Snap Bean Insect Pest Management - ECB management – SCRI Research Update

Wisconsin Crop Management Conference and Agri-Industry Showcase

WCMC

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Outline

- Specialty Crops Research Initiative
- Results of 2012-2014 insecticide delivery trial
- 2014-15 ECB pheromone trap network
- Future directions and new risk assessment tools for ECB

SCRI-Snap bean insect pest management

Project Objectives

Objective 1. Identify consumer preferences and willingness to pay for sustainably produced and processed vegetables and quantify market segments

Objective 2: Create and test sustainability assessment tools and sustainability metrics for commercial vegetable growers

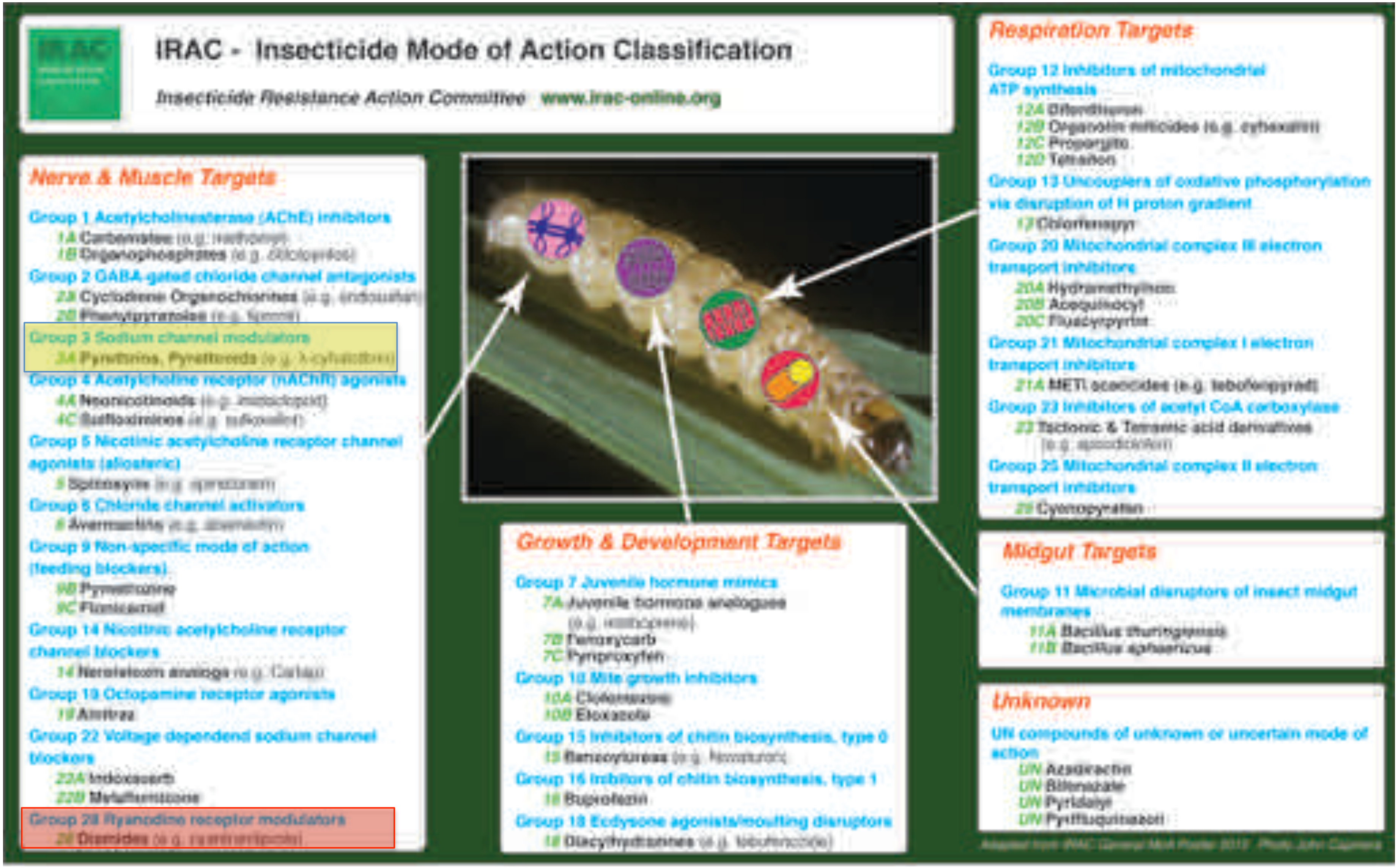
Objective 3: Validate and improve the relationship between practice-based sustainability assessments and environmental and economic outcomes at the farm scale in each region

Implement sustainable practices to identify opportunities for improved water, nitrogen, and pesticide use efficiency at the field and farm level (Bland, Colquhoun, Mitchell, Ruark)

Refine sustainable production practices to reduce environmental and economic risk (Bland, Colquhuon, Hutchison, **Nault, Groves**, Ruark)

Objective 4: Build critical mass of support for sustainably grown and processed vegetables.

Diamides-a new reduced-risk material



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Diamides for pest management

- <u>Mode of action</u>: attacks the ryanodine receptors
- Insect stops feeding, becomes paralyzed and dies (<72h)
- Most effective through ingestion
- Exceptionally long residual control (14-21 days)
- Active against Lepidoptera, Coleoptera and Hemiptera
- Much less toxic to bees than neonics or pyrethroids

<u>Exirel 10SE (*cyazypyr*):</u>

- Anthranillic diamide (MoA group 28)
  - Use rate 13.5 – 20.5 fl. oz / ac (foliar)
  - Control of **Leps, Aphids, and PLH**
  - Application timing critical
  - Label anticipated for bean 2015 (?)

<u>Coragen™ (*rynaxypyr*):</u>

- Anthranillic diamide (MoA group 28)
  - Use rate 3.5 - 5 fl. oz / ac (foliar)
  - Control of **Leps**

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SCRI-IPM project objectives (NY & WI)

1. **Small-plot field trials**
    - Evaluate reduced-risk products (e.g. diamides) for insect control in bean
    - Evaluate earlier application timings of reduced-risk products for ECB and PLH control
    - Evaluate compatibility of diamide insecticides with either fungicides or herbicides for ECB and PLH control

2. **Field-scale implementation trials**
    - Compare effectiveness of a new pest management program using reduced-risk products with the current approach
    - Compare effectiveness of a new sustainable pest, disease and weed control program with the current approach

