

Flies in the ointment: Update on onion maggot and Allium leafminer management



2020 Empire State Producers EXPO
January 15, 2020

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Cornell AgriTech
New York State Agricultural Experiment Station



Topics



Onion maggot

- Current insecticide options
- Insecticide resistance management guidelines



Allium leafminer

- Distribution and life history
- Current insecticide options



Onion maggot

- Major pest of onion
- Can reduce plant stands by nearly 100%
- Three generations per year





Insecticides registered on onion for onion maggot control

Product	Active Ingredient(s)	Class (IRAC ² group)	Application Type
FarMore FI500	thiamethoxam + spinosad	Neonicotinoid (4A) + Spinosyn (5)	Seed treatment
Regard SC ³	spinosad	Spinosyn (5)	Seed treatment
Sepresto 75WS	clothianidin + imidacloprid	Neonicotinoid (4A) + Neonicotinoid (4A)	Seed treatment
Trigard OMC	cyromazine	Triazine (17)	Seed treatment
Diazinon AG500 and OLF ¹	diazinon	Organophosphate (1B)	Pre-plant broadcast & incorporate
Lorsban Advanced and OLF ¹	chlorpyrifos	Organophosphate (1B)	At planting in-furrow, or Post-plant band

¹OLF: other labeled formulation.

²IRAC: Insecticide resistance action committee

³OMRI-Listed



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- EPA has threatened to pull all food uses for chlorpyrifos (e.g., Lorsban), including onion.
- NY chose NOT to ban Lorsban, but its use will be further restricted. Does it really matter for onion growers?



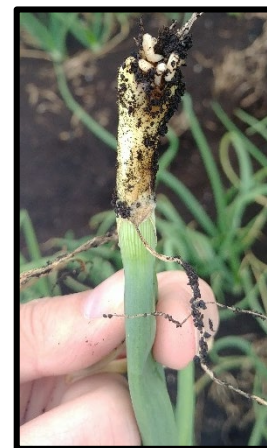


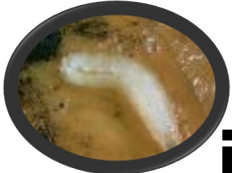
Is Lorsban needed for maggot control?

- **Evaluate efficacy of Trigard OMC seed treatment alone, FarMore FI500 seed treatment alone and both co-applied with chlorpyrifos (Lorsban)**

Seed treatment studies

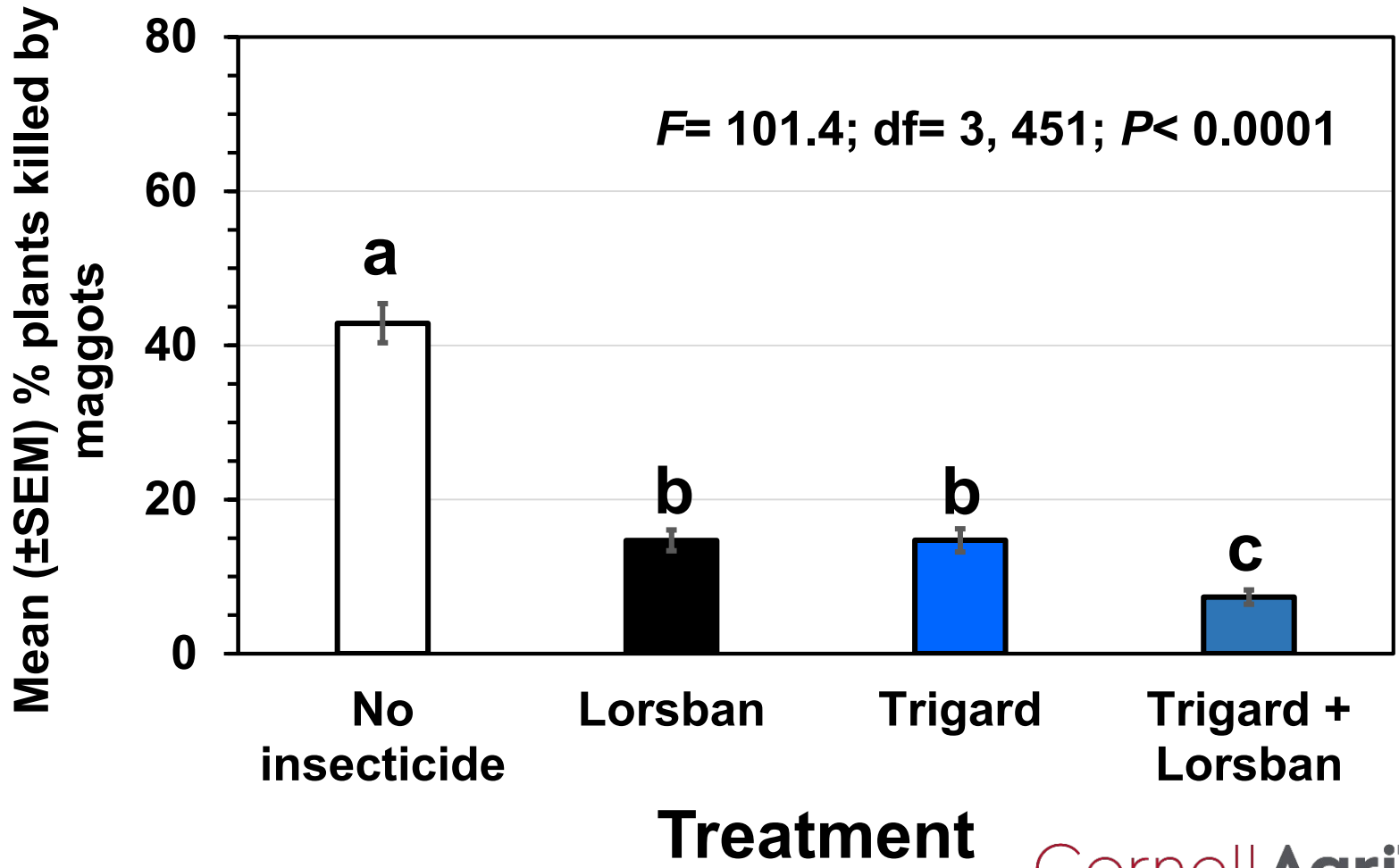
- Plots were 30-ft long and treatments replicated 5 times
- **Chlorpyrifos (Lorsban Advanced)** applied as a drench at planting @ **32 fl oz/acre**
- Seeds were treated commercially
- Numbers of field trials
 - **Trigard OMC** n=26 (2002-2016)
 - **FarMore FI500** n=5 (2012-2016)
- Numbers of onion plants dead or dying from maggots assessed 1-2 times per week during first generation



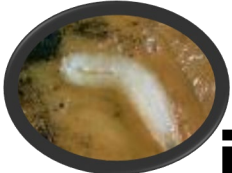


Onion maggot control using insecticides in direct-seeded onion

2002-2016 (n = 26 data sets; all regions in NY)

