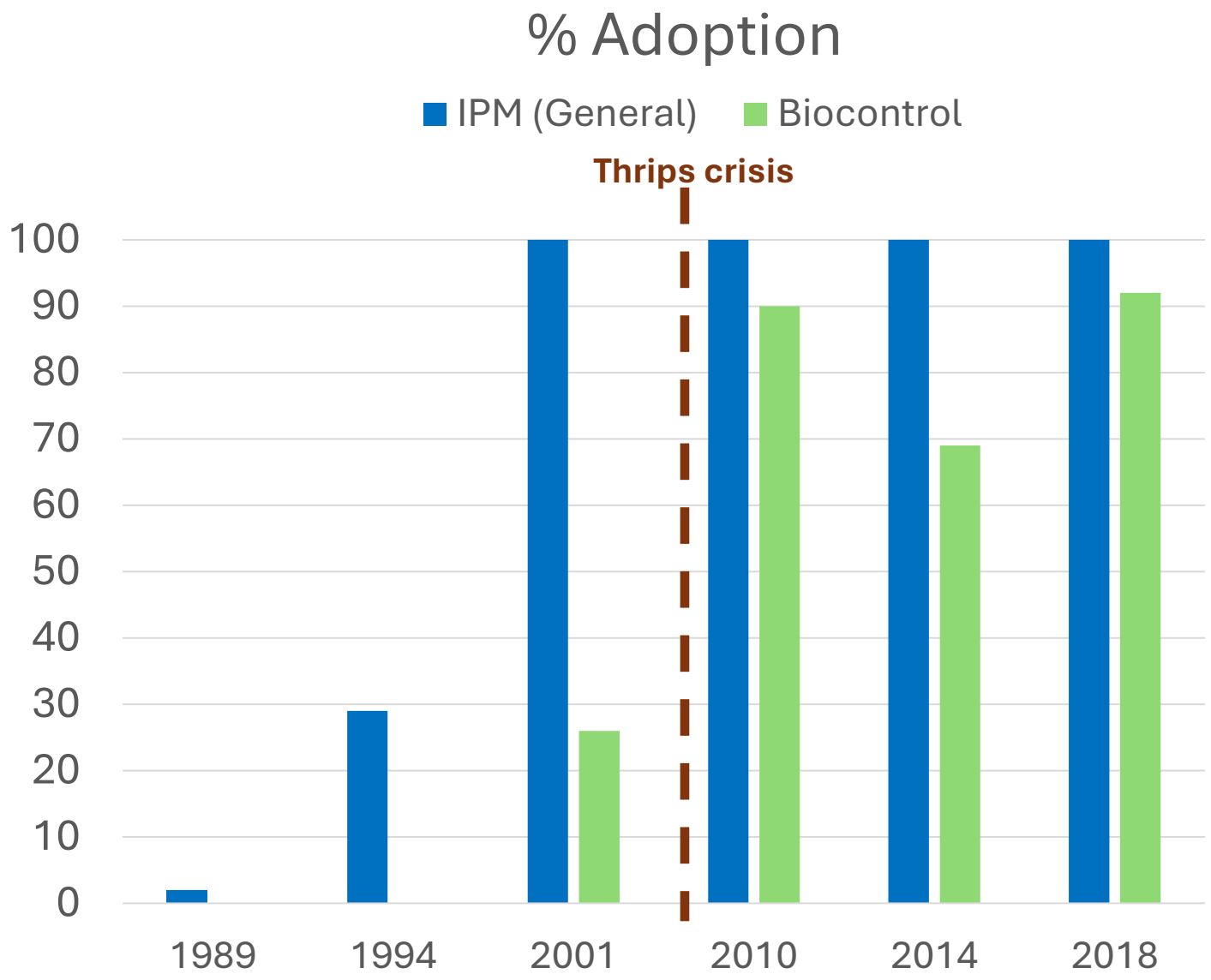
- No product is lost between pots after spacing
- Loads mites <u>where</u> you need them (plants!)

