

# Colorado Potato Beetle Management Strategies for Organically and Conventionally Grown Potato

2018 New York State Potato School

February 21, 2018

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# Topics

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## I. Colorado potato beetle

- Review of biology
- Overview of IPM strategies
- Management using insecticides
- Insecticide resistance management



## II. Potato leafhopper

- Overview of IPM strategies
- Monitoring
- Management using insecticides





# Colorado potato beetle (CPB)

Adult



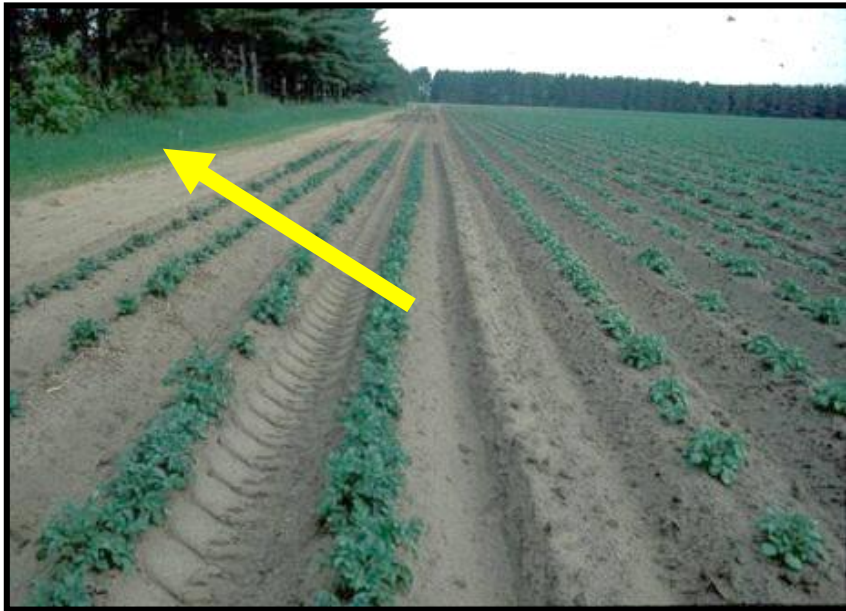
Larvae



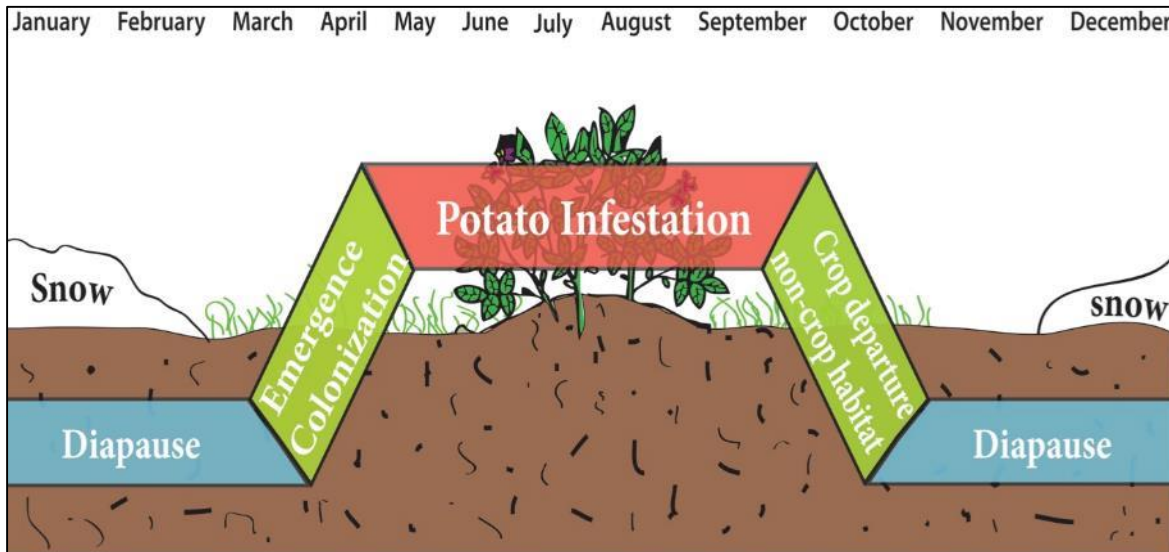
## Complete defoliation



# Colorado potato beetle (CPB)

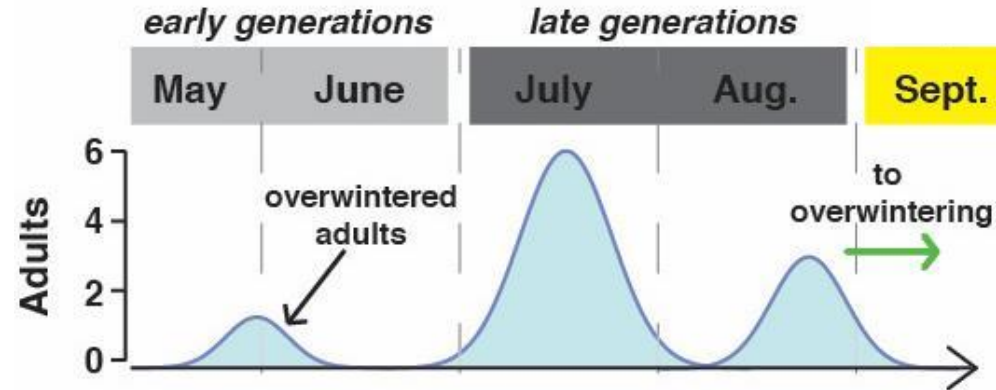


- Adults overwinter in potato fields and non-crop habitats
- Colonize potato crop by walking