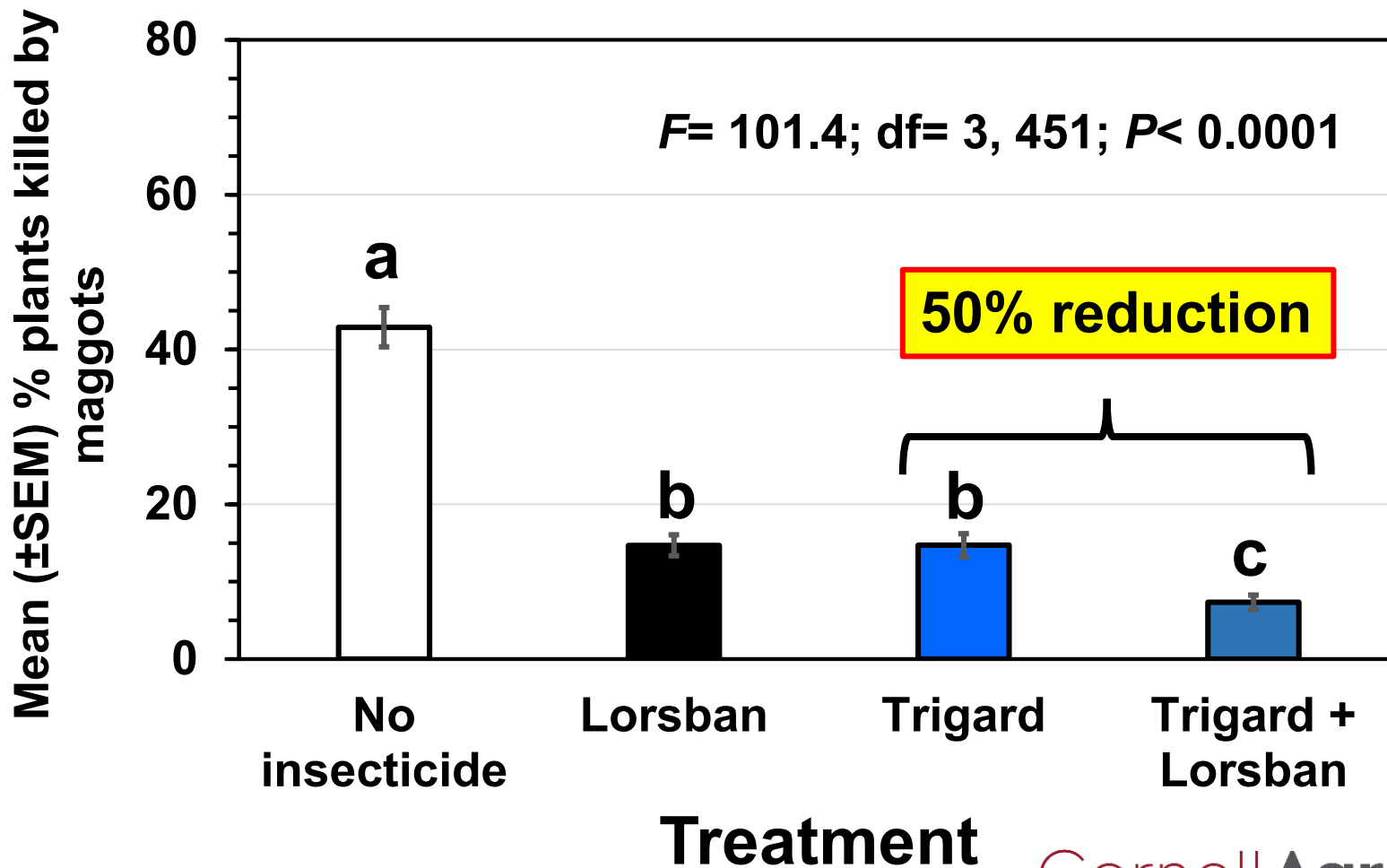


Note: Lorsban applied @ 1 qt/acre



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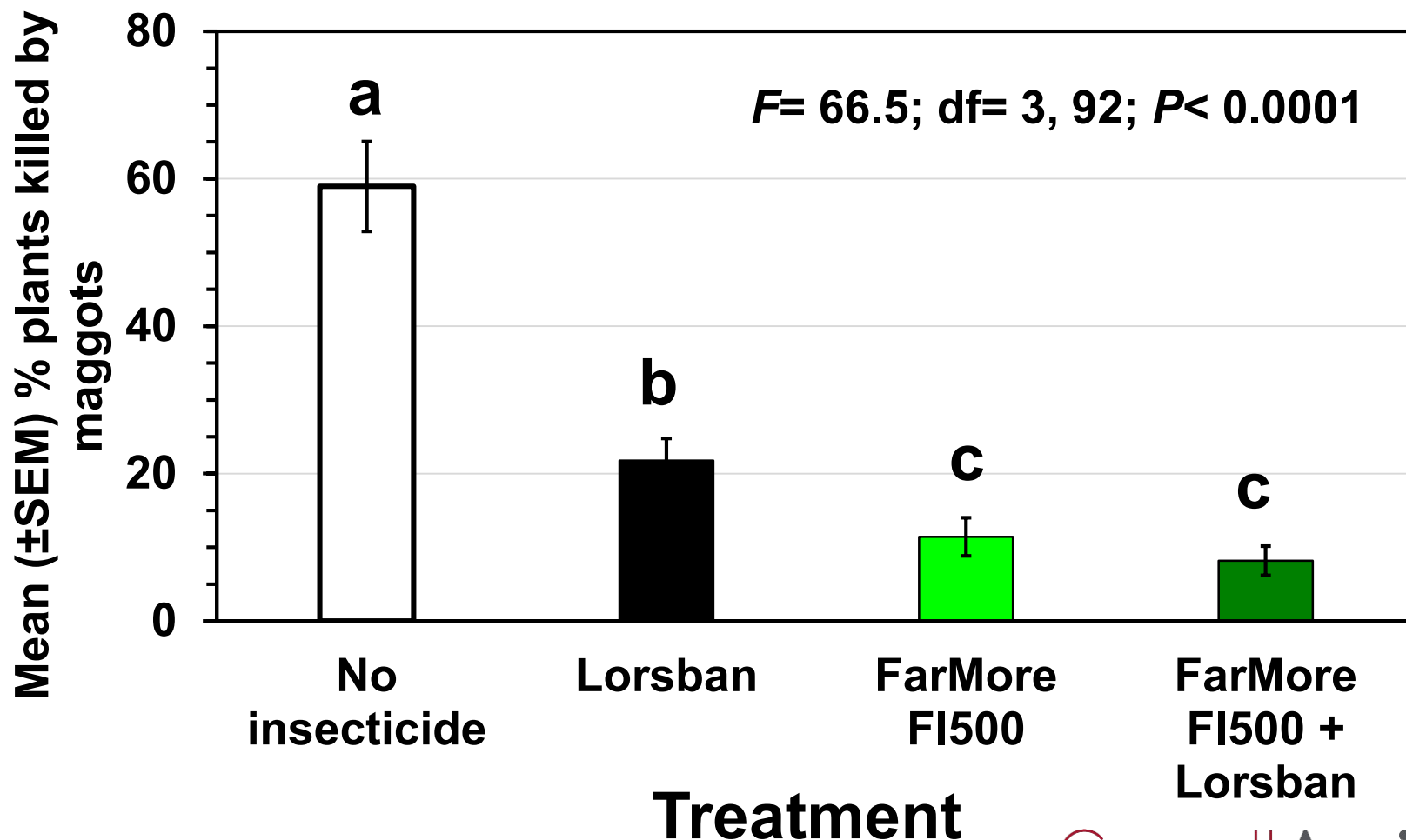


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Onion maggot control using insecticides in direct-seeded onion

2012-2016 (n = 5 data sets; Wayne and Oswego)

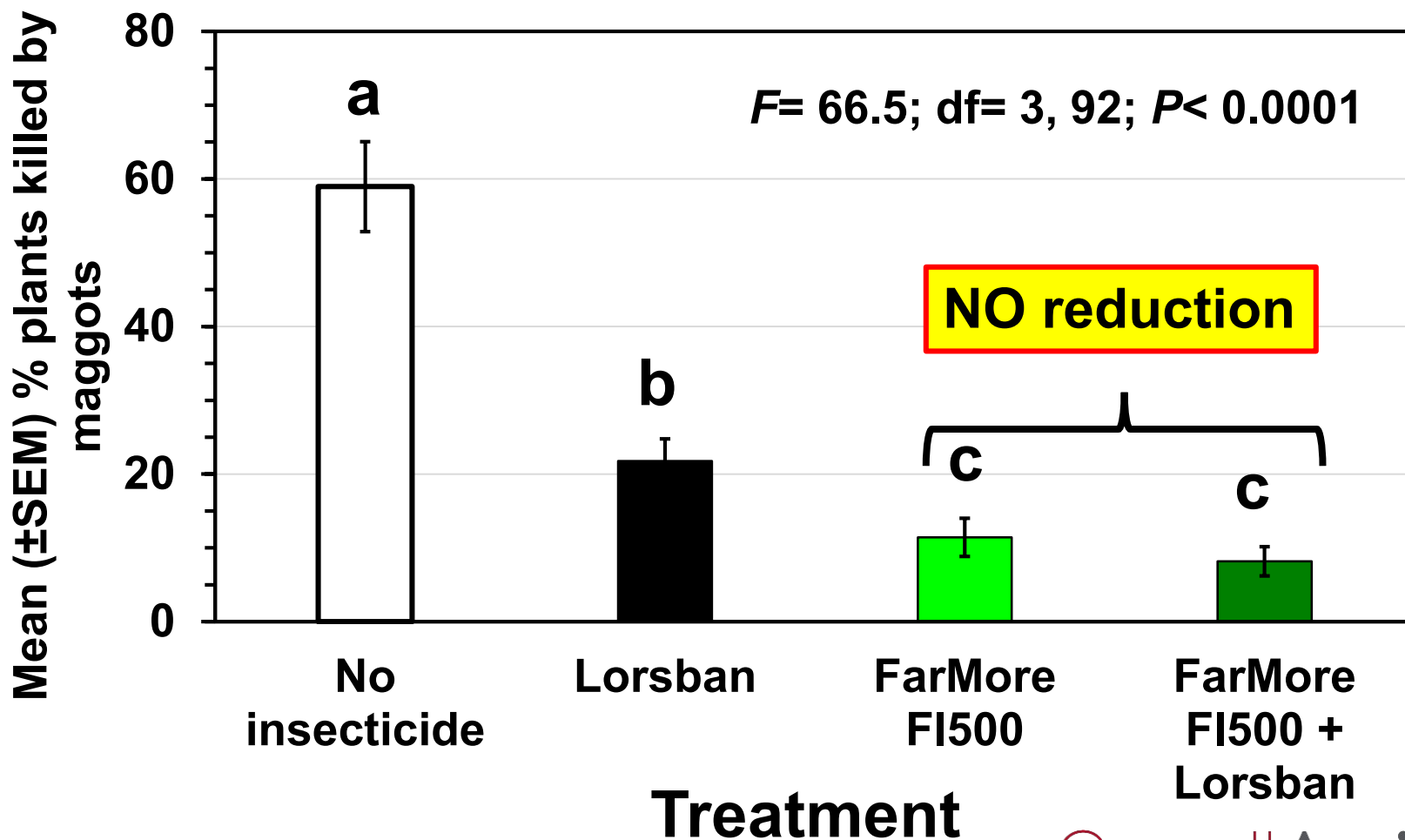


Note: Lorsban applied @ 1 qt/acre



Onion maggot control using insecticides in direct-seeded onion

2012-2016 (n = 5 data sets; Wayne and Oswego)



Note: Lorsban applied @ 1 qt/acre



Is Lorsban needed for maggot control?