- Provide a steady source of mites; work over time (decreased labor)



Necessity is the mother of invention...or adoption

Switch to biocontrol of thrips = **biocontrol needed for other greenhouse pests**



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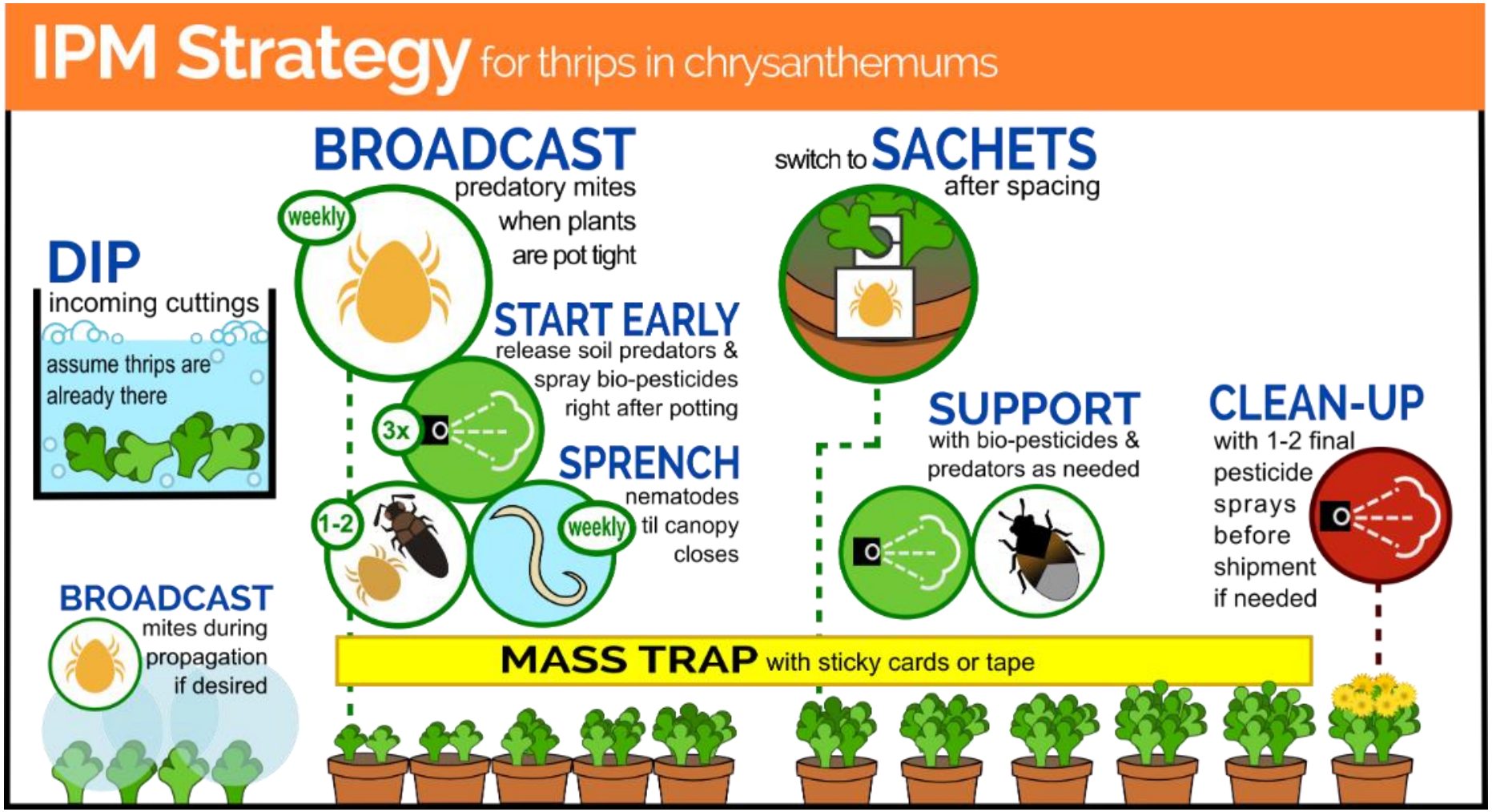
We’re done now, right???



vineland RESEARCH & INNOVATION CENTRE

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Biocontrol Failures for Thrips - 2014