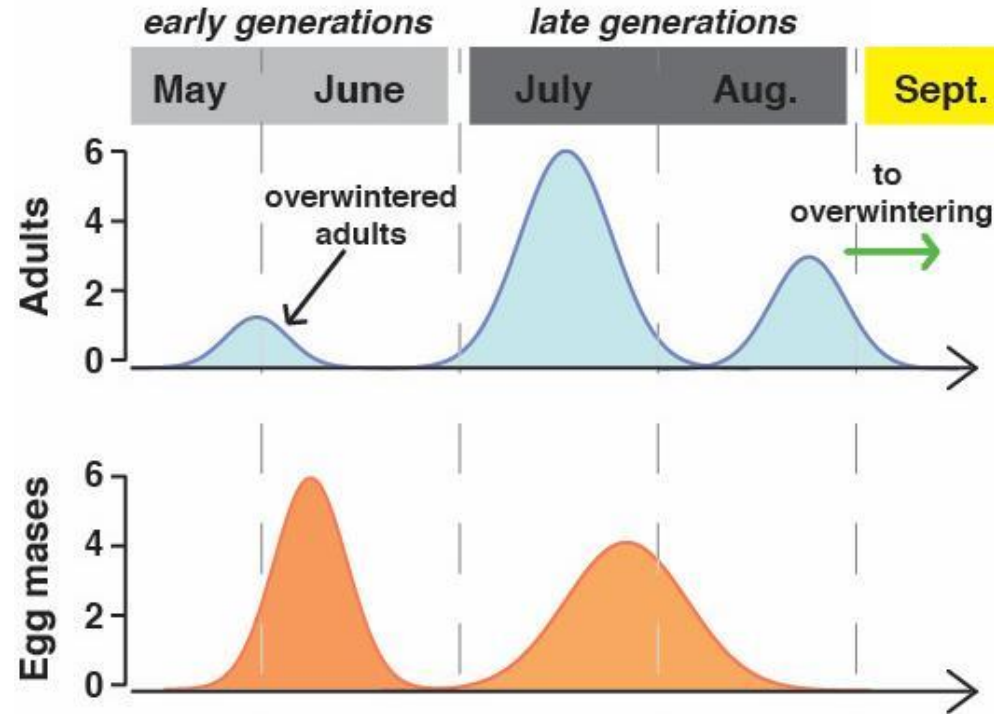




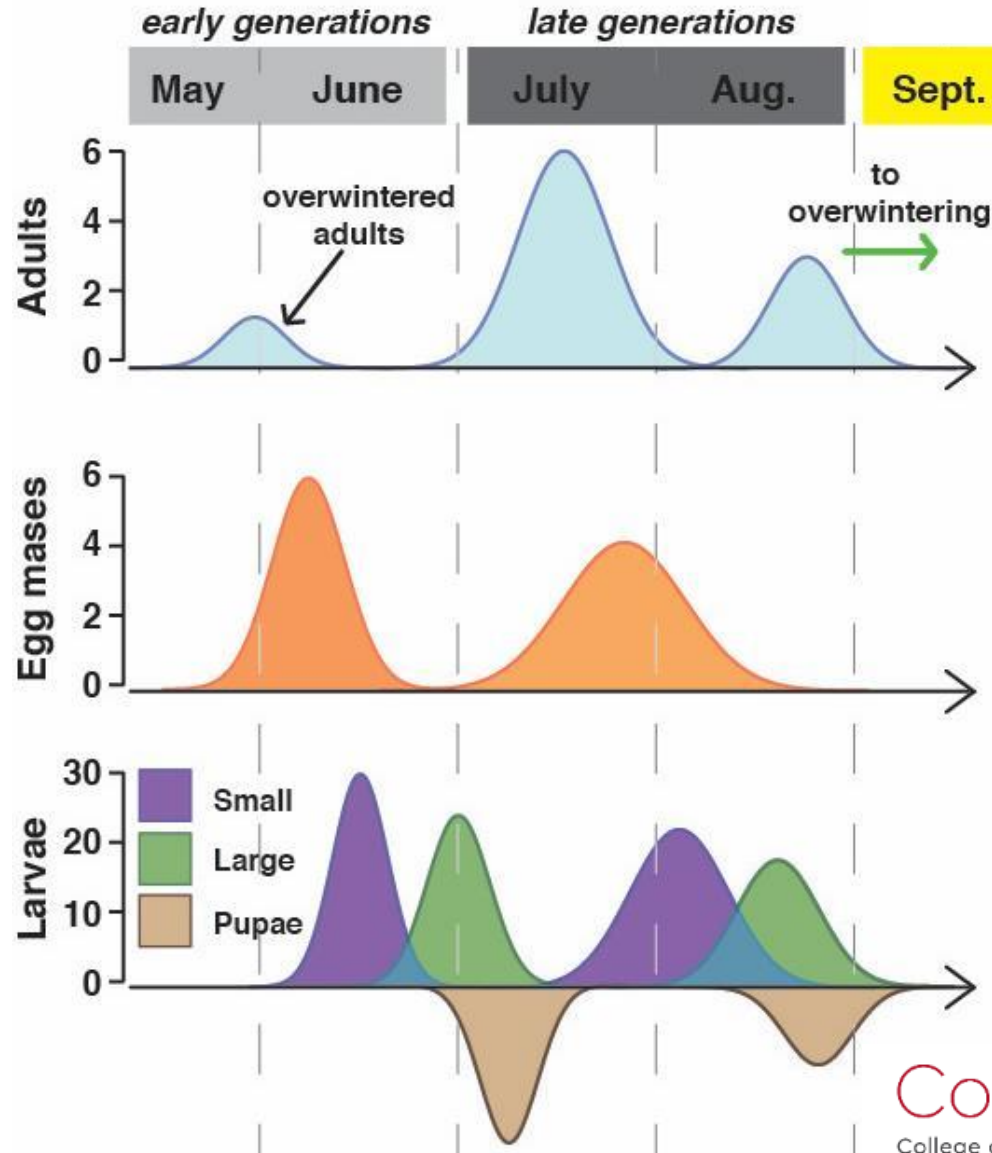
# Colorado potato beetle (CPB)



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# Colorado potato beetle (CPB)



# Colorado potato beetle management

**Plant Resistance**

**Chemical Control**



**Cultural Control**

**Biological Control**



# Colorado potato beetle management

**Plant Resistance**

**Chemical Control**



**Cultural Control**

**Biological Control**



# Cultural Control

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- **Crop rotation** – as far away from previous year's potato crop as possible (>0.25 mile)
- **Early harvest** – vine kill as soon as crop is mature to eliminate food for overwintering adults
- **Trap crop** – plant early-maturing potato shallow and before main potato crop near overwintering site; must then control with insecticides



# Cultural Control

- **Plastic-lined trenches** – place between overwintering site and main potato crop
- **Row cover** – protect small plants against overwintering adults
- **Flamers** – propane burners for killing adults on small plants (6 inches or smaller)







# Biological Control

- **Twelve-spotted ladybird beetle**

- Adults and larvae eat CPB eggs and small larvae
- Reduce CPB populations by 30-60%



- **Spined soldier bug**

- Adults and nymphs eat CPB adults and larvae



# Colorado potato beetle management

**Plant Resistance**

**Chemical Control**

Conventional



**Cultural Control**

**Biological Control**

# Most common CPB management approach using conventional insecticides

## CPB Generation

Early

Late

**At-plant product  
(1 application)**

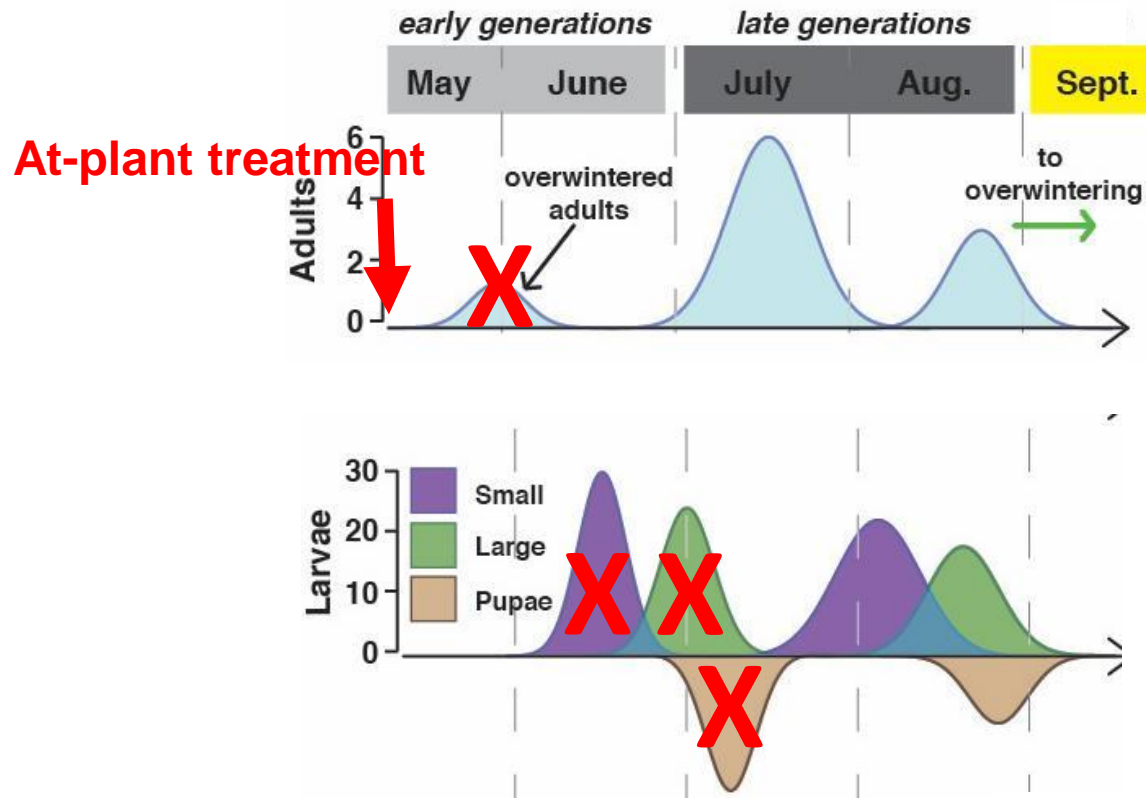
**Foliar product  
1- 3 applications**



# Typical approach for managing CPB with conventional insecticides in potato

## 1) Spring generation

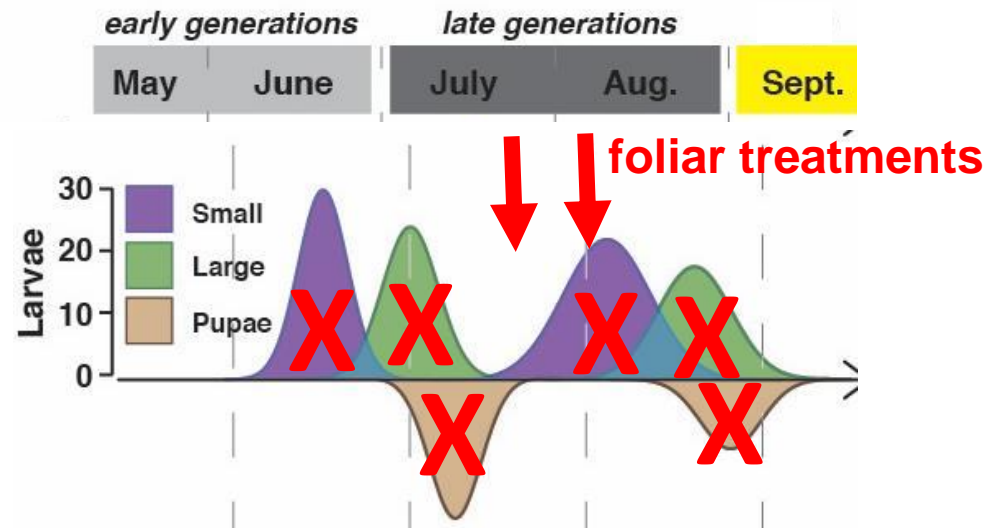
- An at-plant treatment (seed treatment or in-furrow application) to manage overwintered adults and first-generation larvae and pupae



# Typical approach for managing CPB with conventional insecticides in potato

## 2) Summer generation

- Foliar applications targeting summer generation (first-generation adults and second-generation larvae)