- **Answer: Yes and No**
 - **Better onion maggot control was achieved by co-applying chlorpyrifos (Lorsban) drench with Trigard seed treatment, but not co-applying it with FarMore FI500 seed treatment**
-



So the realistic options for maggot control are...

- **FarMore FI500 seed treatment**
(spinosad kills onion maggot and seedcorn maggot; thiamethoxam kills seedcorn maggot)
 - **Trigard OMC + chlorpyrifos (Lorsban) drench**
(anecdotal - Trigard kills onion maggot, while Lorsban kills seedcorn maggot)
-



A “new” seed treatment option exists for onion maggot

“New” FarMore FI500 seed treatment package:

- Dynasty seed treatment fungicide
 - Maxim 4FS seed treatment fungicide
 - Apron XL seed treatment fungicide
 - Cruiser 70WS seed treatment insecticide
 - **Trigard OMC seed treatment insecticide**
-

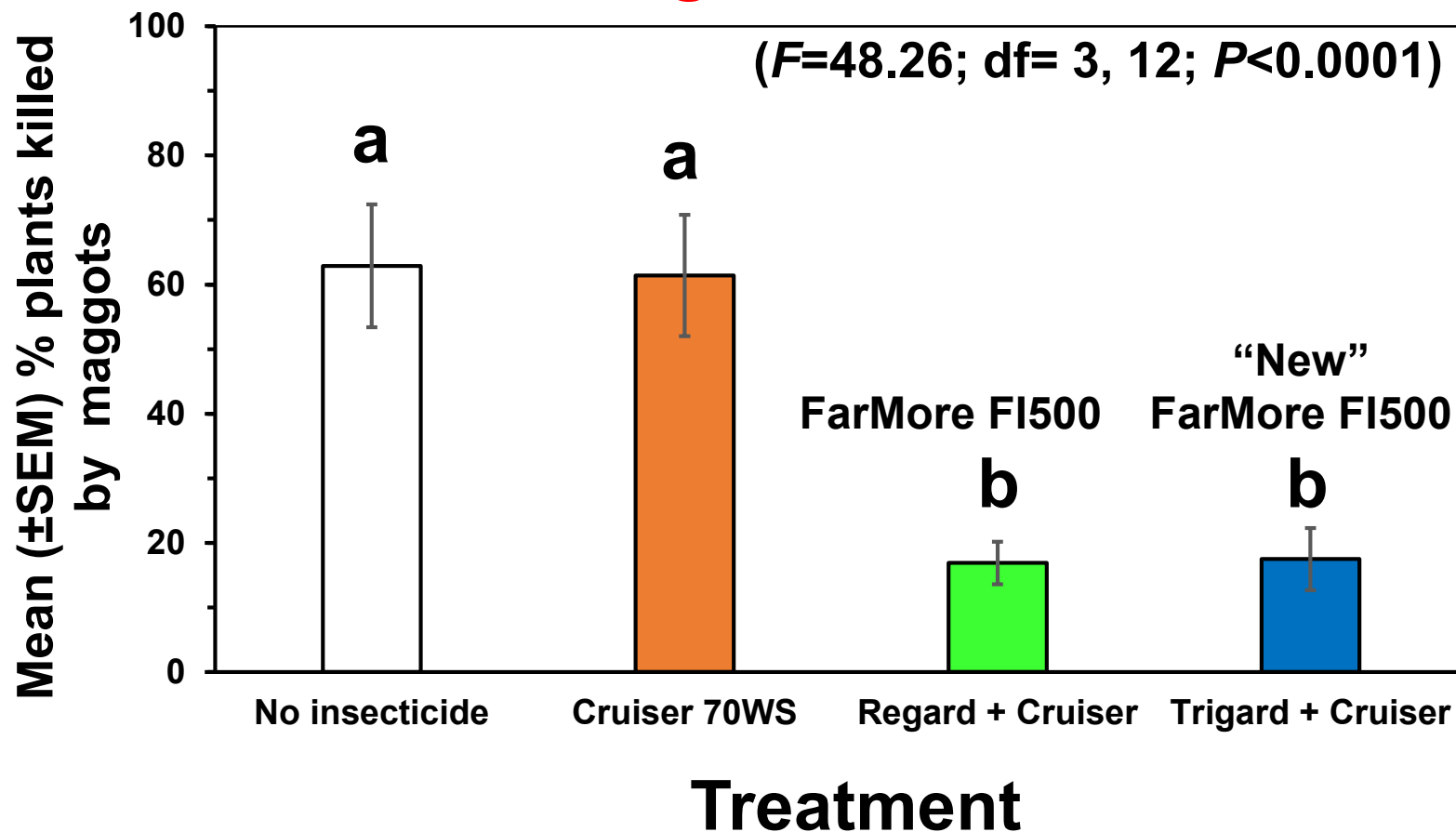
*Lorsban not needed



Onion maggot control using insecticides in direct-seeded onion



Oswego, NY 2019

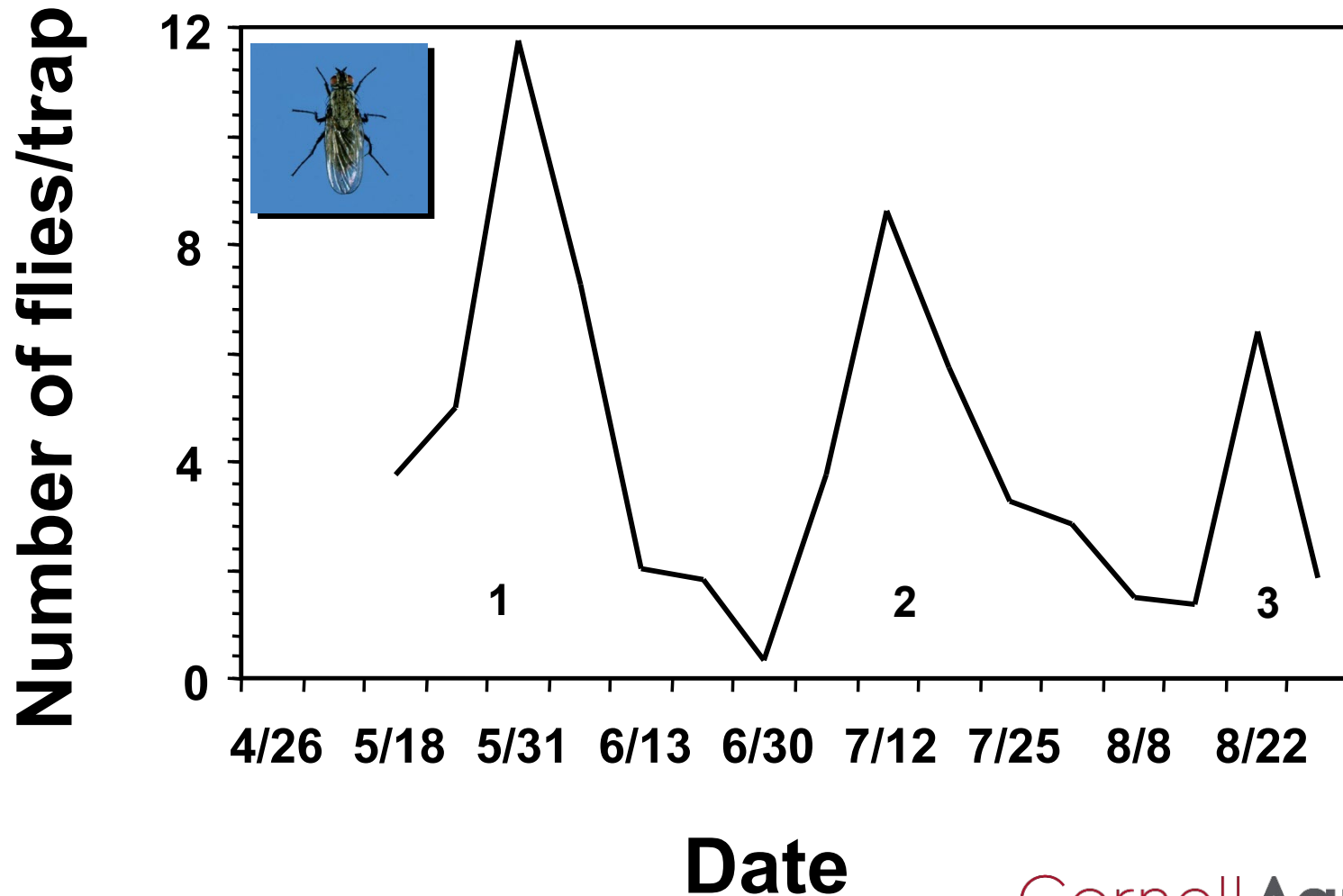


Notes: Apron XL, Maxim 4 FS and Dynasty on all;
Dithane F-45 Rainshield used; Lorsban not included

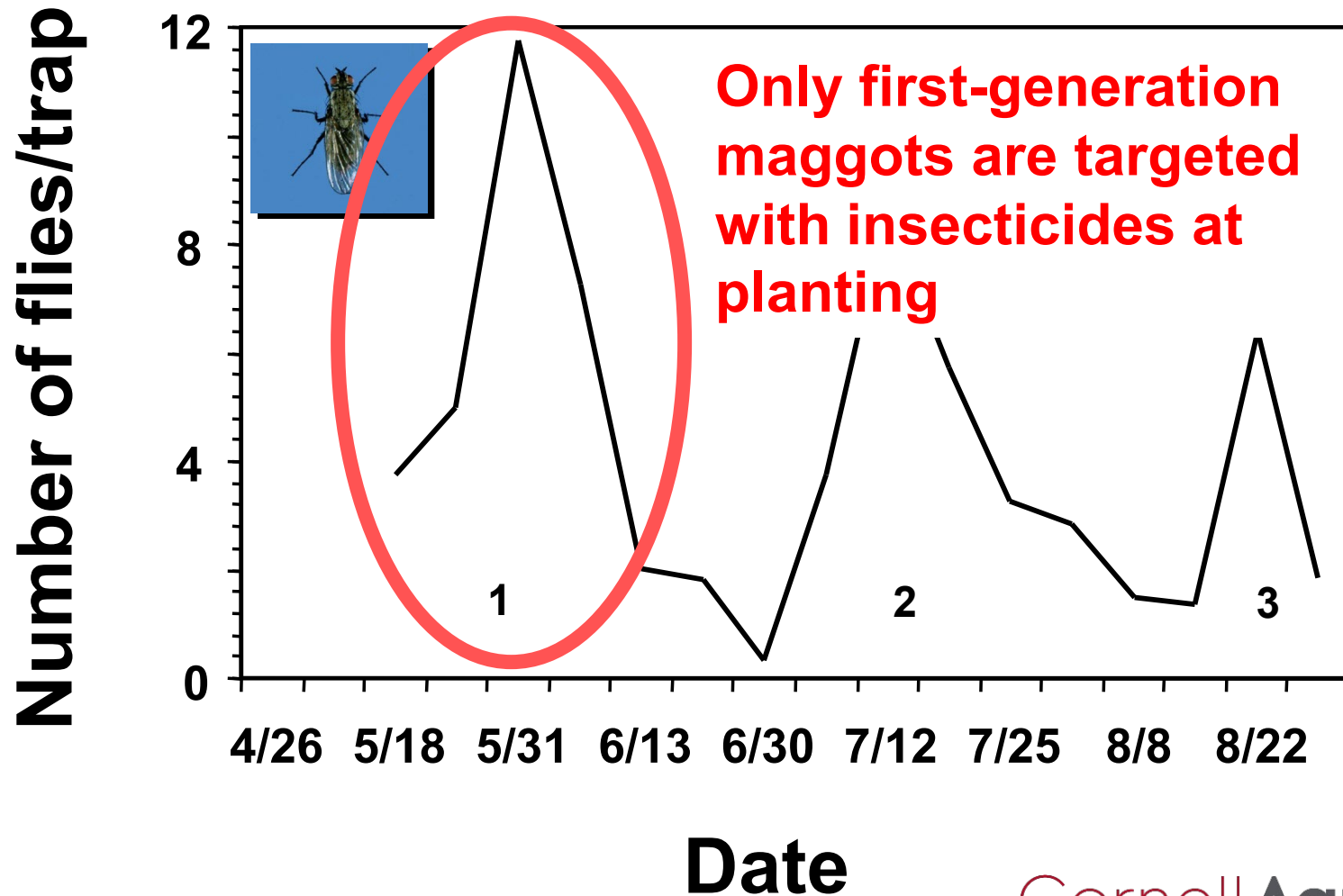
Insecticide Resistance Management (IRM) Principles

- **Minimize insecticide use; consider non-chemical tactics**
 - **Do not use more than one class of chemistry per insect generation**
 - **Rotate classes of chemistry (Regard & Trigard)**
-

Seasonal Activity of Onion Maggot Adults In New York (3 generations)

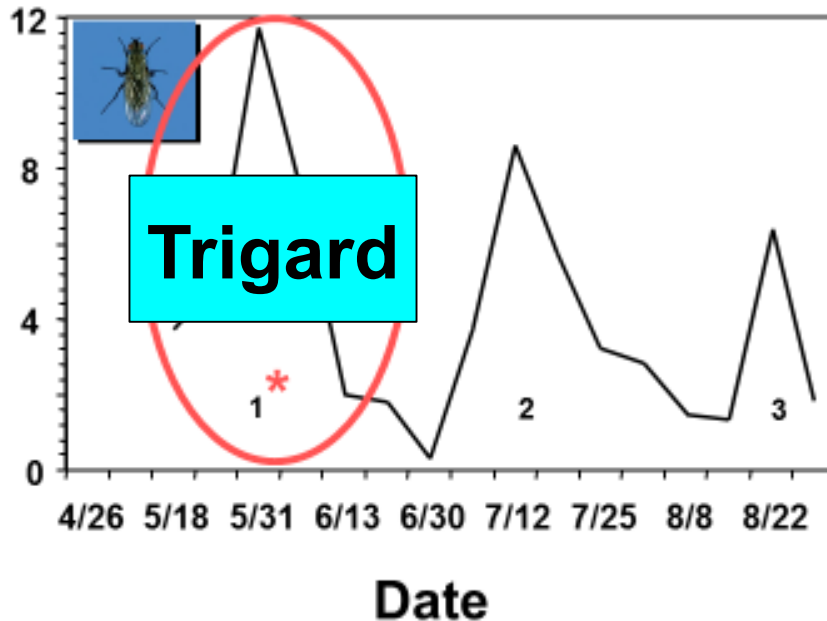
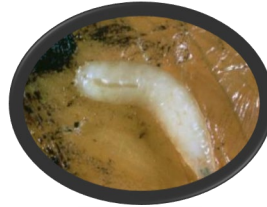


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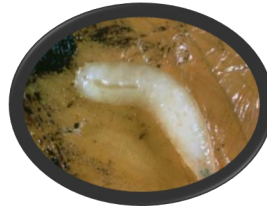