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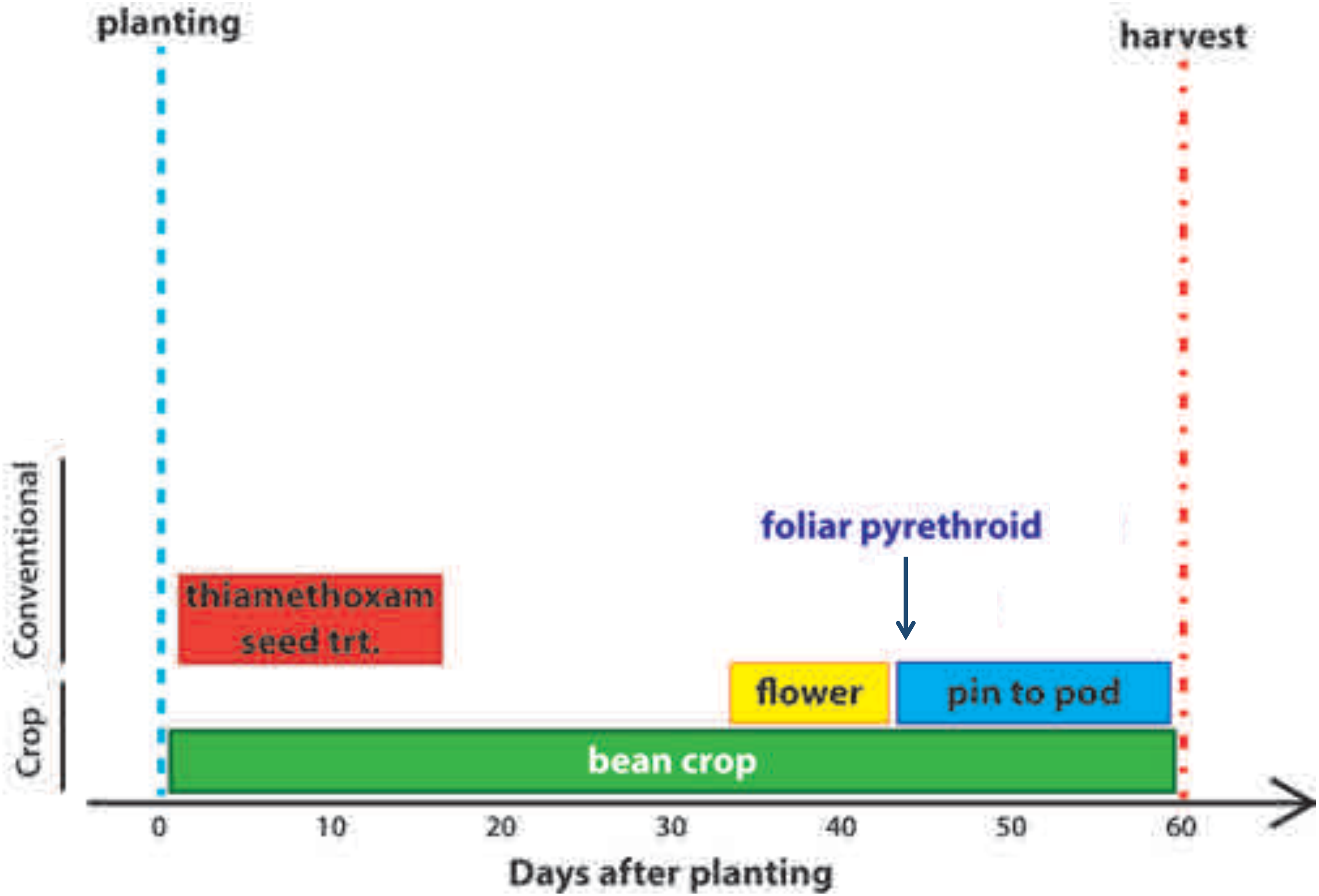
Conventional management program



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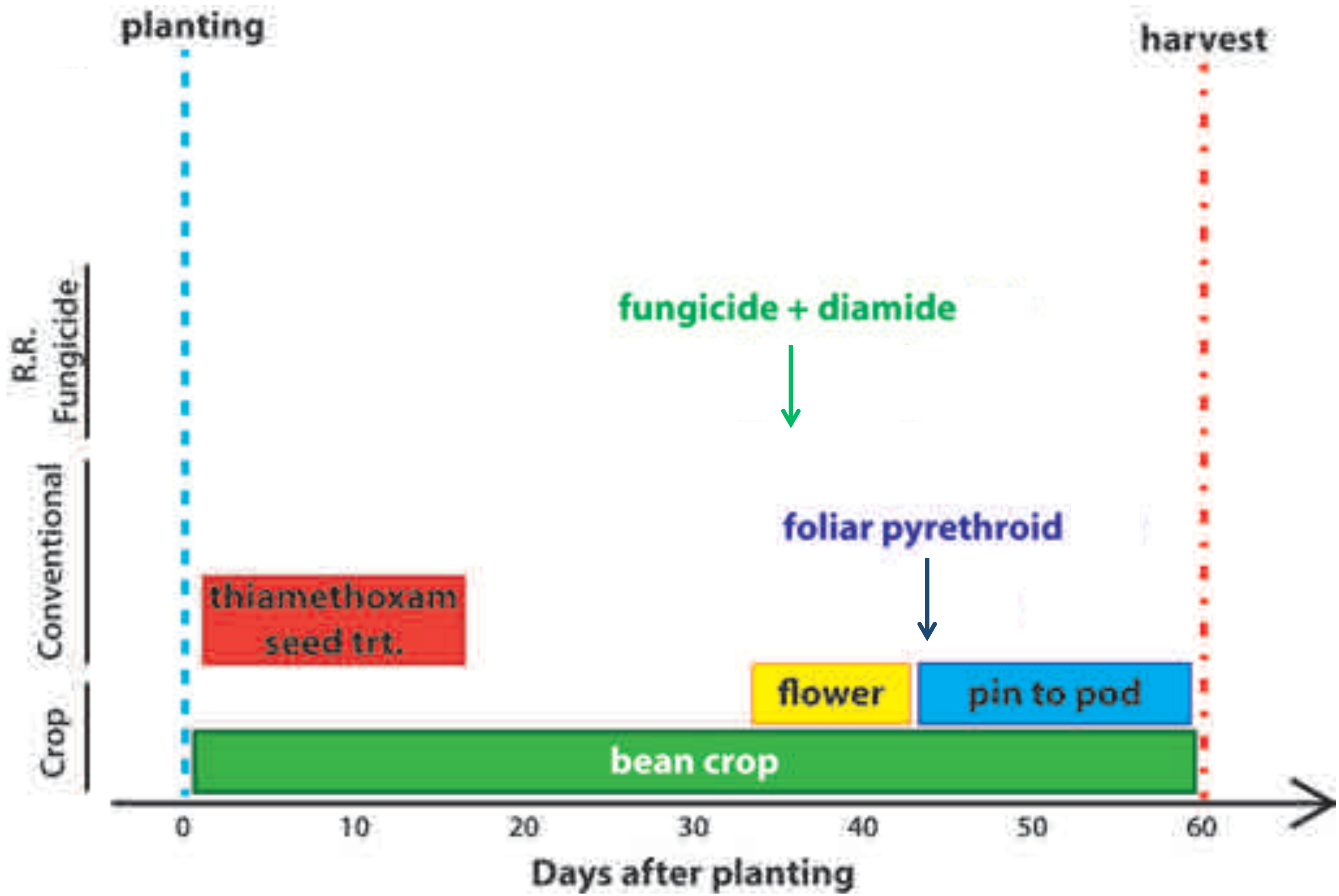
Fungicide & insecticide tank mix



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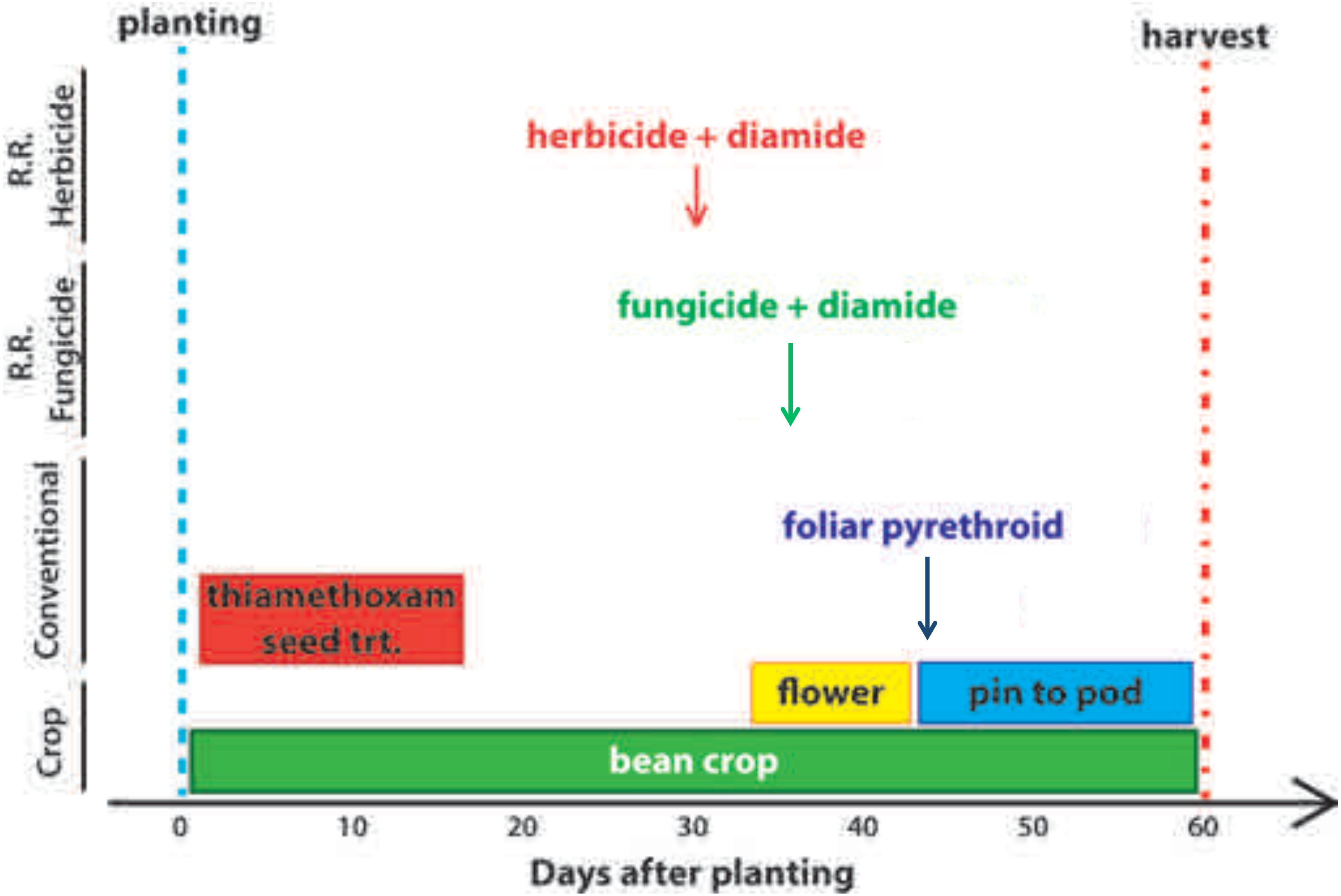
Herbicide & insecticide tank mix