# Conventional insecticides for CPB in NY

## At-plant options

Product(s)	Active ingredient	Group (IRAC group)
Verimark	cyantraniliprole (seed and soil trt)	Diamides (28)
Admire Pro, Tops-MZ-Gauche, others	imidacloprid (seed trt)	Neonicotinoids (4A)
Admire Pro, others	imidacloprid (soil trt)	
Cruiser 5FS, CruiserMaxx	thiamethoxam (seed trt)	
Platinum 75SG	thiamethoxam (soil trt)	
Brigadier	imidacloprid + bifenthrin	Neonicotinoid (4A) + Pyrethroid (3)

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# Conventional insecticides for CPB in NY

## Foliar options: Single active ingredient

Product	Active ingredient	Group (IRAC group)
Rimon 0.83EC	novaluron	Benzoylureas (15)
Lannate LV	methomyl	Carbamates (1A)
Coragen	chlorantraniliprole	Diamides (28)
Exirel	cyantraniliprole	
Assail 30SG	acetamiprid	Neonicotinoids (6)
Admire Pro, others	imidacloprid	
Actara	thiamethoxam	
Avaunt	indoxacarb	Oxadiazines (22A)
Warrior II Zeon Technology	lambda-cyhalothrin	Pyrethroids (3A)
Radiant SC	spinetoram	Spinosyns (5)
Blackhawk, Entrust	spinosad	

# Conventional insecticides for CPB in NY

## Foliar options: Multiple active ingredients

Product	Active ingredient	Group (IRAC group)
Gladiator	avermectin B1 + zeta-cypermethrin	Avermectin (6) + Pyrethroid (3a)
Athena	avermectin B1 + bifenthrin	
Minecto Pro	avermectin B1 + cyantraniliprole	Avermectin (6) + Diamide (28)
Besiege	chlorantraniliprole + $\lambda$ -cyhalothrin	Diamide (28) + Pyrethroid (3a)
Endigo ZC	thiamethoxam + $\lambda$ -cyhalothrin	Neonicotinoid (6) + Pyrethroid (3a)
Leverage 360	imidacloprid + cyfluthrin	

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# Conventional insecticides for CPB in NY

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**NOTE: Benefit of multiple active ingredients is control of multiple pests; Detriment is potential resistance development to multiple active ingredients and unnecessary use of a particular active ingredient**



# Foliar application of conventional products

## Scouting & Action Thresholds

- **Sample 5 sites at 5 locations within a field**
- **Treat only when threshold exceeded**

For Coragen, Exirel, Minecto Pro, Radiant, etc.

- **Small larvae: 200 per 50 vines**
- **Large larvae: 75 per 50 vines**
- **Adults: 25 per 50 vines**



# Conventional insecticides evaluated for managing Colorado potato beetle in 2013

Trt#	Product(s)	Active Ingredient(s)	Rate per Acre
1	Untreated	-	-
2	Admire Pro	imidacloprid	8.7 fl oz (AP)
3	Gladiator EW	abamectin + Z-cypermethrin	14 fl oz (F)
4	Blackhawk	spinosad	3.3 oz (F)
5	Coragen SC	chlorantraniliprole	5 fl oz (F)
6	Exirel	cyantraniliprole	5 fl oz (F)

\*AP = at-plant application; F = foliar application

# Methods

- Planted trial in North Rose, NY on 10 May 2013 with 'Red Norland'
- Plots sprayed with a CO<sub>2</sub> -backpack sprayer
  - Single nozzle for at-plant (17 gpa)
  - Two Teejet 8002VS nozzles per row (24 gpa); 40 psi for both
- Foliar applications made on 5 and 12 July
- Number of life stages recorded from 10 plants on 28 June, 5, 12, 19 and 25 July
- Visual estimates of defoliation on 23 July