Annually rotate insecticide seed treatments to slow down resistance

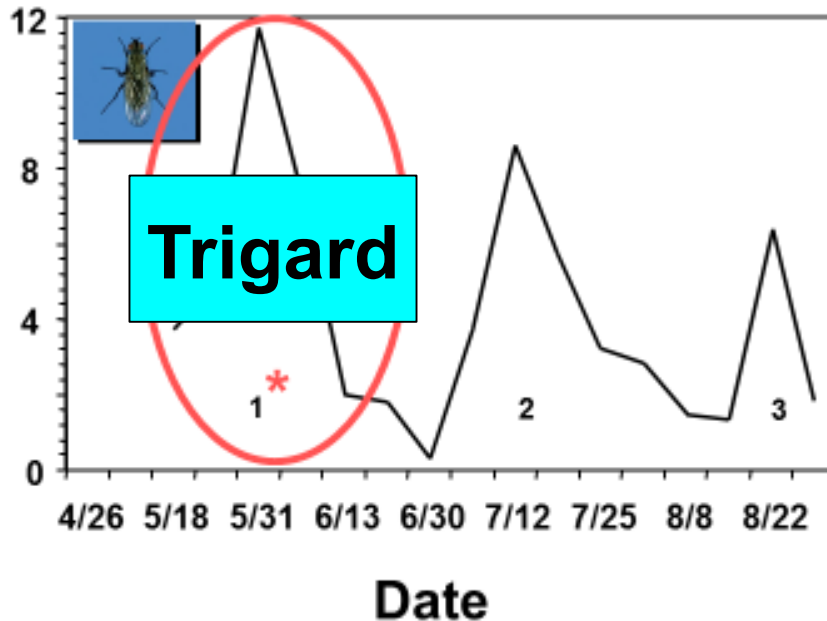
2020



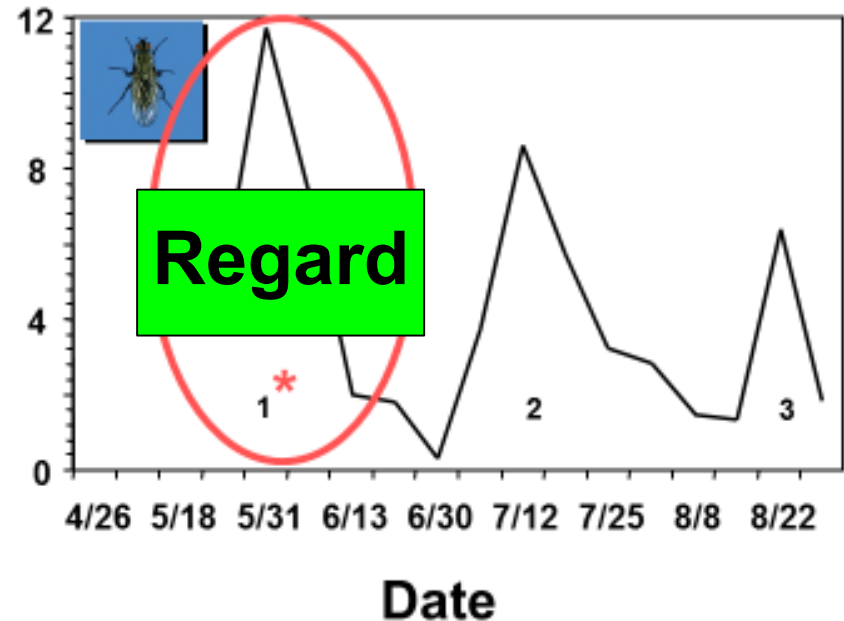
Annually rotate insecticide seed treatments to slow down resistance



2020



2021



*** Only 1 of 6 generations will be exposed to the same insecticide in 2 yrs**

Onion Maggot IIRM Plan

Year 1	Year 2	Year 3	Year 4
Trigard	Regard	Trigard	Regard

- Annually rotate onion seed treated with Trigard OMC and Regard SC
- Coordinate these efforts in locations where neighboring fields are planted by multiple growers

Options for onion maggot control in transplanted onions?

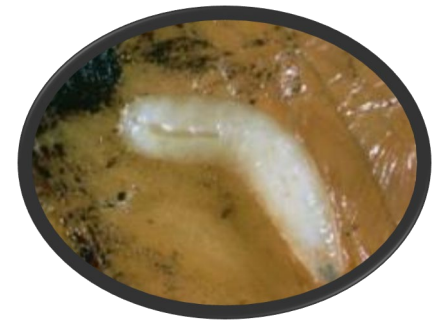




Insecticide options for onion maggot control in transplanted onions

- **Lorsban Advanced or OLF**
 - **not effective (i.e., resistance)**
 - **might be banned soon**
-

Could Entrust SC protect transplants from onion maggot?



Dipping bare-root onion plants in Entrust solution

Onion maggot control using insecticide dip treatments for transplants



cv. 'Bradley' Oswego, NY (n = 5) 2018-2019

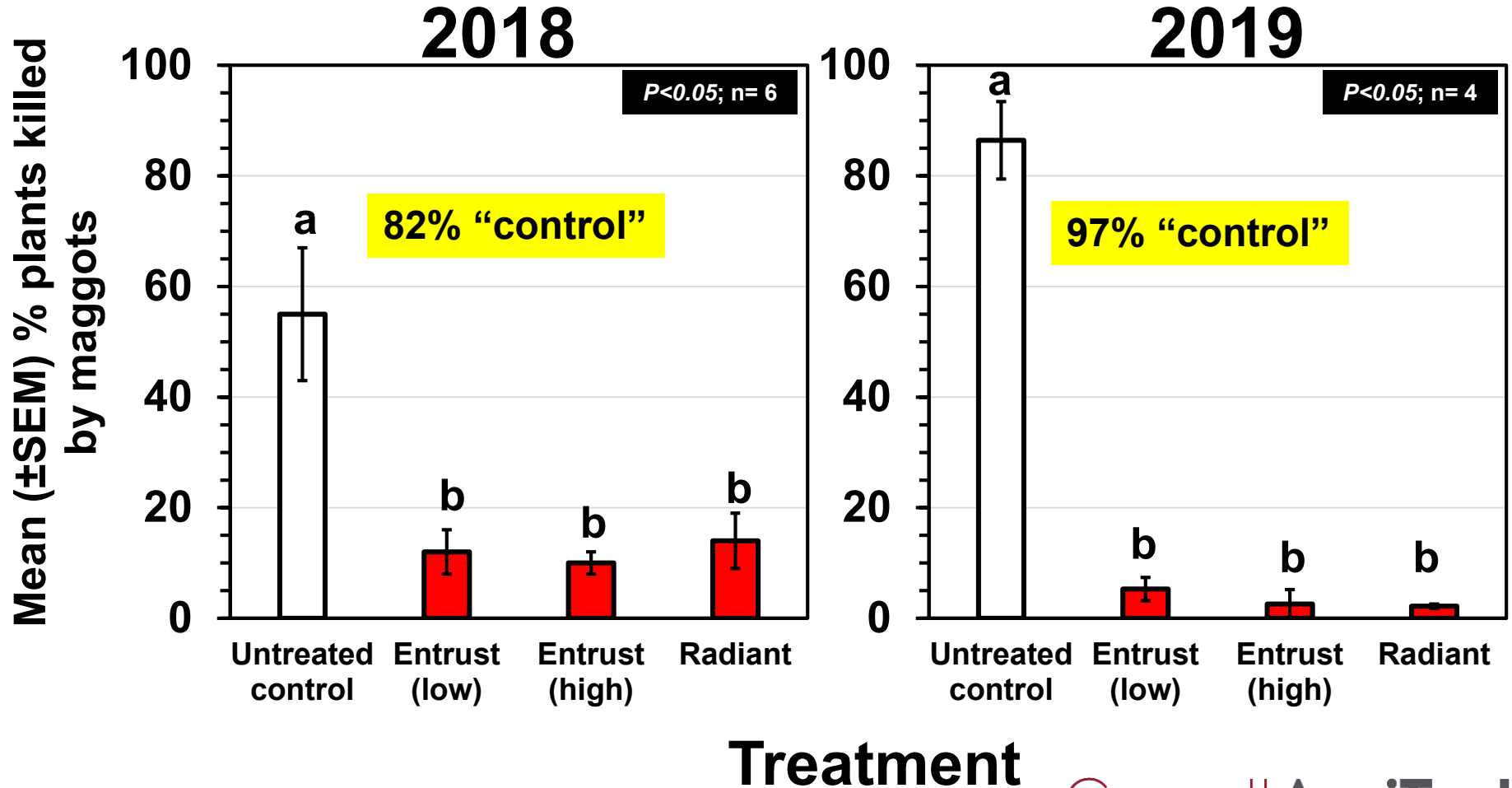
Treatment	Active ingredient	Rate*
No insecticide	-	-
Entrust SC	spinosad	1 fl oz/10,000 plants
Entrust SC	spinosad	2 fl oz/10,000 plants
Radiant SC	spinetoram	1 fl oz/gal of water

* 1.25 gallons of solution will treat
10,000 bare-root plants

Onion maggot control using insecticide dip treatments for transplants



cv. 'Bradley' Oswego, NY





Onion maggot control summary

- **Lorsban not needed with FarMore FI500**
 - **Lorsban added to Trigard improved control**
 - **“New” FarMore FI500 with Trigard should not need Lorsban**
 - **Mitigate resistance by annually rotating Trigard and Regard**
 - **Entrust SC may be a future option for protecting onion transplants**
-