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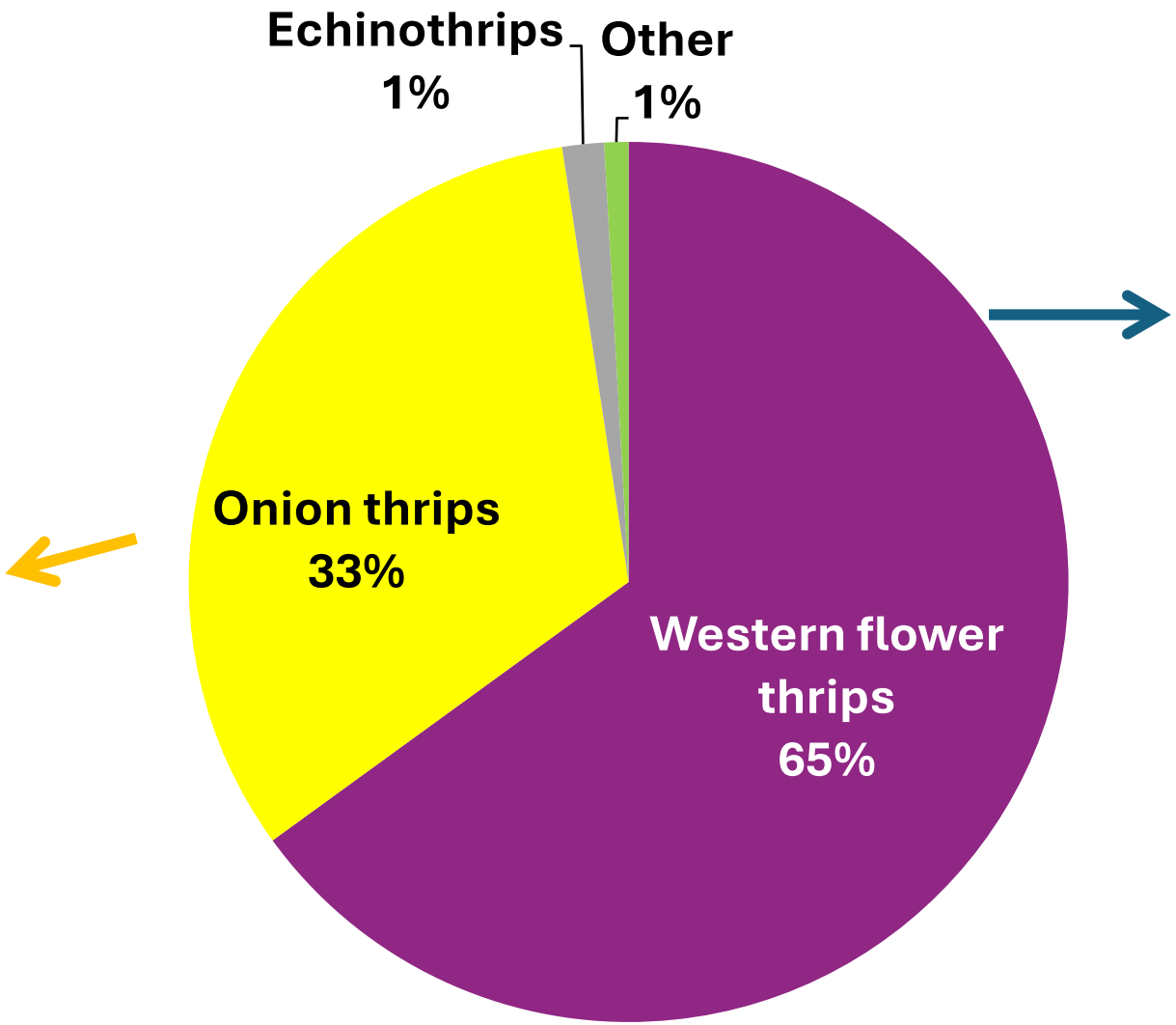
2016 Survey of Thrips Species in ON Flower GHs

Onion thrips (*Thrips tabaci*)



Percent of Thrips Species Found

WFT

2019+ Increasing non-native thrips in ornamentals

- Potential Reasons for Increase
  - **Increased global trade**
  - **Recent tropical foliage boom**
  - Climate change expanding ranges
  - Deregistration of harder pesticides
  - Increased surveillance

Thrips parvispinus

Thrips recorded on Ontario ornamentals

- *Bagnalliella yuccae*
- *Chaetanaphothirps orchidii*
- *Dichromothrips corbettti*
- *Frankliniella bispinosa*
- *Frankliniella schultzei*
- *Gynaikothrips yuccae*
- *Hercinothrips femoralis*
- *Heliothrips haemorrhoidalis*
- *Scirtothrips dorsalis*
- *Thrips palmi*
- *Thrips parvispinus*
- *Thrips setosus*

Emerging Issue Identified

Industry Crisis
Last chemical for thrips fails!

Industry Crisis
Thrips parvipsinus doesn't respond to typical biocontrol programs

Iterative Research & Development

Industry Product Development

Knowledge Translation & Transfer

90% biocontrol adoption

1980 1990 2000 2010 2014 2021

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T. parvispinus damage: Foliage

- Heavy **feeding scars**
- Targets **new growth**
  - New leaves and buds become brittle
- **New leaves abort**
- **No growth**

Damage on older foliage of Schefflera. Photo by OMAFRA

Damage on new growth of Mandevilla. Photo by OMAFRA.