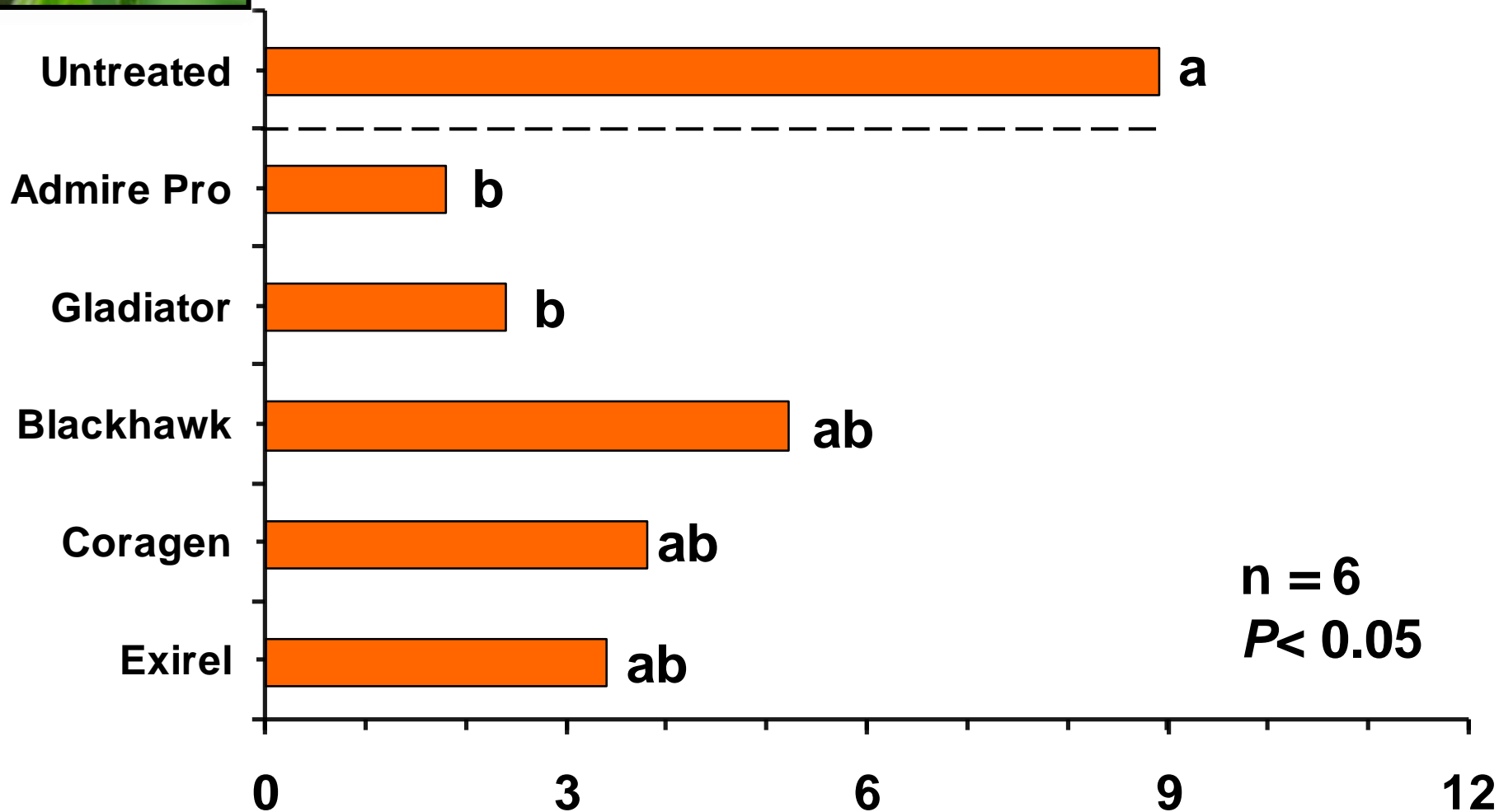




# Conventional insecticide evaluation trial

## LARGE LARVAE

North Rose, NY 2013



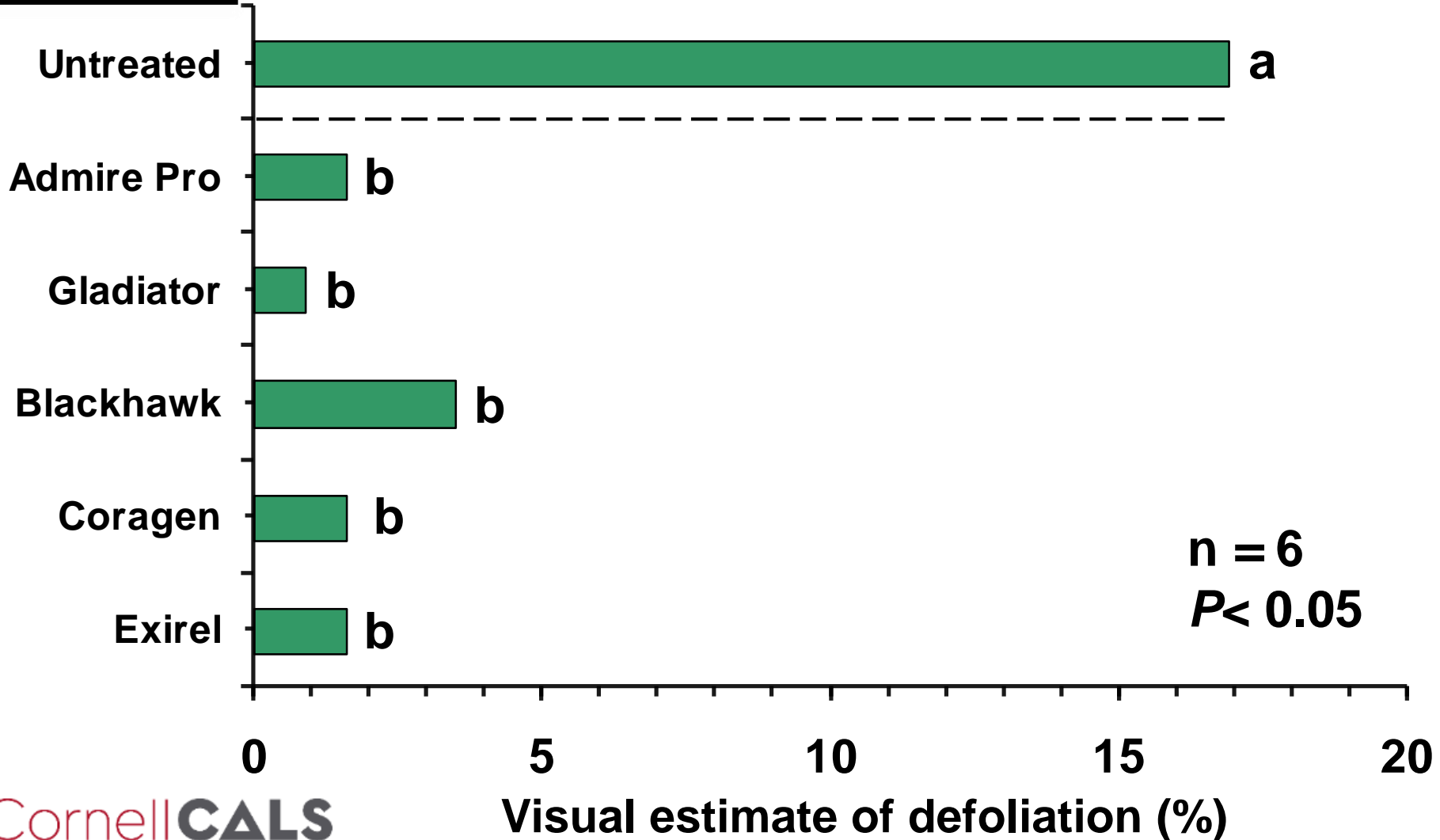


# Conventional insecticide evaluation trial

## DEFOLIATION

North Rose, NY

23 July 2013



# Conventional insecticides evaluated for managing Colorado potato beetle in 2014

Trt	Product(s)	Active Ingredient(s)	Rate per Acre*
1	Untreated	-	-
2	Admire Pro + Coragen SC	imidacloprid + chlorantraniliprole	8.7 fl oz (AP) + 3.5 fl oz (F)
3	Platinum + Agri-Mek SC	abamectin + Z-cypermethrin	2.67 oz (AP) + 1.75 fl oz (F)
4	Verimark + Radiant SC	cyantraniliprole + spinetoram	13.5 fl oz (AP) + 4.5 fl oz (F)
5	Brigadier 2SC + Gladiator	bifenthrin & imidacloprid + abamectin & z-cypermethrin	25.6 fl oz (AP) + 19 fl oz (F)
6	Capture + Admire + Gladiator	bifenthrin + imidacloprid + abamectin & z-cypermethrin	25.6 fl oz + 5.2 fl oz (AP) + 19 fl oz (F)

\*AP = at-plant application; F = foliar application

# Methods

- Planted in North Rose, NY on 14 May 2014 with 'Modoc'
- Plots sprayed with a CO<sub>2</sub> -backpack sprayer
  - Single nozzle for at-plant (17 gpa)
  - Two Teejet 8002VS nozzles per row (23 gpa); 40 psi for both
- Foliar applications -30 July and 6 August
- Number of life stages recorded from 10 plants on 16 and 23 June, 1, 8, 16, 23 and 30 July, and 5 and 11 August
- Visual estimates of defoliation on 16 July and 11 August