Topics



Onion maggot

- Current insecticide options
- Insecticide resistance management guidelines



Allium leafminer

- Distribution and life history
- Current insecticide options

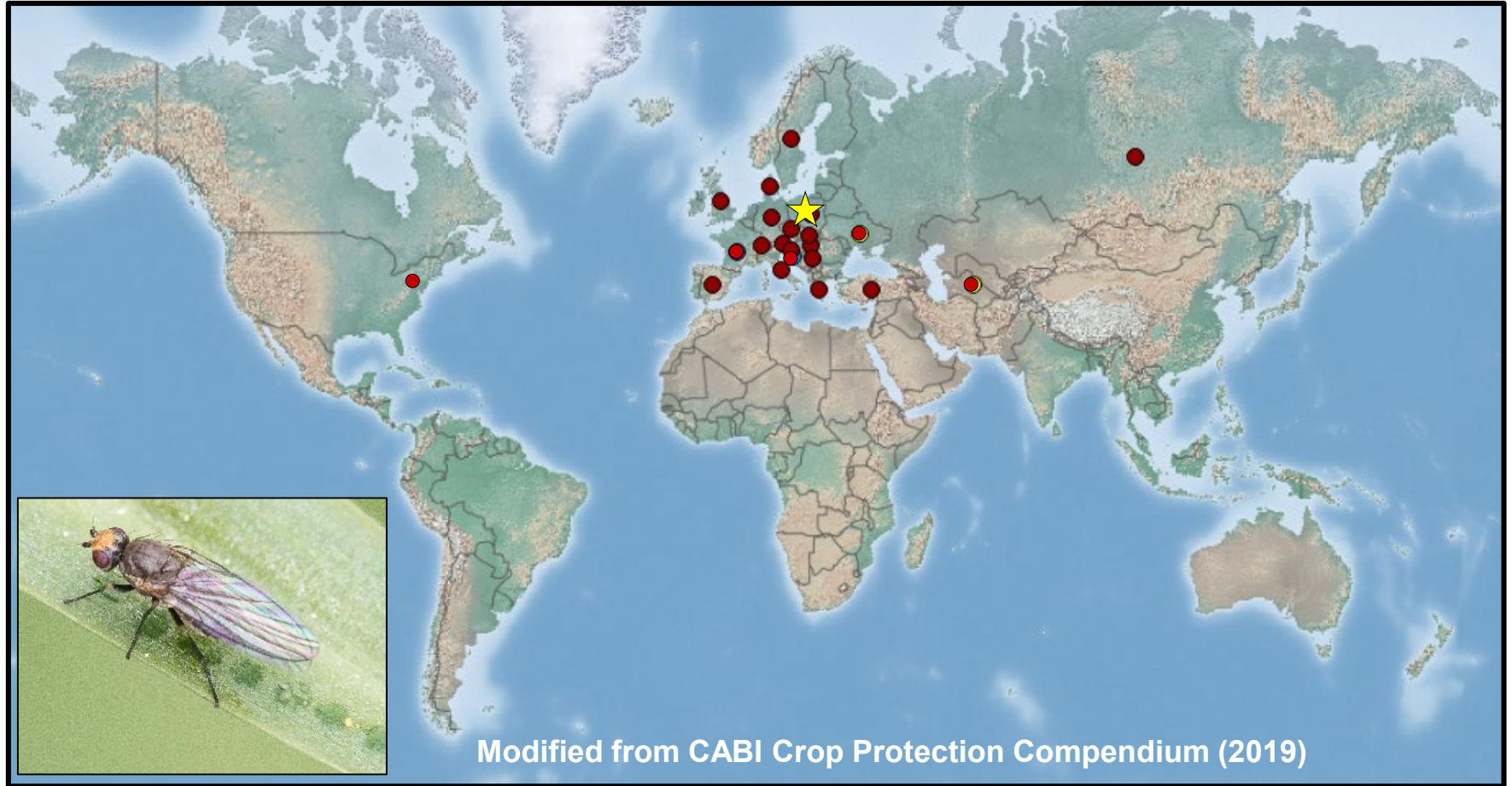


Allium leafminer (ALM), *Phytomyza gymnostoma*



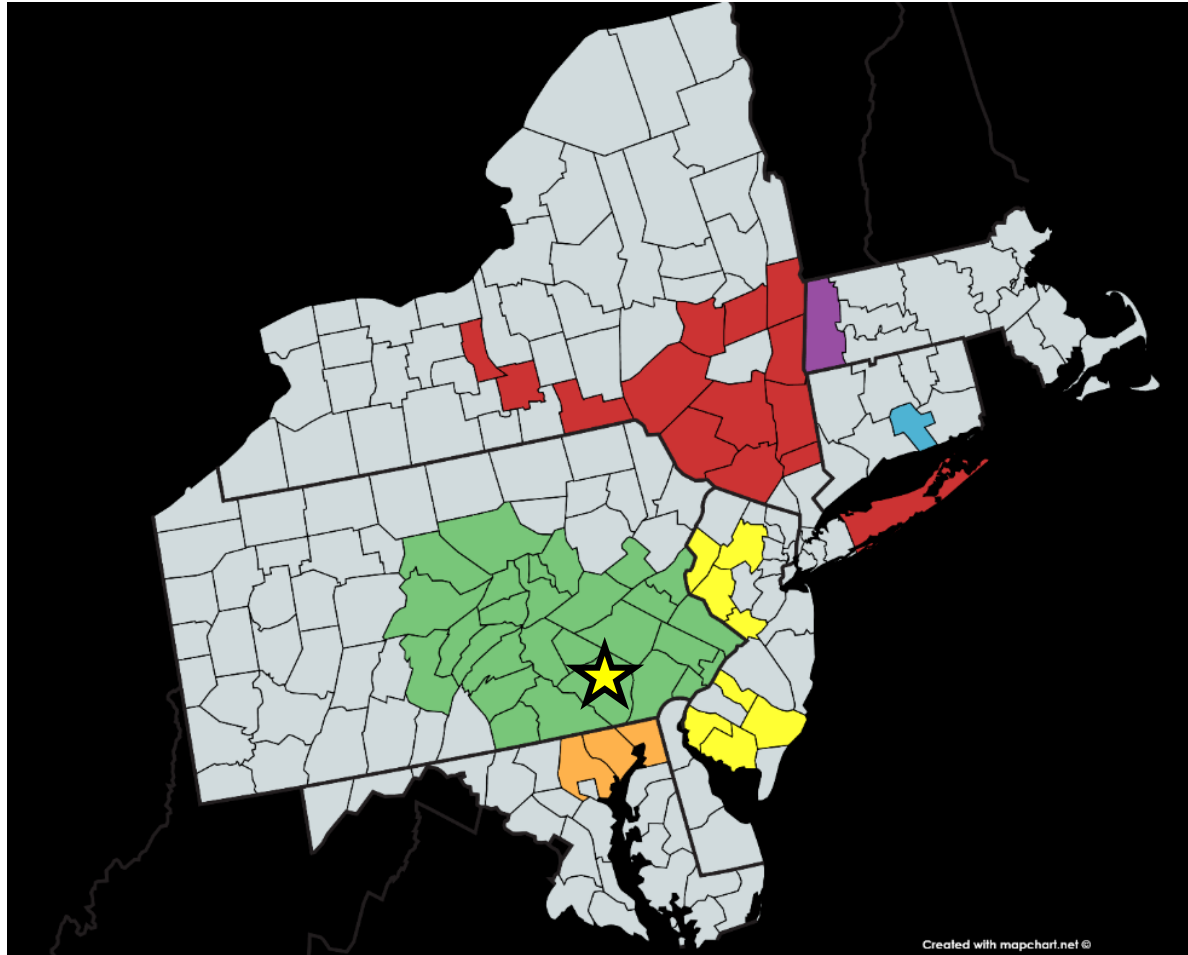
- First detected in North America in 2015
- New invasive pest of crops in the *Allium* genus
- Related to *Liriomyza* spp., but is monophagous