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Crop Losses: Parvi

- **Crop losses of 60% in first year in Mandevilla** in Ontario (~$3M at one greenhouse)
  - Tried to manage it like Western flower thrips
  - Phytoseiid predatory mites DON'T work (even at 4x rate)
  - **Back to the kitchen sink approach!**

Where we started…

- As you can see, it started off good…
- (we even vacuumed plants)
- Eventually found **effective pesticide rotations**
  - Resistance to some products has developed with over-use
  - Growers WANT biocontrol

One monitoring card was placed in each pot of a heavily infested variety of mandevilla at a commercial operation. Photo by OMAFA.

Ontario

“Big” Bios for Parvispinus – our best option?

Several large bios will prey on Parvispinus:

- Orius insidiosus
- Green lacewing
- Mirids
- Anystis
- Atheta (Dalotia)

But how promising are they?
Cost? Rates?

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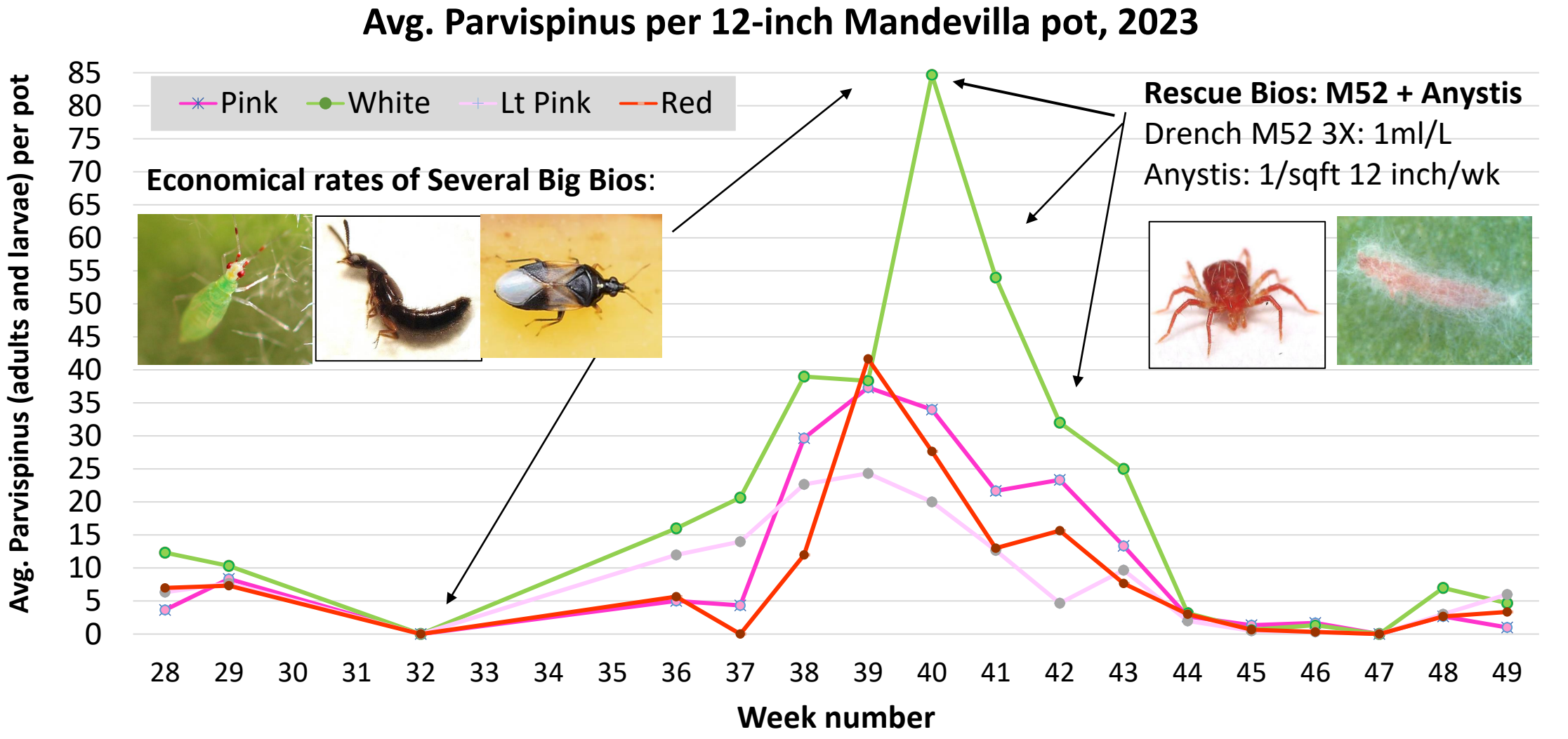
Most Promising Solution: **Fungi + "Big Bio"**



Note: Anystis is more tolerant to microbials than Orius

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Come work with me on Parvispinus!

- In January, google **“Summer Employment Opportunities” Program OMAFA**