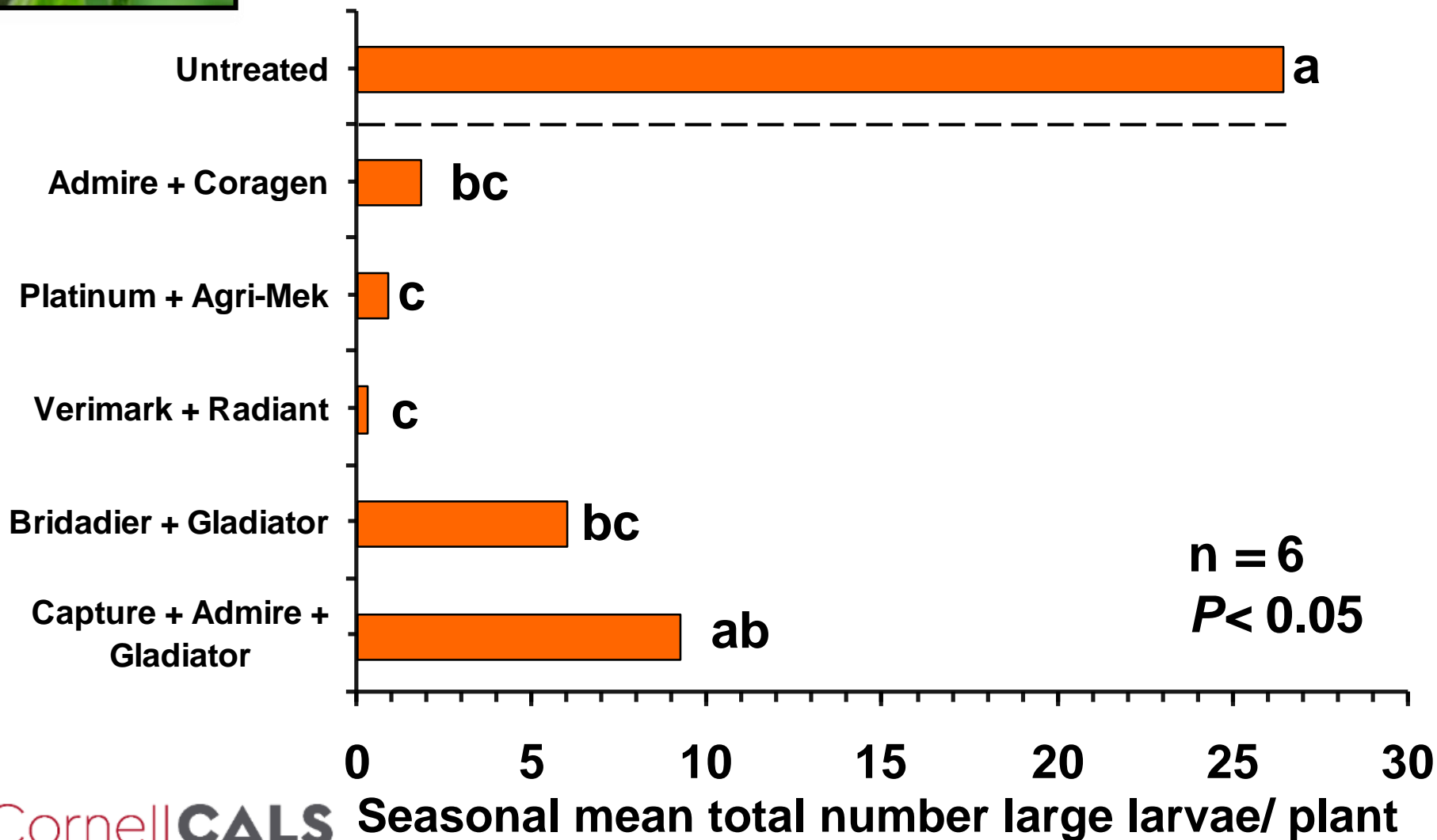




# Conventional insecticide evaluation trial

## LARGE LARVAE

North Rose, NY 2014



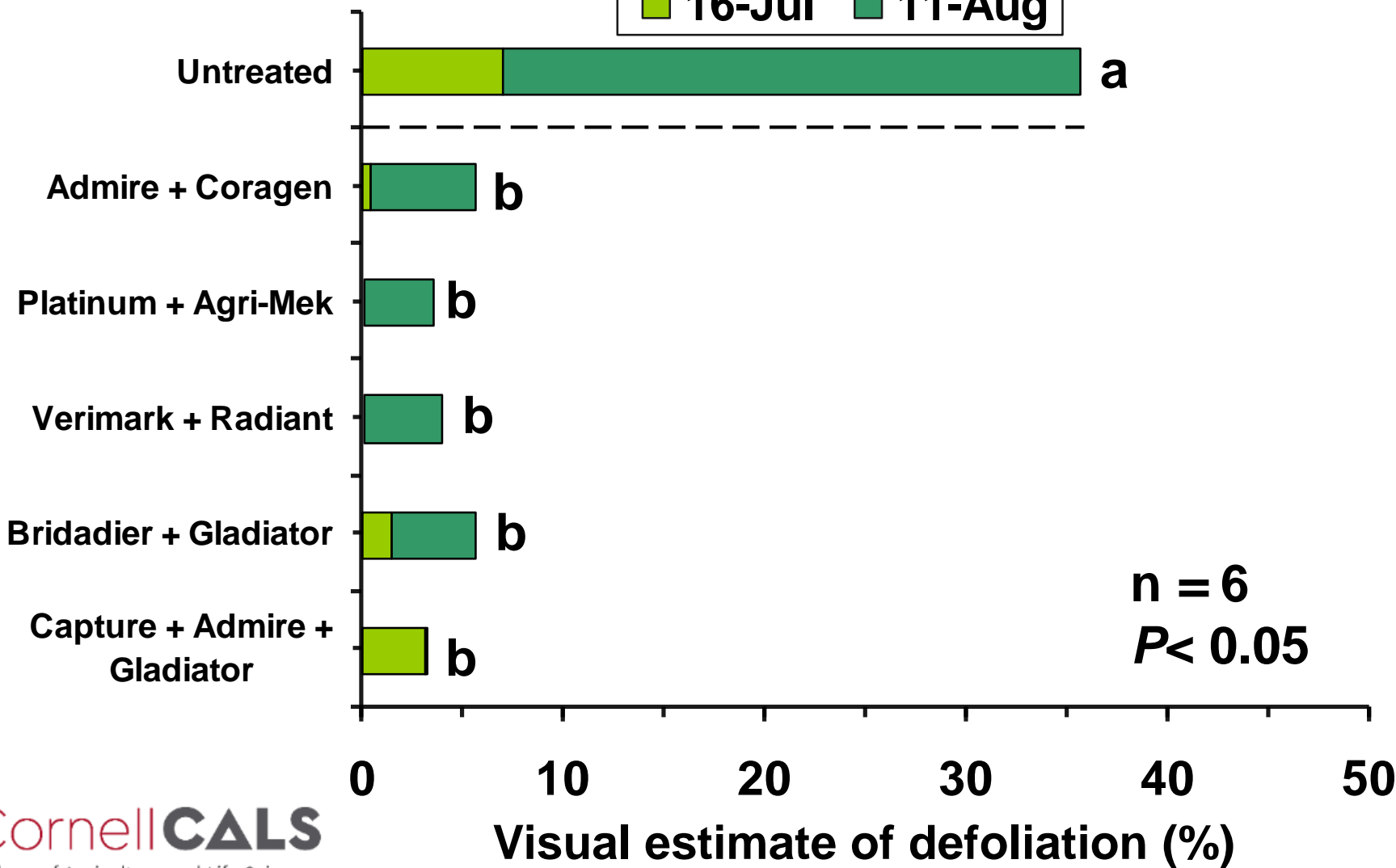


# Conventional insecticide evaluation trial

## DEFOLIATION

North Rose, NY 2014

16-Jul 11-Aug



# Successful conventional insecticide options for CPB management

## CPB Generation

Early

**At-plant product  
(1 application)**

- ✓ Admire Pro
- ✓ Platinum
- ✓ Verimark
- ✓ Brigadier

Late

**Foliar product  
2 applications**

- ✓ Coragen
- ✓ Agri-mek
- ✓ Radiant
- ✓ Gladiator

# Colorado potato beetle management

Plant Resistance

Chemical Control



Cultural Control

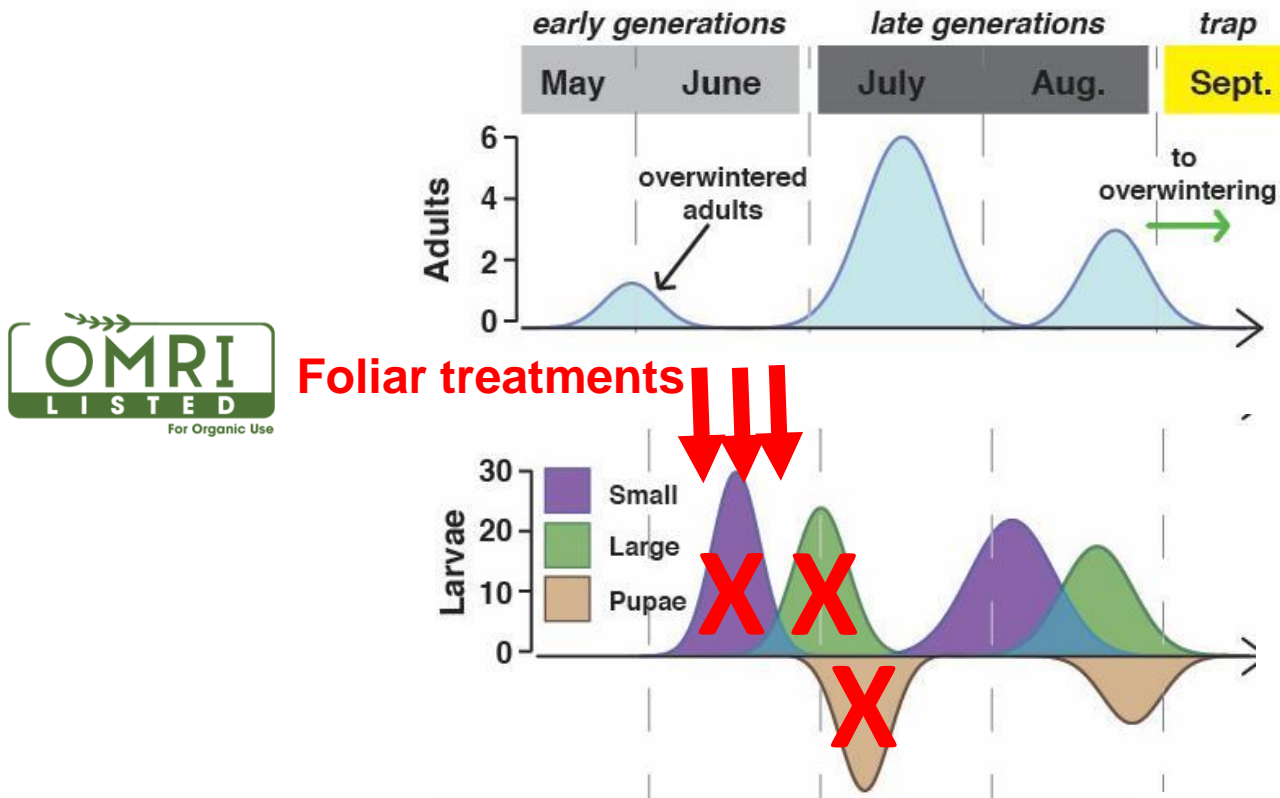
Biological Control



# Typical approach for managing CPB with OMRI-listed insecticides in potato

## 1) Spring generation

- Foliar applications targeting spring generation (maybe some overwintered adults, first-generation larvae)

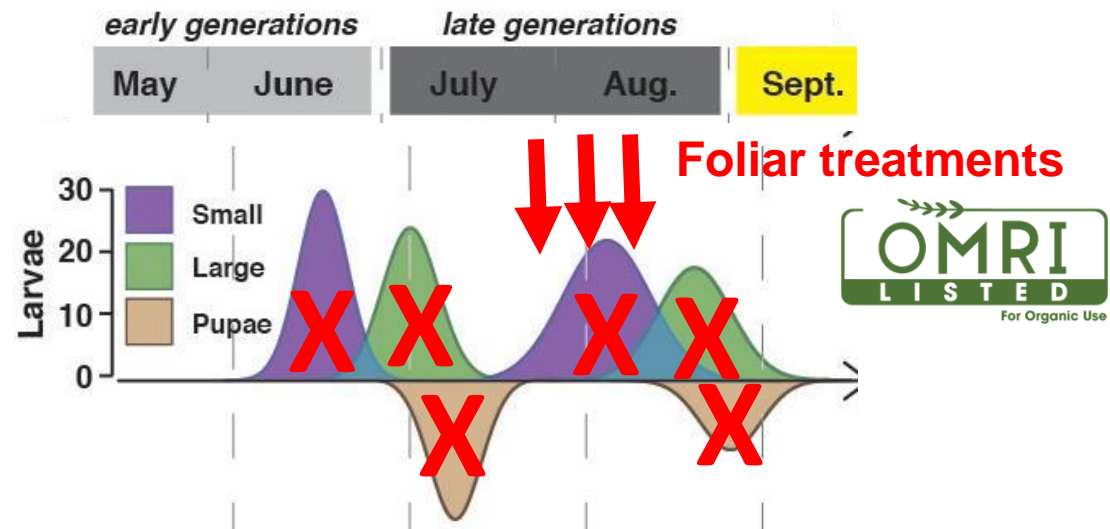


Foliar treatments

# Typical approach for managing CPB with OMRI-listed insecticides in potato

## 2) Summer generation

- Foliar applications targeting summer generation (first-generation adults and second-generation larvae)



# Foliar application of OMRI-listed products

## Scouting & Action Thresholds

- **Sample 5 sites at 5 locations within a field**
- **Treat only when threshold exceeded**

For Azera, Entrust, PyGanic and Trident (Rimon\* and Trigard\*)