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2012, 2013 & 2014 small plot ECB trial

- RCBD (5 reps *x* 20 trts. + UTC)
- Three treatment windows:
  - pre-bud herbicides
  - early bloom fungicides
  - pin fungicides
- 2 insecticides – Brigade & Exirel 20SE (diamide) (13.5 & 20.5 fl oz./ac ± MSO)
- Herbicides: Reflex (fomesafen) + Basagran (bentazon)
- Fungicides: Topsin (thiophanate-methyl, Bravo (chlorothalonil)
- Infested with ECB neonates (n≈2,500 per plot)
- Planted: May 31, 2012, June 5, 2013 & June 3 2014
- Harvested: August 1, 2012, August 6, 2013 & 5 August 2014.

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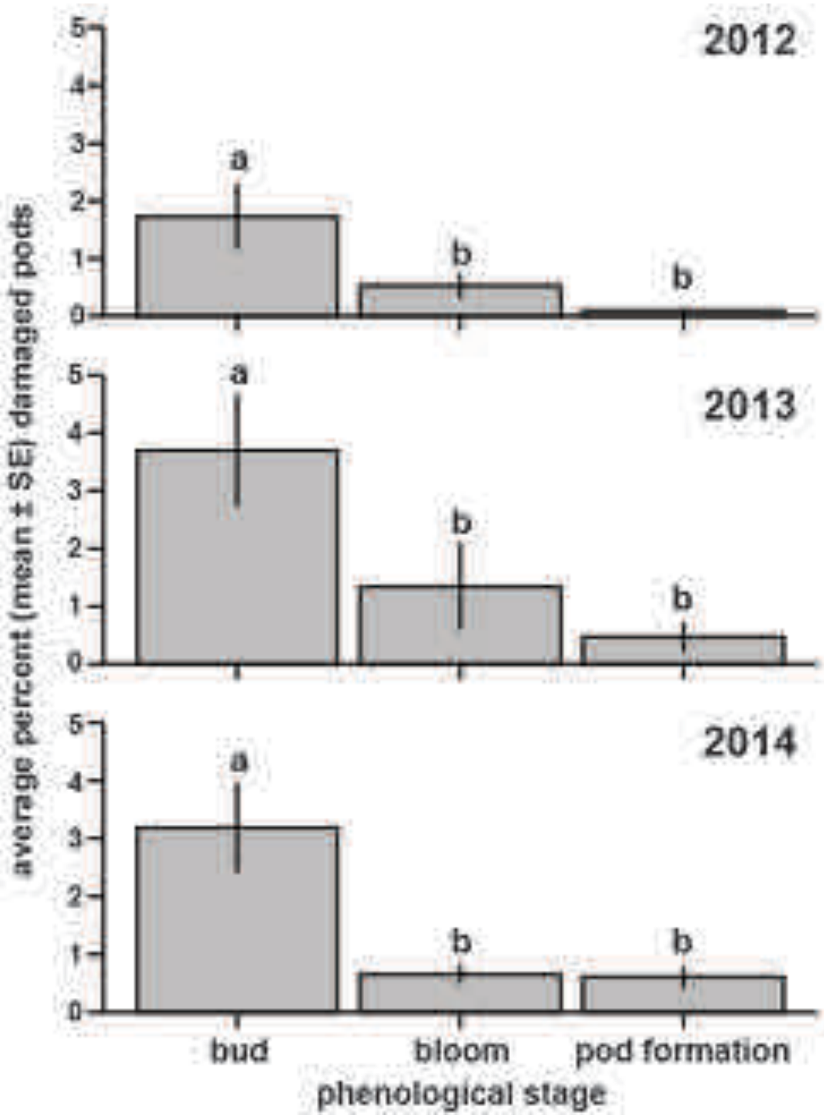
Results – Proportion pods damaged



- Average (mean percentage±SE) *O. nubilalis* snap bean pod damage within each phenological application timing.
- Timing was significant in each year.
- Insecticide treatment main effect was significant in 2012 and 2013, but not 2014.
- Treatment by timing interactions were not significant in either year.

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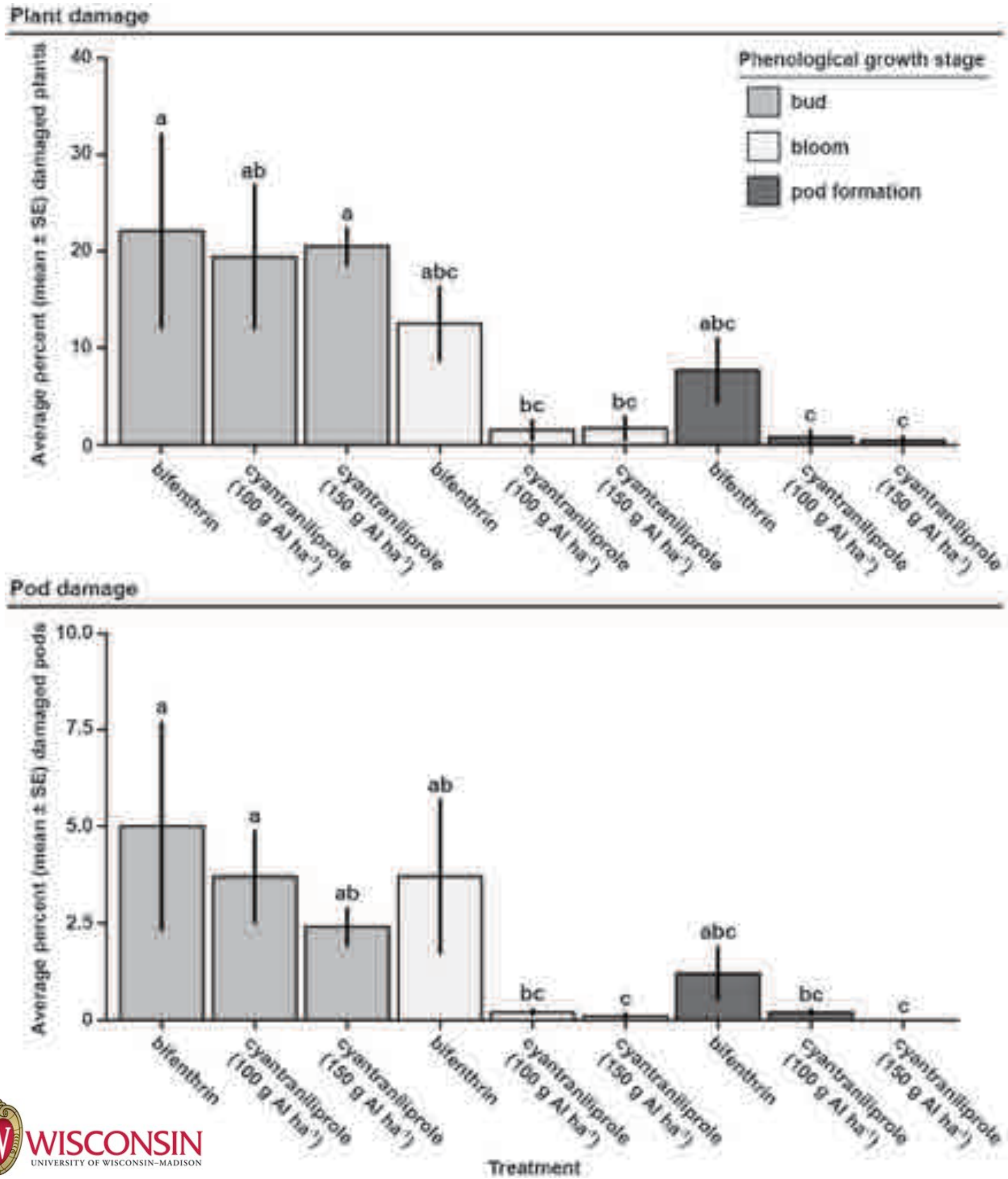
Huseth et al. 2015