World distribution of *Allium* leafminer



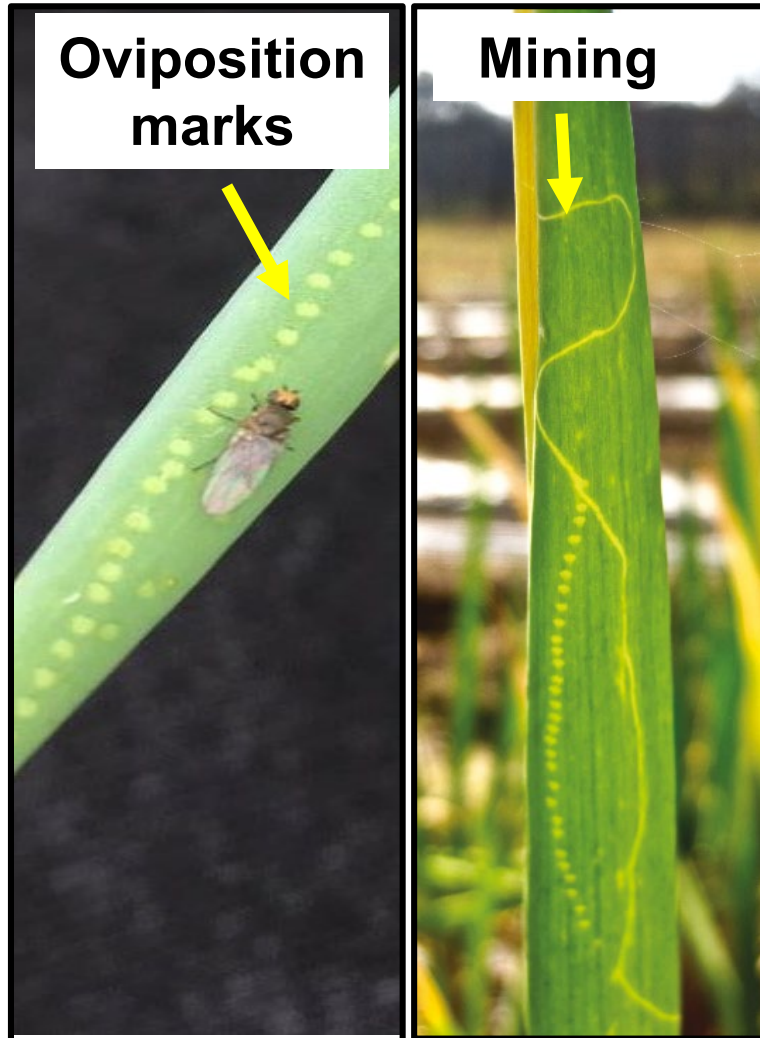
- ★ Origin – Poland (1858)
- 21 countries in Europe; 2 in Asia; 1 in NA

North American distribution of Allium leafminer



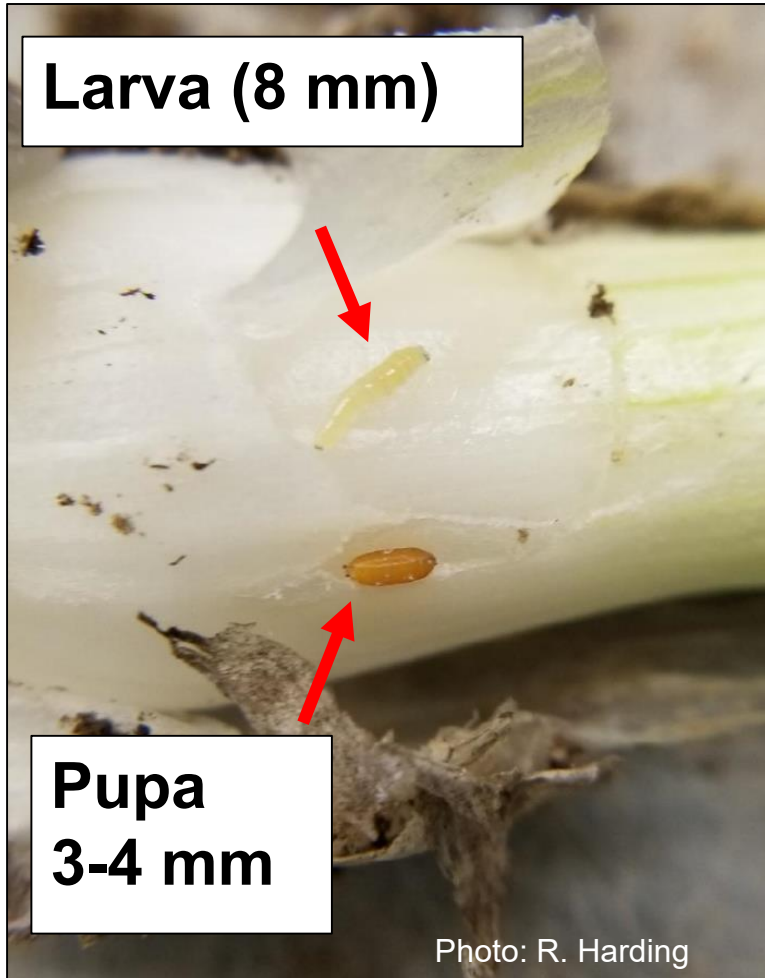
- ★ First detected in Lancaster County, PA (2015)
- Confirmed in CT, MA, MD, NJ, NY & PA (as of Nov. 2019)

Diagnostic features of an Allium leafminer infestation



- Larvae mine down the leaf to the lower portions of the plant where they will pupate

Damage by Allium leafminer



- Relatively large leafminer
- Infested plants often associated with bacterial rot



Allium leafminer has caused severe crop losses on small farms



Organic leeks in Seneca County, NY

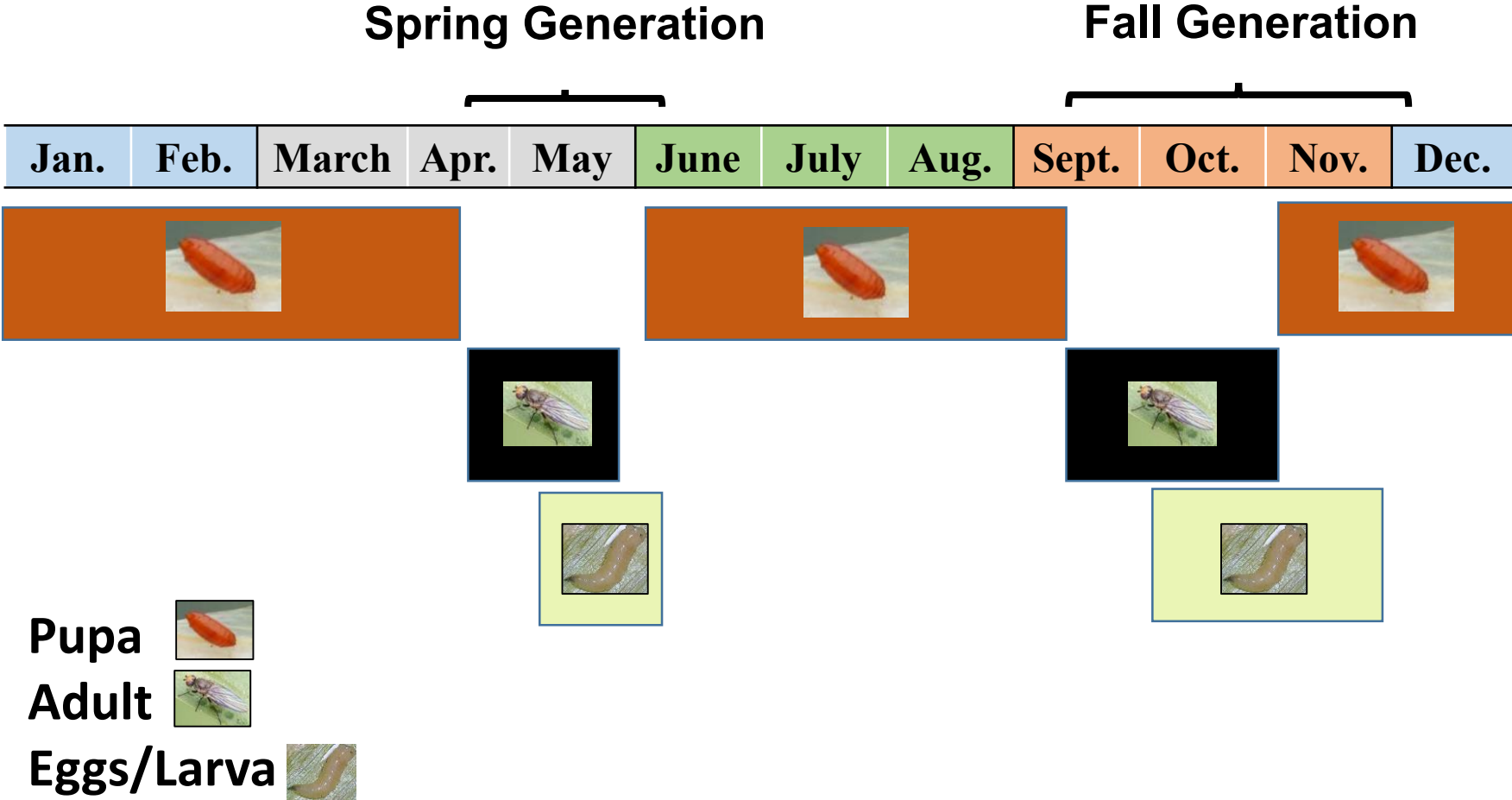
Damage by *Allium* leafminer



Bulb onion

- **Economic loss from ALM damage has not occurred in conventional bulb onion fields**
- **ALM infested onion bulbs are not common**