- **Egg masses: 4 per 50 vines (with at least 25% hatching)**
- **Small larvae: 75 per 50 vines**
- **Large larvae: 30 per 50 vines**

\*Not OMRI-listed





# **insecticides registered for managing Colorado potato beetle in potato**

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- **Azera** (azadirachtin + pyrethrin)
- **Entrust** (spinosad)
- **Neemix 4.5** (azadirachtin)
- **PyGanic Specialty** (pyrethrins)
- **Trident** (*Bacillus thuringiensis* subsp. *tenebrionis*)





# **insecticides evaluated for managing Colorado potato beetle in potato**

<b>Trt#</b>	<b>Product(s)</b>	<b>Active Ingredient(s)</b>	<b>Rate per Acre</b>
1	Untreated	-	-
2	Azera	azadirachtin + pyrethrin	40 fl oz
3	Entrust	spinosad	10 fl oz
4	Grandevo*	<i>Chromobacterium subtsugae</i>	3 lbs/A
5	BeetleGONE!*	<i>B.t. galleriae</i> Srain SDS 502	4 lbs/A
6	Trident	<i>B.t. tenebrionis</i>	3 qts/A

\*Not labelled for Colorado potato beetle control



# Methods

- Planted trial in North Rose, NY on 4 May 2017 with 'Genesee'
- Plots sprayed with a CO<sub>2</sub> -backpack sprayer (2 Conejet TXVS-12 nozzels per row); 31 gpa; 40 psi
- Applications made on 15, 19 and 24 June
- Co-applied with NuFilm P @ 8 fl oz per acre
- Number of life stages recorded from 10 plants on 19, 23 and 29 June
- Visual estimates of defoliation on 26 June and 3 July

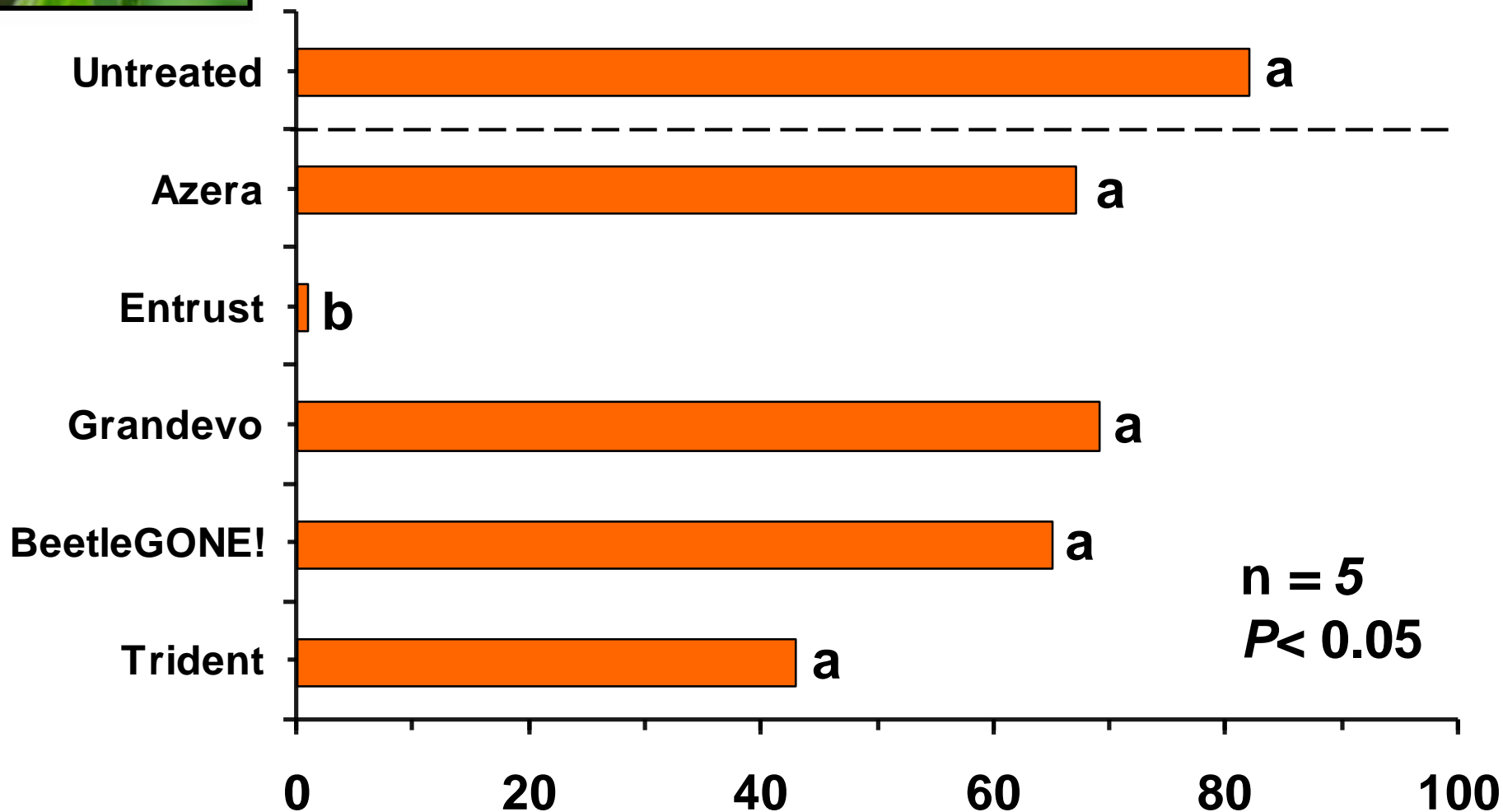




# Insecticide Evaluation Trial

## LARGE LARVAE

North Rose, NY 2017



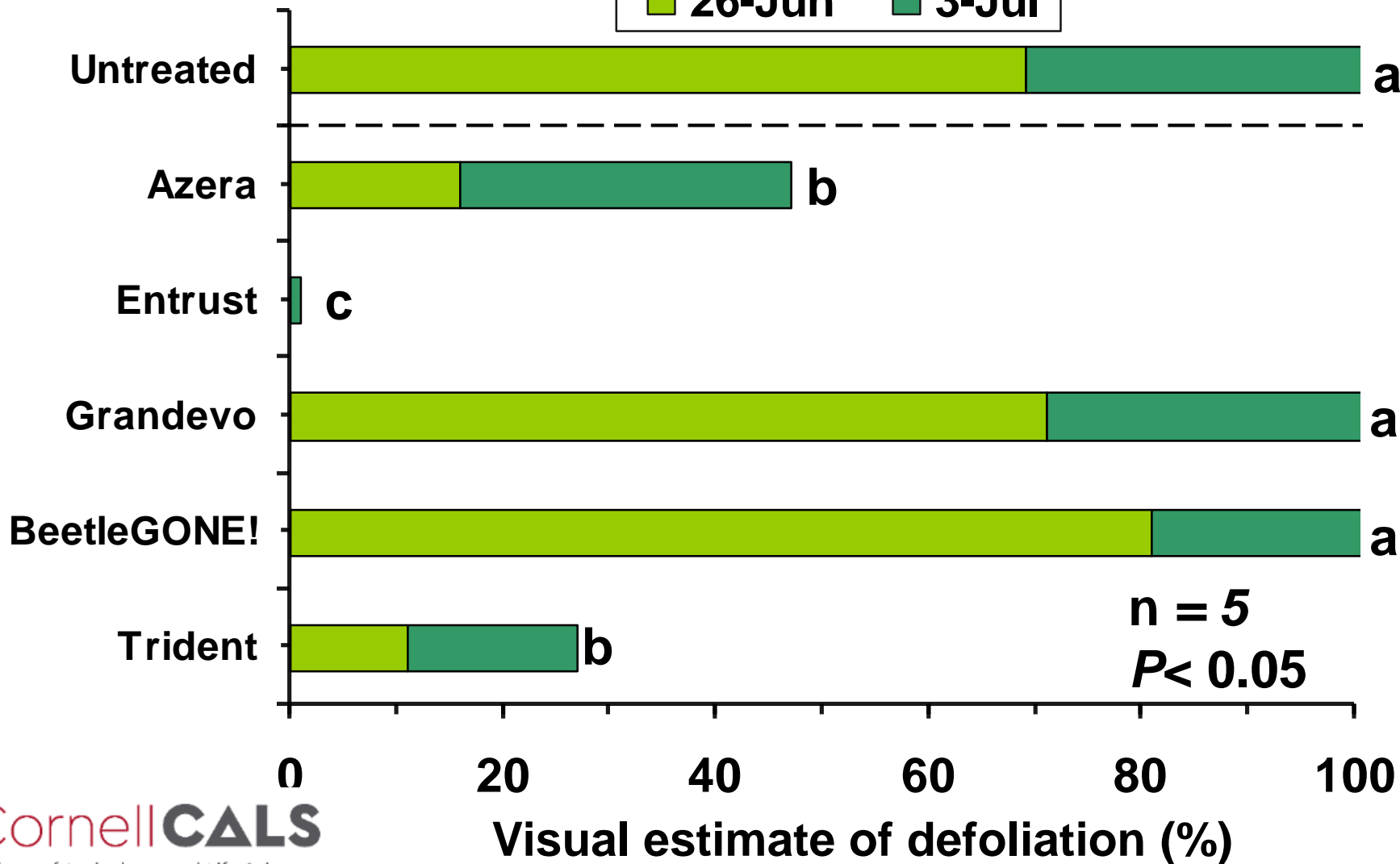


# Insecticide Evaluation Trial

## DEFOLIATION

North Rose, NY 2017

26-Jun 3-Jul





# insecticides effective for managing Colorado potato beetle in potato

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✓ **Azera** (azadirachtin + pyrethrin)