Means separation by treatment and timing – NY 2013



Huseth et al. 2015

Means separation by treatment and timing – WI 2013

Phenological stage	Insecticide	Plant damage		Pod damage
untreated	-	18.5±5.2 a		8.7±2.5a
bud	bifenthrin (6.4 fl oz/ac)	9.0±6.4 b		2.6±1.2 bc
	chlorantraniliprole (5.0 fl oz/ac) (aka. rynaxypyr) - Coragen 1.67SC	4.1±3.3 bc		1.9±1.1 bc
	cyantraniliprole (10.2 fl oz/ac) (aka. cyazypyr) – Exirel 10OD	1.0±0.7 c		0.7±0.3 bc
	cyantraniliprole (13.5 fl oz/ac) (aka. cyazypyr) – Exirel 10 OD	0.8±0.5 c		0.6±0.2 c
bloom	bifenthrin (6.4 fl oz/ac)	0.7±0.4 c		1.4±0.4 bc
	chlorantraniliprole (5.0 fl oz/ac) (aka. rynaxypyr) - Coragen 1.67SC	0.0±0.0 c		0.0±0.0 c
	cyantraniliprole (10.2 fl oz/ac) (aka. cyazypyr) – Exirel 10OD	0.1±0.1 c		0.2±0.1 c
	cyantraniliprole (13.5 fl oz/ac) (aka. cyazypyr) – Exirel 10 OD	0.0±0.0 c		0.1±0.1 c
pod formation	bifenthrin (6.4 fl oz/ac)	0.0±0.0 c		0.0±0.0 c
	chlorantraniliprole (5.0 fl oz/ac) (aka. rynaxypyr) - Coragen 1.67SC	0.0±0.0 c		0.3±0.1 c
	cyantraniliprole (10.2 fl oz/ac) (aka. cyazypyr) – Exirel 10OD	0.0±0.0 c		0.0±0.0 c
	cyantraniliprole (13.5 fl oz/ac) (aka. cyazypyr) – Exirel 10 OD	0.0±0.0 c		0.0±0.0 c

Huseth et al. 2015

Summary of Co-application studies – WI and NY

- Diamide insecticides (e.g. Coragen & Exirel) appear to have very good activity against ECB when applied as a foliar.

- Co-application of diamides with fungicides (bloom) had no antagonistic effects and were similar in performance to current foliar recommendations (pod-formation)

- Cyantraniliprole (aka. cyazypyr) was effective against ECB when applied as a in- furrow and as a liquid fertilizer pre-mix applications.

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Huseth et al. 2015

2013 & 2014 field implementation trial

- **8 conventional** fields paired with **8 novel** treatment fields planted between 6/24 & 7/23/2013 and 6/2 & 6/19/2014
- Collaborators: Seneca Foods, Nault, Dillard, & Kikkert
- *cv*. Huntington and Summit
- Livingston, Steuben and Yates counties
- Approximately 198 acres
- Commercial yields and ECB contaminants

Timing	Conventional trt.[a]	Novel trt.[b]	Pests/Diseases
At-plant	Cruiser + fung.	Cruiser + fung.	SCM, PLH, diseases
Early bloom (10-30%)	Topsin + Bifenture	Topsin @ threshold + Coragen	White mold & ECB
Late bloom (100%)	Bravo + Bifenture	Bravo + Coragen	White mold & ECB

[a]pre-emerge (Dual), first trifoliate (Basagran & Reflex)
[b]pre-emerge (none), first trifoliate (Dual, Basagran, Reflex, Select Max)

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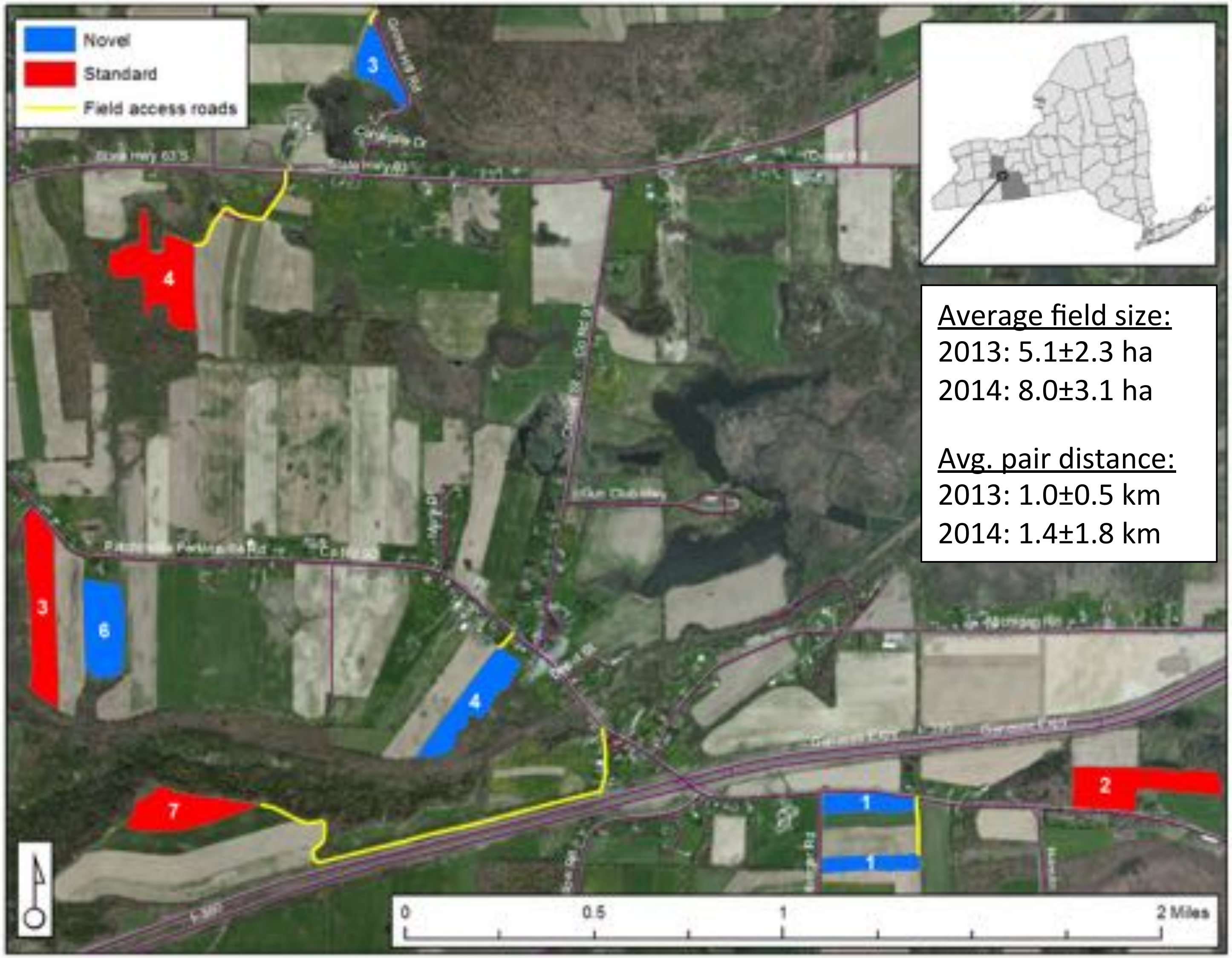
2013 & 2014 paired field treatments