✓ **Entrust** (spinosad)



✓ **Trident** (*Bacillus thuringiensis* subsp. *tenebrionis*)



# Colorado potato beetle management

**Plant Resistance**

**Chemical Control**



**Cultural Control**

**Biological Control**



# CPB insecticide resistance

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**Avoid this...**



**...maintain this**

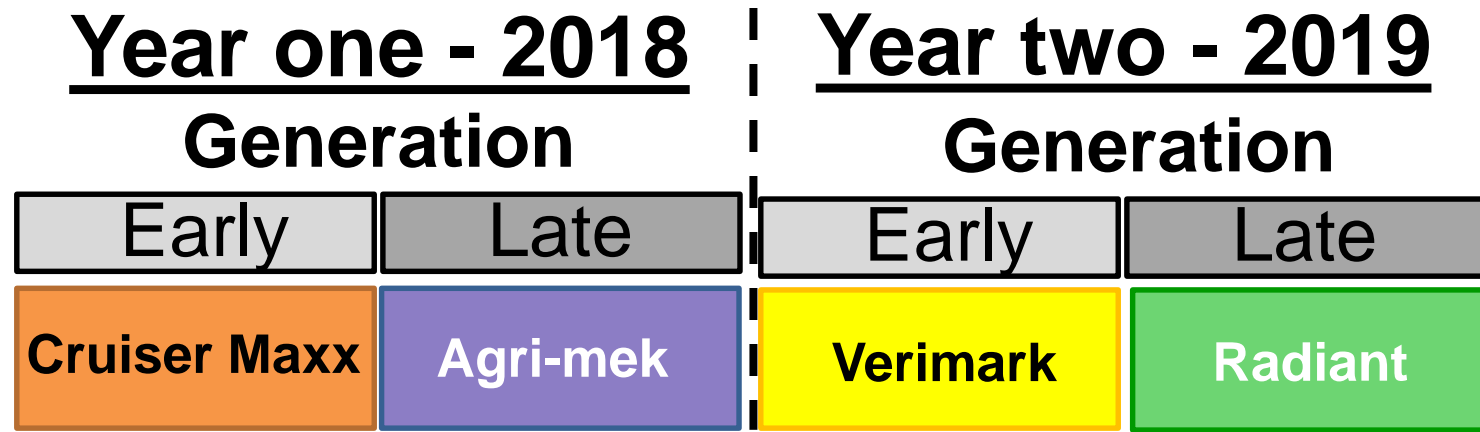


# General insecticide resistance management (IRM) principles






- **Manage pests without insecticides**
  - use other tactics (e.g., cultural control and biological control)
- **Maximize efficacy of insecticides**
  - apply properly to crop, regulate dose, add synergist
  - target specific stage of insect
- **Minimize use of insecticides**
  - limit number of applications permitted
  - use action thresholds
  - rotate insecticides of different classes (IRAC groups)

# Example of conventional insecticide sequences for CPB management following IRM principles



## *IRAC MoA groups*

 avermectins (6)	 diamides (28)	 neonicotinoids (4A)
 benzoylureas (15)	 oxadiazines (22A)	 spinosyns (5)

# Example of insecticide sequences for CPB management following IRM principles

## Year one - 2018

### Generation

Early	Late
Entrust	PyGanic

## Year two - 2019

### Generation

Early	Late
Trident	Neemix 4.5

### *IRAC MoA groups*



spinosyns (5)



*Bacillus thuringiensis* (11)



pyrethrins (3)

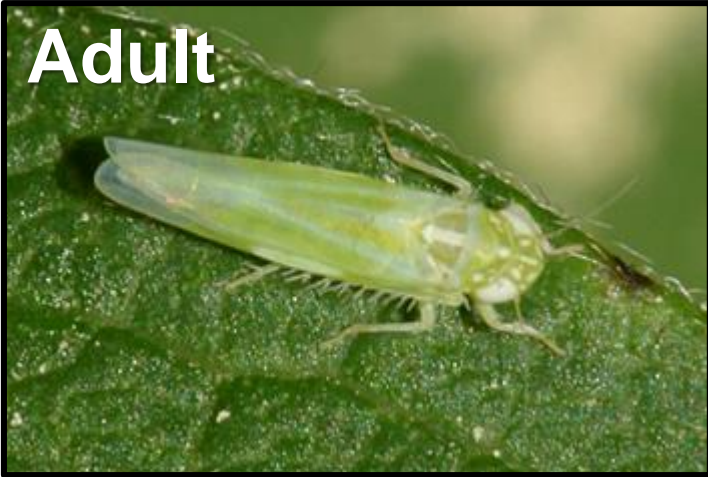


azadirachtin (unknown)



# Potato leafhopper (PLH)

Adult



Hopperburn



Nymph

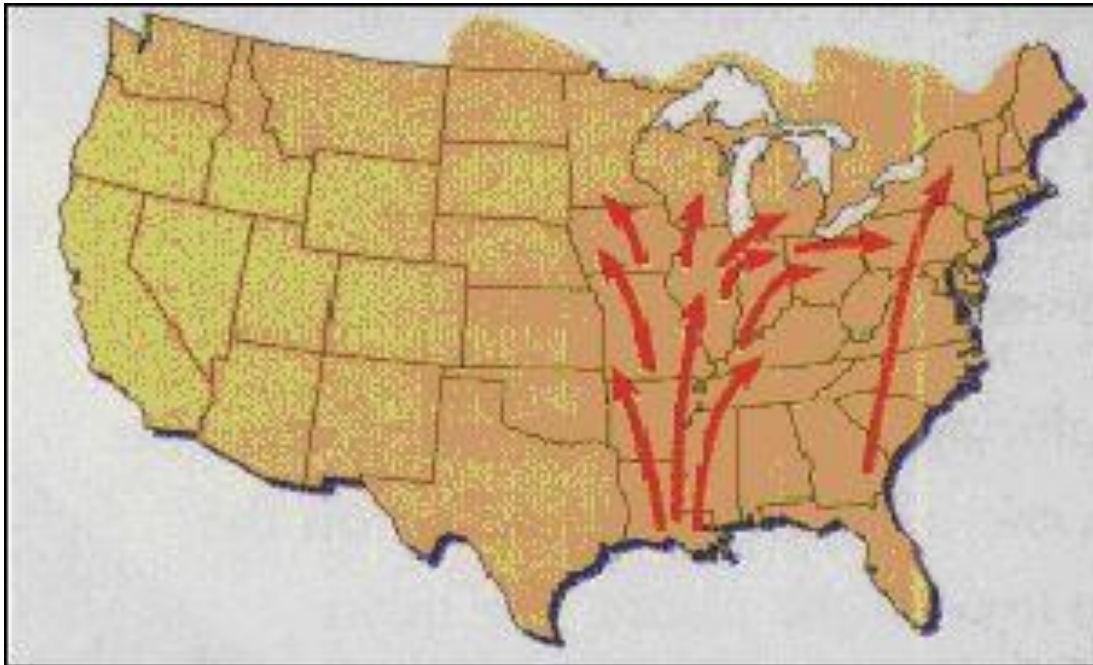




# Potato leafhopper (PLH)



- Does not overwinter in New York
- Adults migrate from gulf states
- Arrive June, 2-3 generations/yr
- Broad host range includes potato, beans, alfalfa
- Can infest quickly



# Potato leafhopper management

**Plant Resistance**

**Chemical Control**



**Cultural Control**

**Biological Control**

# Potato leafhopper management

**Plant Resistance**

**Chemical Control**



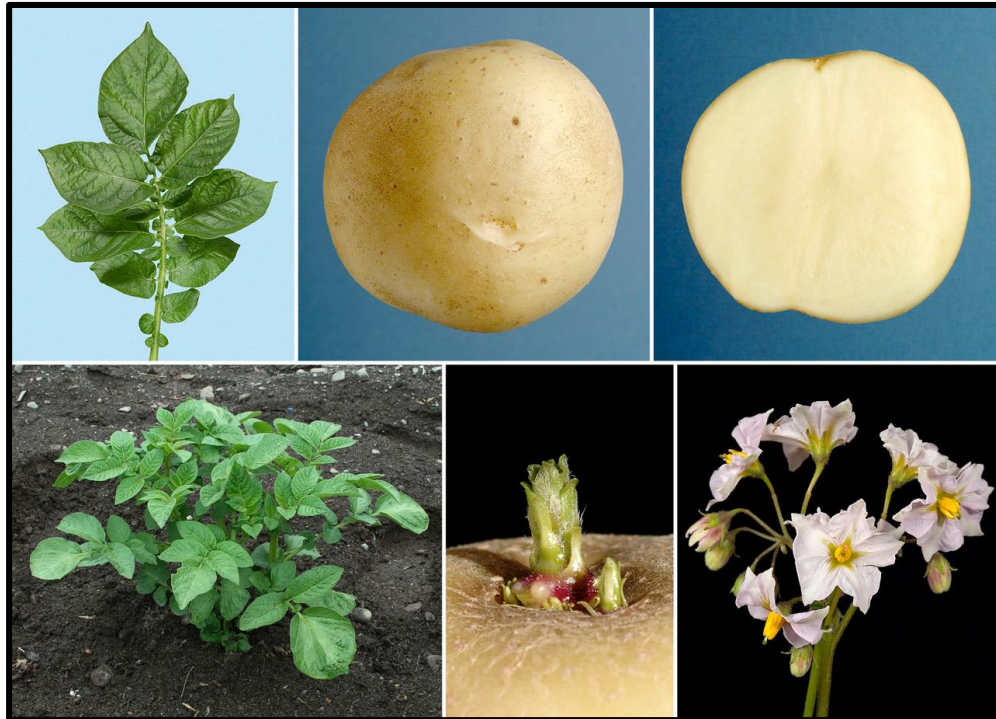
**Cultural Control**

**Biological Control**



# Plant Resistance

- **‘King Harry’ - developed by Walter DeJong**
  - Also resistant to aphids





# Potato leafhopper – Varietal Susceptibility





# Potato leafhopper management

## Scouting



- Monitor often (> June 1)
- Treat only when threshold exceeded (>1 adult/ sweep or > 15 nymphs per 50 leaves)
- Do not let nymphs build up

# Insecticides for PLH management in NY

## Conventional Insecticide Options

Product	Active ingredient	Group (IRAC group)
Lannate LV	methomyl	Carbamates (1A)
Assail 30SG	acetamiprid	Neonicotinoids (6)
Admire Pro, others	imidacloprid	
Platinum, Actara	thiamethoxam	
Leverage 360	imidacloprid + $\lambda$ -cyhalothrin	Neonicotinoid (6) + Pyrethroid (3A)
Endigo ZC	thiamethoxam + $\lambda$ -cyhalothrin	
Dimethoate 400	dimethoate	Organophosphates (1B)
Warrior II Zeon Technology	lambda-cyhalothrin	Pyrethroids (3A)
Besiege	$\lambda$ -cyhalothrin + chlorantraniliprole	Pyrethroid (3A) + Diamide (28)

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# Insecticides for PLH management in NY

## OMRI-Listed Insecticide Options

Product	Active ingredient	Group (IRAC group)
PyGanic Specialty	pyrethrin	Pyrethrins (3)
Aza-Direct, Neemix 4.5, others	azadirachtin	Unknown
Azera	azadirachtin +pyrethrin	Unknown + Pyrethrins (3)
Surround WP	kaolin clay	Unknown
JMS Stylet Oil	parafinic oil	Unknown
M-Pede	insecticidal soap	Unknown

2016 Cornell Organic Production and IPM Guide for Potatoes



# **insecticides evaluated for managing potato leafhopper in snap bean**

<b>Trt#</b>	<b>Product(s)*,**</b>	<b>Active Ingredient(s)</b>	<b>Rate</b>
1	Untreated	-	-
2	Azera	azadirachtin + pyrethrin	40 fl oz/acre
3	PyGanic Specialty	pyrethrin	0.4% v:v
4	Thyme Guard	thyme oil	0.5% v:v

**\*Insecticides were co-applied with the surfactant Nu-Film P @ 8 fl oz/acre**

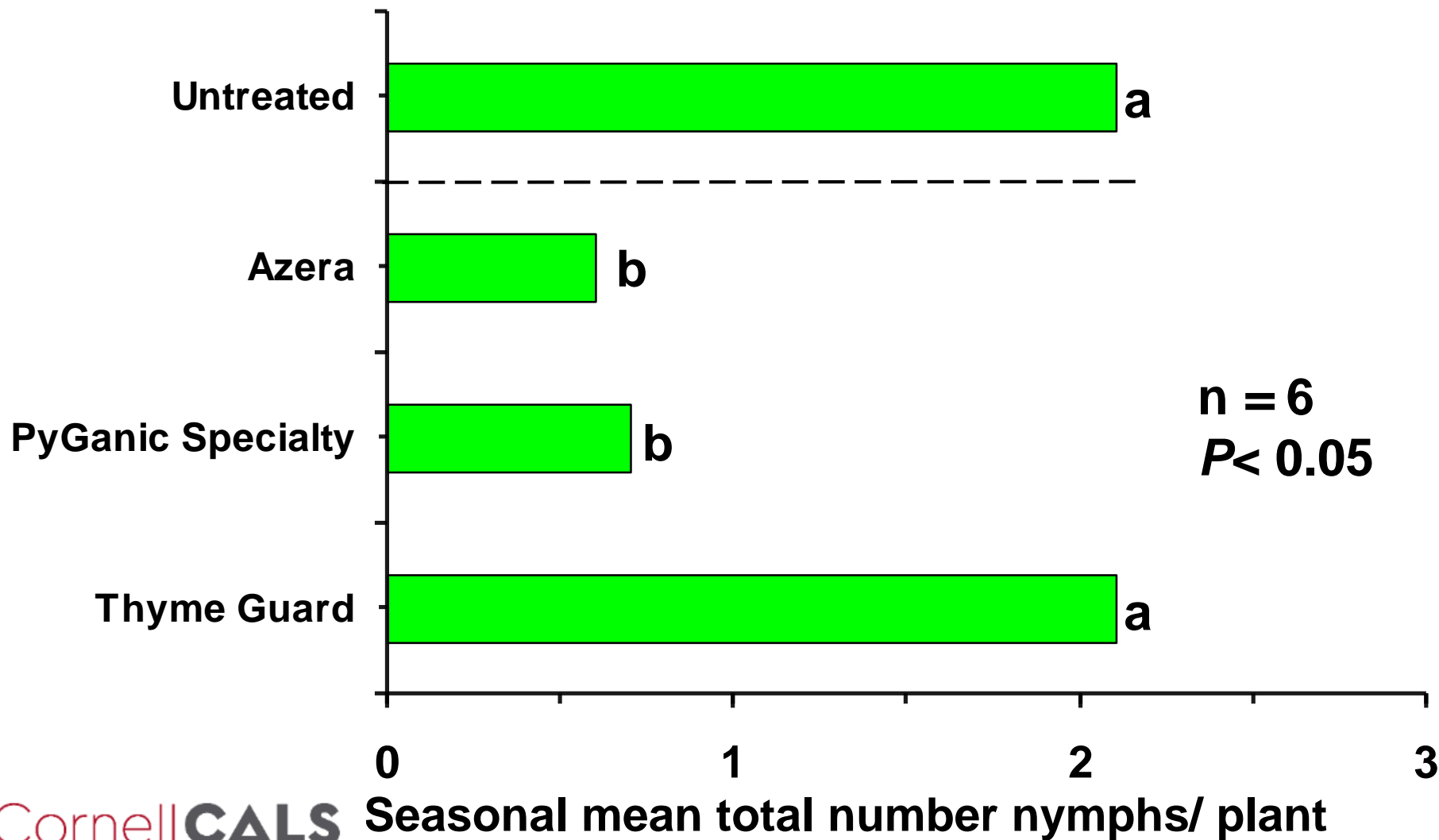
**\*\* Three applications were made on 11, 16 and 21 July**



# Insecticide Evaluation Trial

## NYMPHS

Geneva, NY 2017





# Take home points

## Colorado potato beetle



- Use cultural and chemical tactics to manage CPB
- Conserve predators by minimizing insecticide use
- Rotate classes of insecticides to slow down resistance

## Potato leafhopper



- Consider resistant cultivar 'King Harry'
- Monitor for PLH
- Management using insecticides



# Questions?



<http://nault.entomology.cornell.edu/>

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FEBRUARY 20, 2018

## BRIAN NAULT'S LAB

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### Welcome to our lab

The Nault Lab | Cornell University | Potatoes

Our research focuses on understanding the biology and ecology of insects that attack and/or spread viruses to vegetable crops as well as insects that are beneficial to these crops, such as pollinators. Major projects have included describing spatial and temporal patterns of insect dispersal and the epidemiology of insect-transmitted viruses in vegetable cropping systems.

#### Recent News

- Ashley Leach receives the 2017 Virtual Poster Award at ESA
- Riley Harding hired as Technician for the Nault Program
- Welcome to Professor Nault's new lab site!

#### Tweets by @cornellvegnet

Brian Nault @cornellvegnet  
#Biology #Ecology and management of onion thrips in commercial onion production systems bit.ly/2Qr5n9K #Entomology #Agriculture  
Jan 26, 2016

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Cornell Cooperative Extension

These guidelines are not a substitute for pesticide labeling. Always read and understand the product label before using any pesticide.