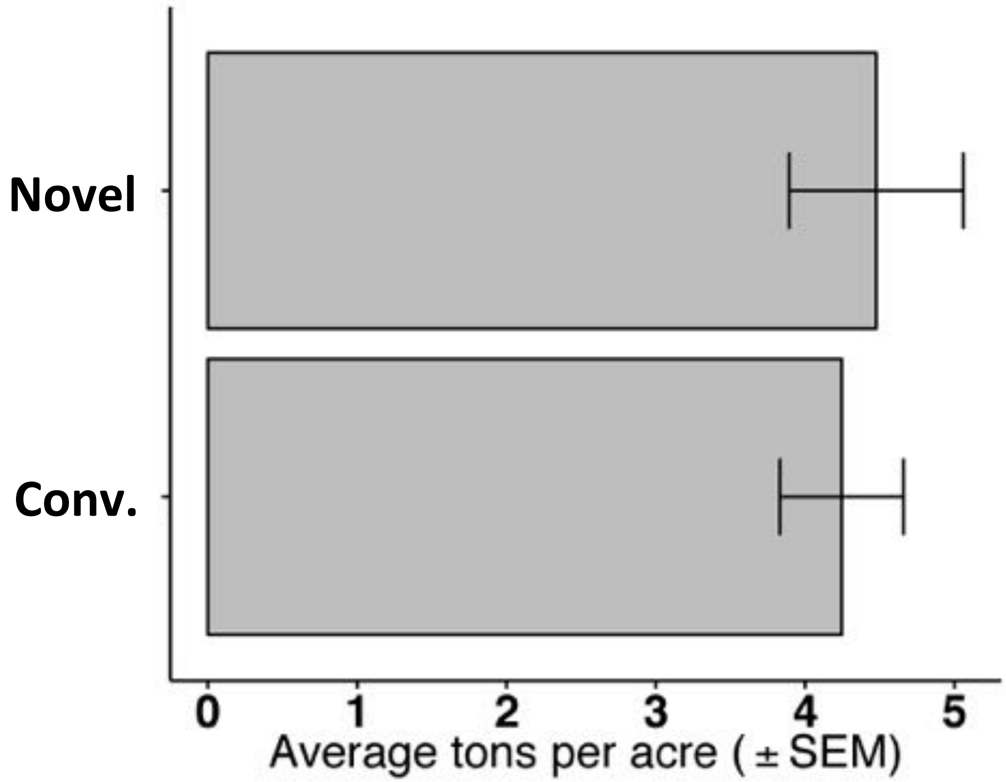


Average field size:
2013: 5.1±2.3 ha
2014: 8.0±3.1 ha

Avg. pair distance:
2013: 1.0±0.5 km
2014: 1.4±1.8 km

Results – 2013 & 2014 field implementation trial

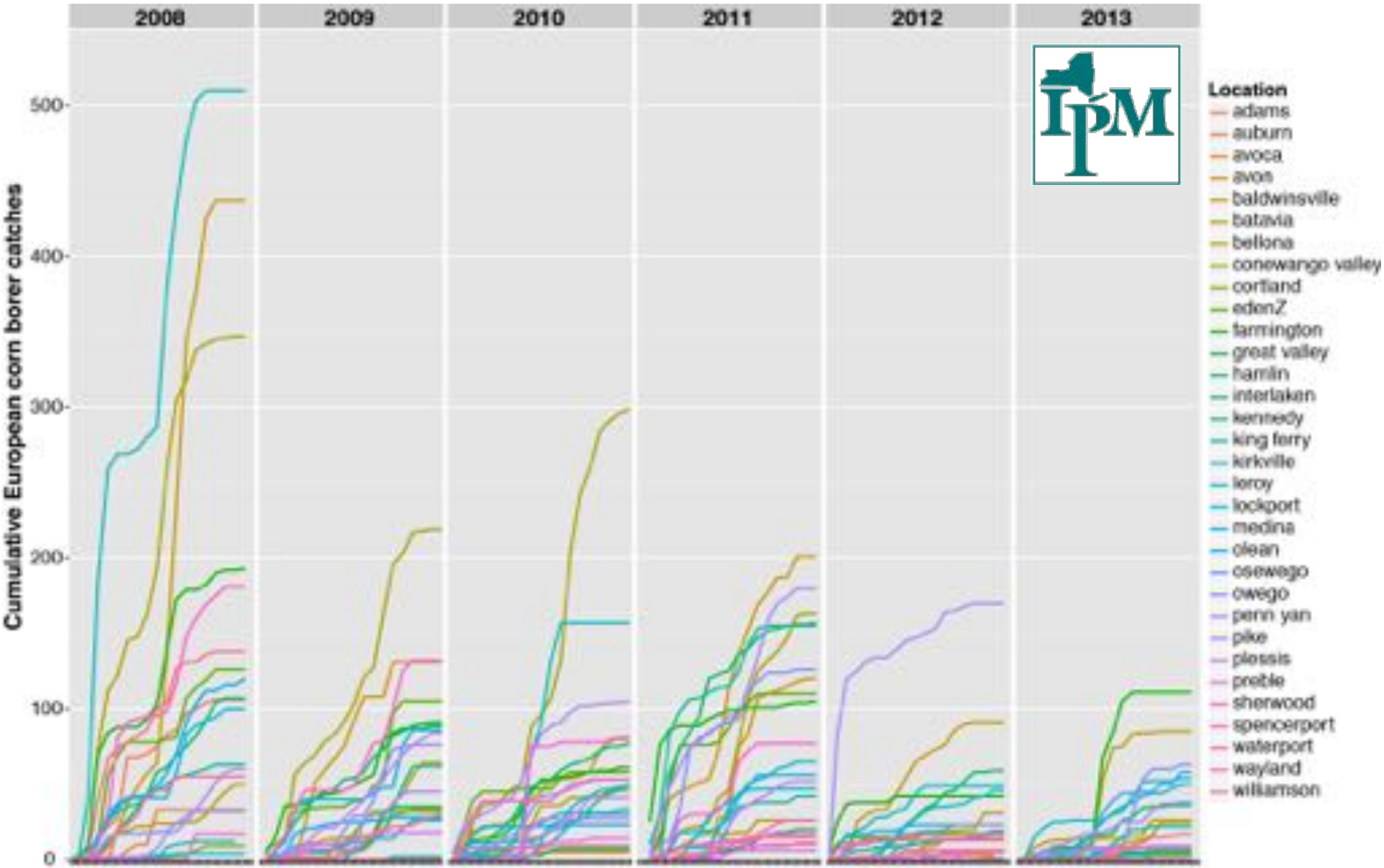
2013 commercial trial results



- No ECB detected in crop in either study year.
- 2013 average marketable bean yield in bifenthrin treated fields was 9.5±2.6 metric tonnes ha^{-1} in 2013 and 10.3±2.2 metric tonnes ha^{-1} in 2014.
- Average marketable bean yield in chlorantraniliprole treated fields was 10.0±3.7 metric tonnes ha^{-1} in 2013 and 11.4±3.9 metric tonnes ha^{-1} in 2014.

If insects remain at low densities are insecticides always necessary?

Future directions: ECB population decline in NY



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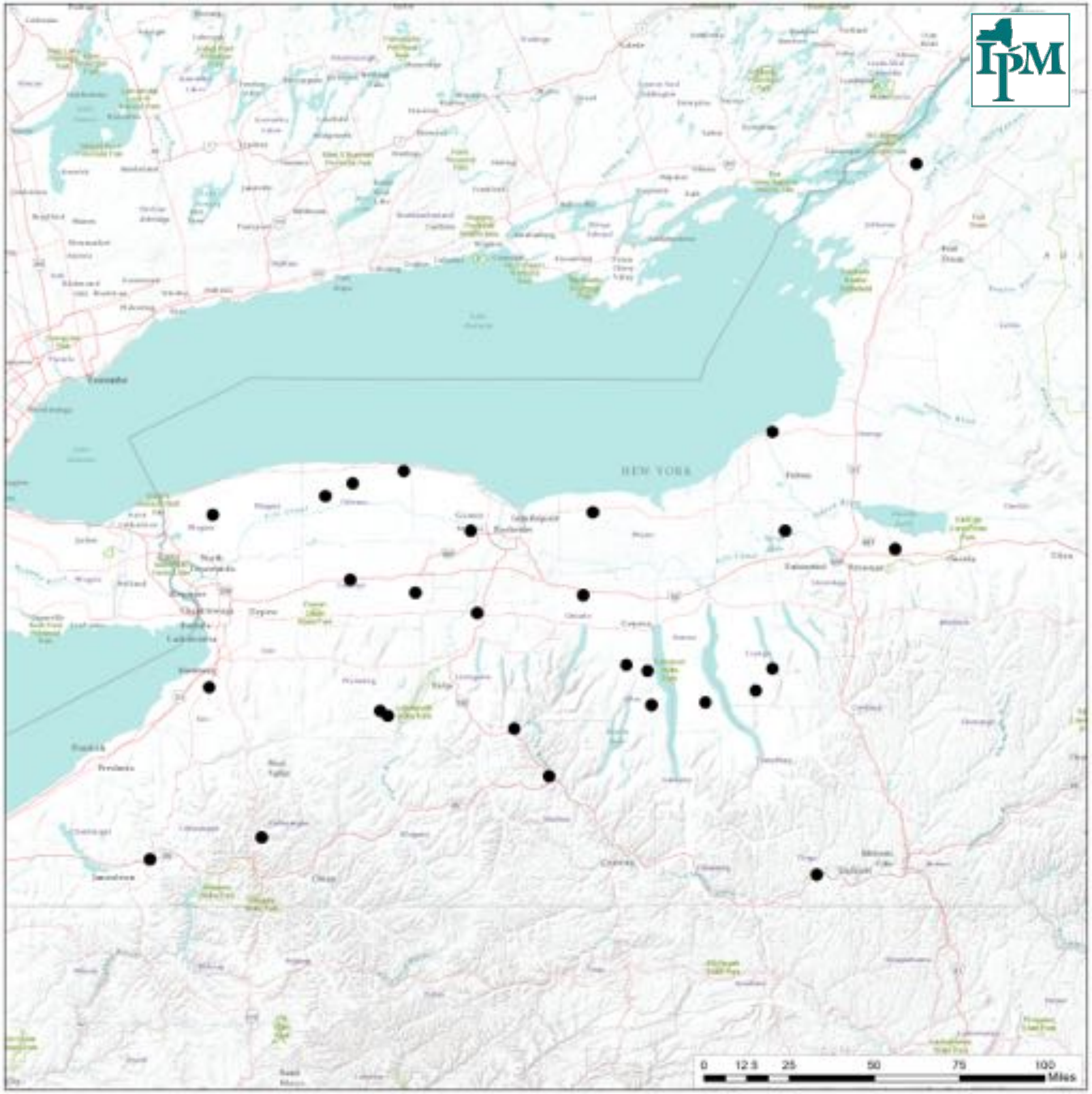
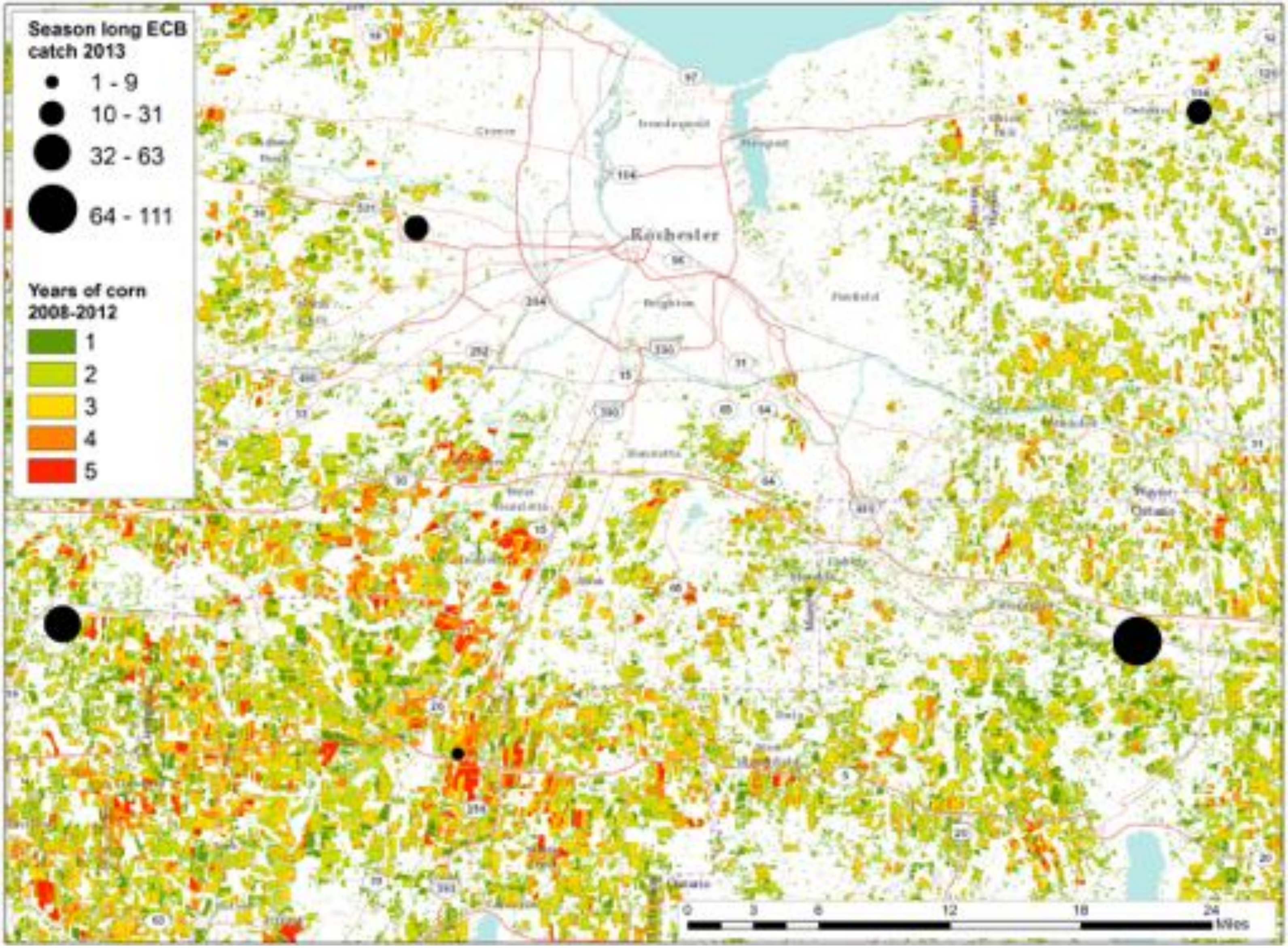
Pheromone trap locations 2008-2014

- Pheromone catch data
- Land cover data (NASS-CDL)
- Landscape-based risk model

Has Bt corn affected pest density in Western NY?



ECB trap data & corn production intensity



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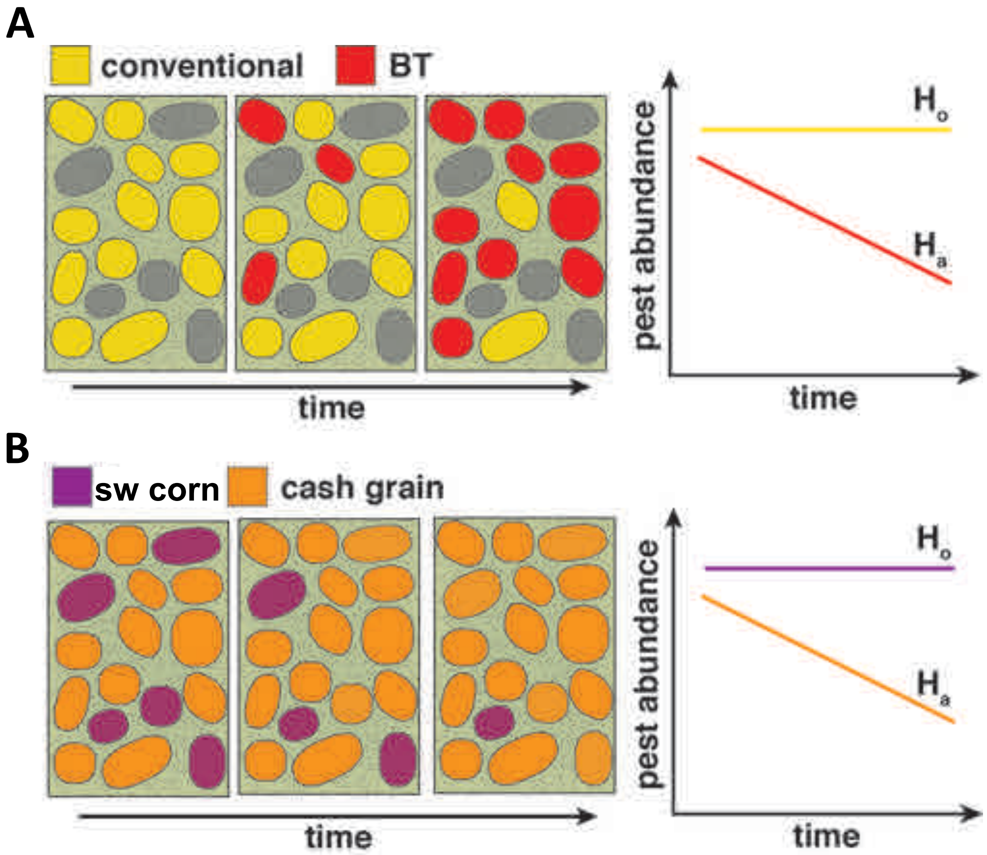
ECB landscape risk objective

Describe the influence of transgenic crop abundance on ECB abundance in alternate host crops

1. Abundance of ECB will decline with BT abundance* in the landscape that will result in an ecosystem service (*benefit*) to processing crops (**A**).

2. The abundance of pyrethroid treated sweet corn will provide a stable refugia from Bt and greater risk to processing crops in specific WNY agroecosystems (**B**).



*Assuming a high proportion of maize grown in WNY contains one or more Bt events that have lepidopteran activity

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Estimating corn abundance in time

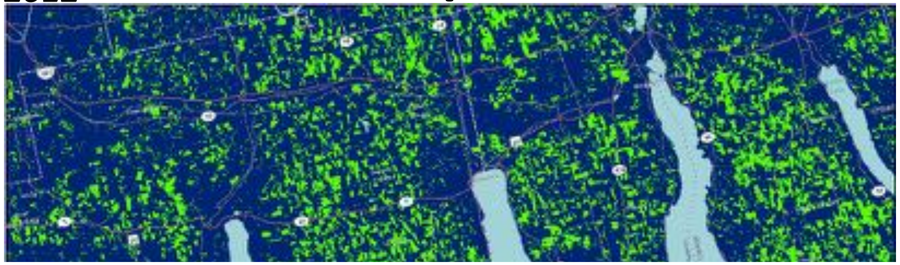
- Compile NASS Cropland Data Layers 2008-2013
- Reclassify crop types for each year (corn or not)
- Sum annual corn incidence
- Calculate spatiotemporal abundance from GIS output:

$$\textbf{Corn dominance metric} = \frac{\sum_{i=1}^{j} i \bullet T_i}{\sum_{i=1}^{j} T_i}$$

2011

+

2012



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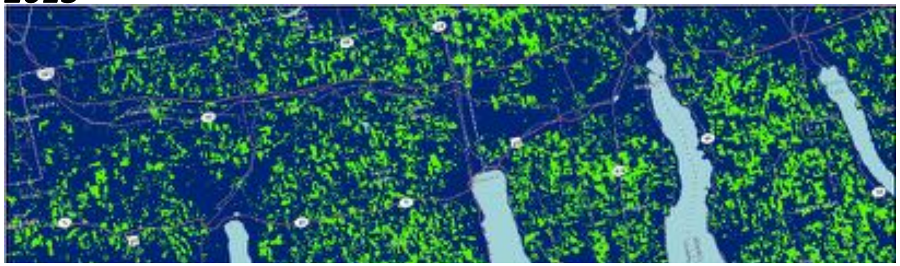
2013



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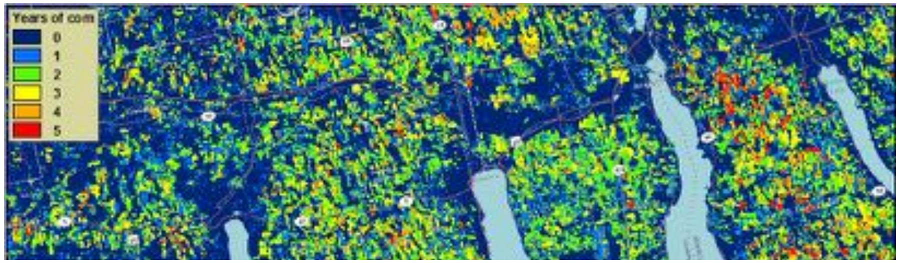
2008 - 2013



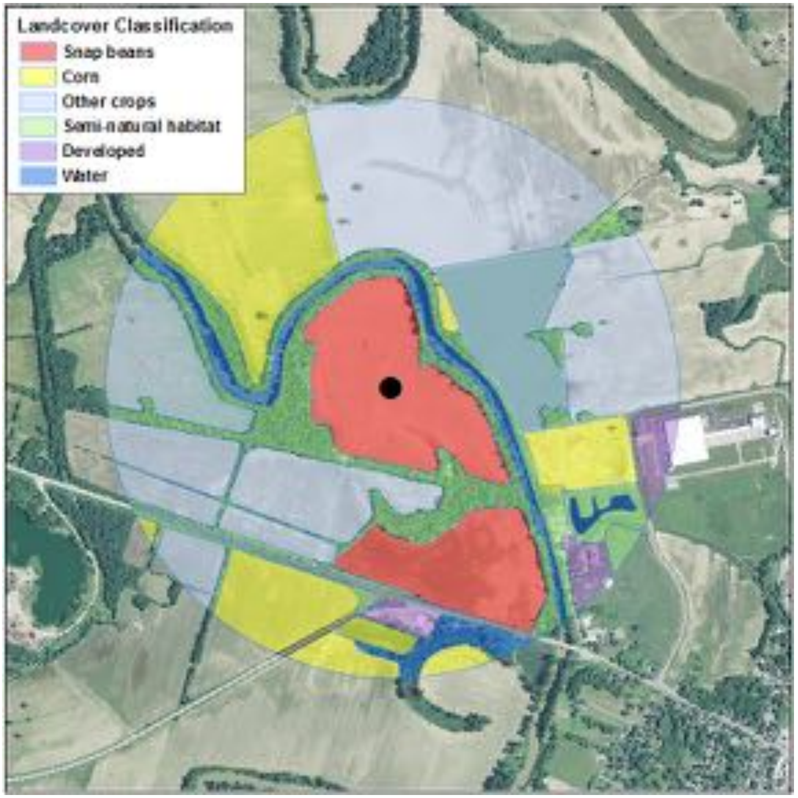
Sampled locations 2014

- 40 sampled fields
- Maintained 20 high risk & 20 low traps

- ECB-*E* pheromone
- July – mid September (N=40 sites)

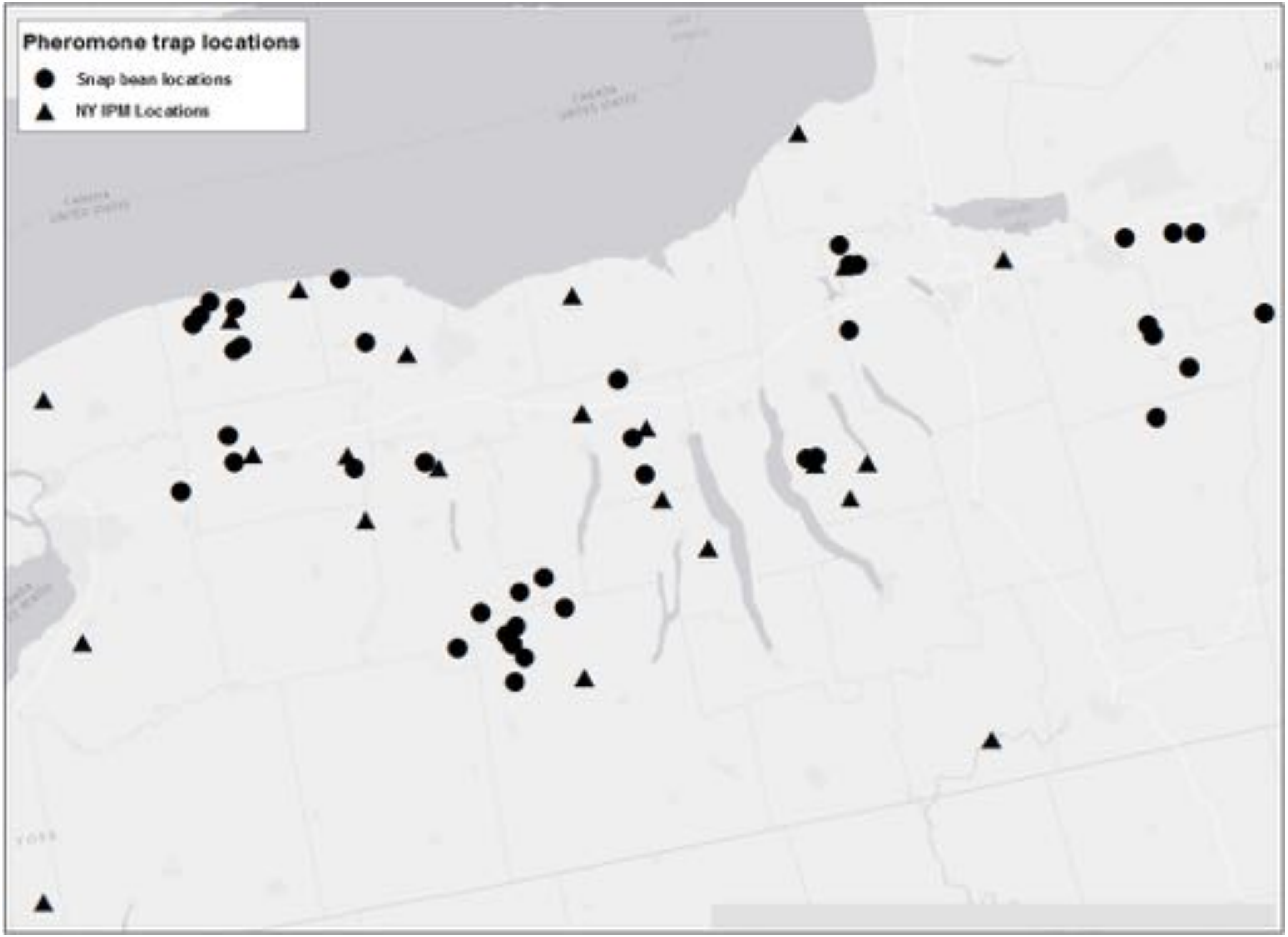
less ← ***ECB risk*** → **greater**

Avon, NY **– CDM score: 3.37**



Dansville, NY **– CDM score: 1.22**

Sampled snap bean fields 2014 continued in 2015



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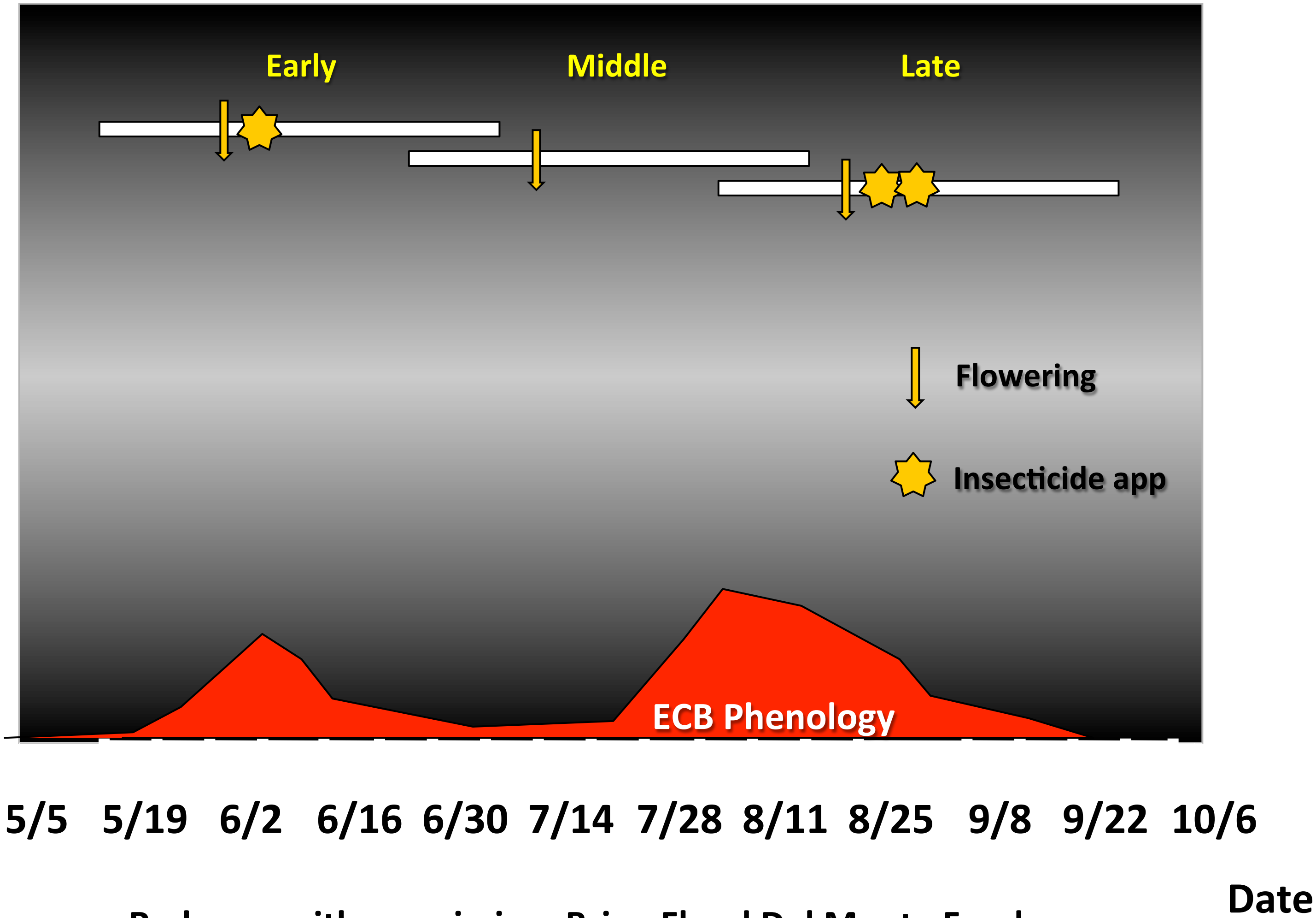
European corn borer - phenology



Redrawn with permission, Brian Flood Del Monte Foods

Insecticides for Managing Snap Bean Pests

Recently Labeled in Wisconsin:

- Radiant SC (spinetoram)
- Coragen 1.67 SC (chlorantraniliprole) – foliar
- Blackhawk (spinosad) – foliar
- Beseige (chlorantraniliprole + lambda-cyhalothrin)
  (aka. Voliam Xpress)
- Belt SC (flubendiamide) – foliar
- Entrust SC (spinosad) – foliar
- Movento (spirotetramat) – foliar (sap-feeding insects only)
- Transform WG (sulfoxaflor) – foliar (cancelled)

In the Pipeline or in Review:

- Exirel, Verimark (cyantraniliprole) – 2015/16

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Questions?
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