Life Cycle of Allium leafminer in Northeastern US



Bulb onion foliage availability for ovipositing *Allium* leafminer in Northeastern US

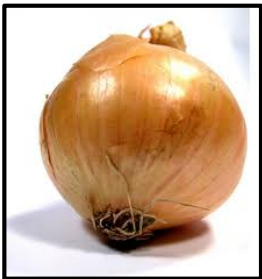
Transplanting

Sowing seeds

Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
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seeded onion

transplanted onion



Bulb onion foliage availability for ovipositing *Allium* leafminer in Northeastern US

Spring Generation

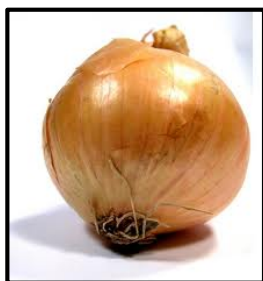
Fall Generation

Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
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***Transplanted onions are
at risk for *Allium* leafminer
infestation only in the
spring**

seeded onion

transplanted onion



Insecticides for *Allium* leafminer control in Europe

➤ Effective active ingredients

Active ingredient (IRAC classification)

- abamectin (6)
- acetamiprid (4A)
- cypermethrin + chlorpyrifos (3A + 1B)
- cyromazine (17)
- dimethoate (1B)
- imidacloprid w and w/o deltamethrin (4A + 3A)
- spinosad (5)
- fenitrothion (1B)
- novaluron (15)

Insecticides for *Allium* leafminer control in Europe

➤ Effective active ingredients

Active ingredient (IRAC classification)

Registered
on bulb
vegetable
crops in US

- abamectin (6)
- acetamiprid (4A)
- cypermethrin + chlorpyrifos (3A + 1B)
- cyromazine (17)
- dimethoate (1B)
- imidacloprid w and w/o deltamethrin (4A + 3A)
- spinosad (5)
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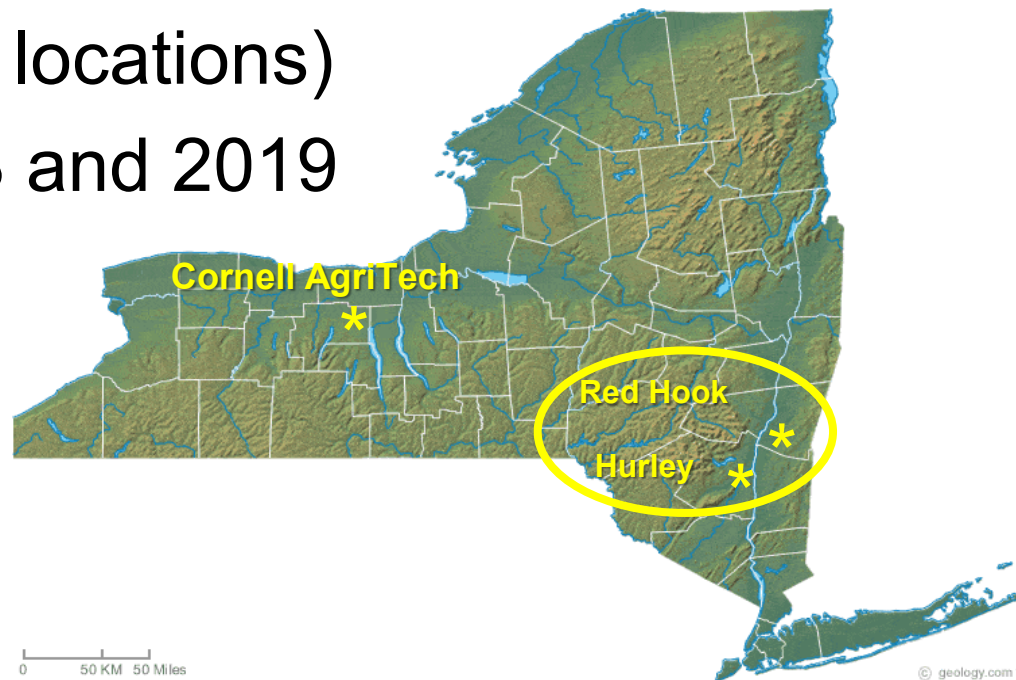
What insecticides and delivery strategies control ALM?

- Identify effective insecticides (**conventional** and **OMRI-Listed**)
 - Evaluate foliar applications and at-plant transplant treatments
-


Locations

New York

- ✓ Bulb onions in spring 2018
- ✓ Leeks in fall 2018 (2 locations)
- ✓ Scallions in fall 2018 and 2019



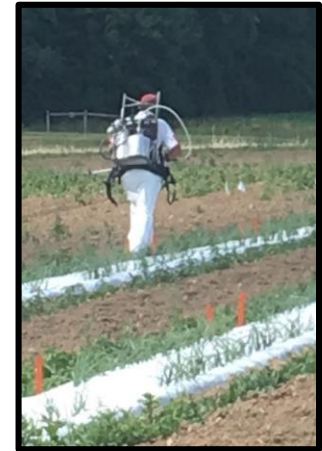
Insecticides evaluated for Allium leafminer control

Active ingredient ¹	Product	 OMRI LISTED <small>For Organic Use</small>	IRAC Group	# of trials
abamectin	Agri-Mek SC	no	6	3
acetamiprid	Assail 30SG	no	4A	3
azadirachtin*	Aza-Direct	yes	unknown	4
azadirachtin + pyrethrin*	Azera	yes	unknown + 3A	1
cyantraniliprole	Exirel	no	28	4
cyromazine	Trigard	no	17	3
dinotefuran	Scorpion 35SL	no	4A	4
imidacloprid	Admire Pro	no	4A	3
kaolin clay*	Surround WP	yes	unknown	1
lambda-cyhalothrin	Warrior II w/zeon tech.	no	3A	3
methomyl	Lannate LV	no	1A	2
pyrethrin*	PyGanic Specialty	yes	3A	4
spinetoram	Radiant SC	no	5	4
spinosad*	Entrust SC	yes	5	3
spirotetramat	Movento	no	23	1


¹**Conventional products** co-applied with LI-700; **OMRI products** co-applied with either Nu-Film or M-Pede

Foliar application strategy

- Two-row plots (10-ft long)
- Plots sprayed with a **hand-held CO₂ -backpack sprayer** (twin-flat fan nozzles, 48 gpa @ 40 psi)
- **Applications made weekly either in May (n=4) or Sept/Oct (n=5 or 6)**
- Ten to 50 plants per experimental unit were removed, **dissected and inspected for larvae and pupae**




RESULTS: Foliar application strategy for Allium leafminer control

Active ingredient	Product		% trials significantly reduced damage	Mean % control
dinotefuran	Scorpion 35SL	no	100 (n=4)	89
cyantraniliprole	Exirel	no	75 (n=4)	84
spinetoram	Radiant SC	no	75 (n=4)	78
methomyl	Lannate LV	no	50 (n=2)	85
lambda-cyhalothrin	Warrior II w/zeon tech.	no	33 (n=3)	79
acetamiprid	Assail 30SG	no	33 (n=3)	78
cyromazine	Trigard	no	33 (n=3)	68
spinosad*	Entrust SC	yes	25 (n=4)	70
abamectin	Agri-Mek SC	no	0 (n=3)	69
imidacloprid	Admire Pro	no	0 (n=3)	59
kaolin clay*	Surround WP	yes	0 (n=1)	44
spirotetramat	Movento	no	0 (n=1)	35
azadirachtin + pyrethrin*	Azera	yes	0 (n=1)	22
azadirachtin*	Aza-Direct	yes	0 (n=4)	10
pyrethrin*	PyGanic Specialty	yes	0 (n=4)	0

NOTE: Results for each trial are available at:

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

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abamectin	Agri-Mek SC	no	0 (n=3)	69
imidacloprid	Admire Pro	no	0 (n=3)	59
kaolin clay*	Surround WP	yes	0 (n=1)	44
spirotetramat	Movento	no	0 (n=1)	35
azadirachtin + pyrethrin*	Azera	yes	0 (n=1)	22
azadirachtin*	Aza-Direct	yes	0 (n=4)	10
pyrethrin*	PyGanic Specialty	yes	0 (n=4)	0

NOTE: Results for each trial are available at:
<http://nault.entomology.cornell.edu/extension/>

Transplant application strategies

- **Spinosad (Entrust SC)** used in all trials @ a rate of 1 fl oz/ 10,000 plants (*this use is not currently labelled*)
- Two most common transplant types

Bare root

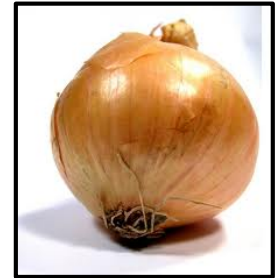
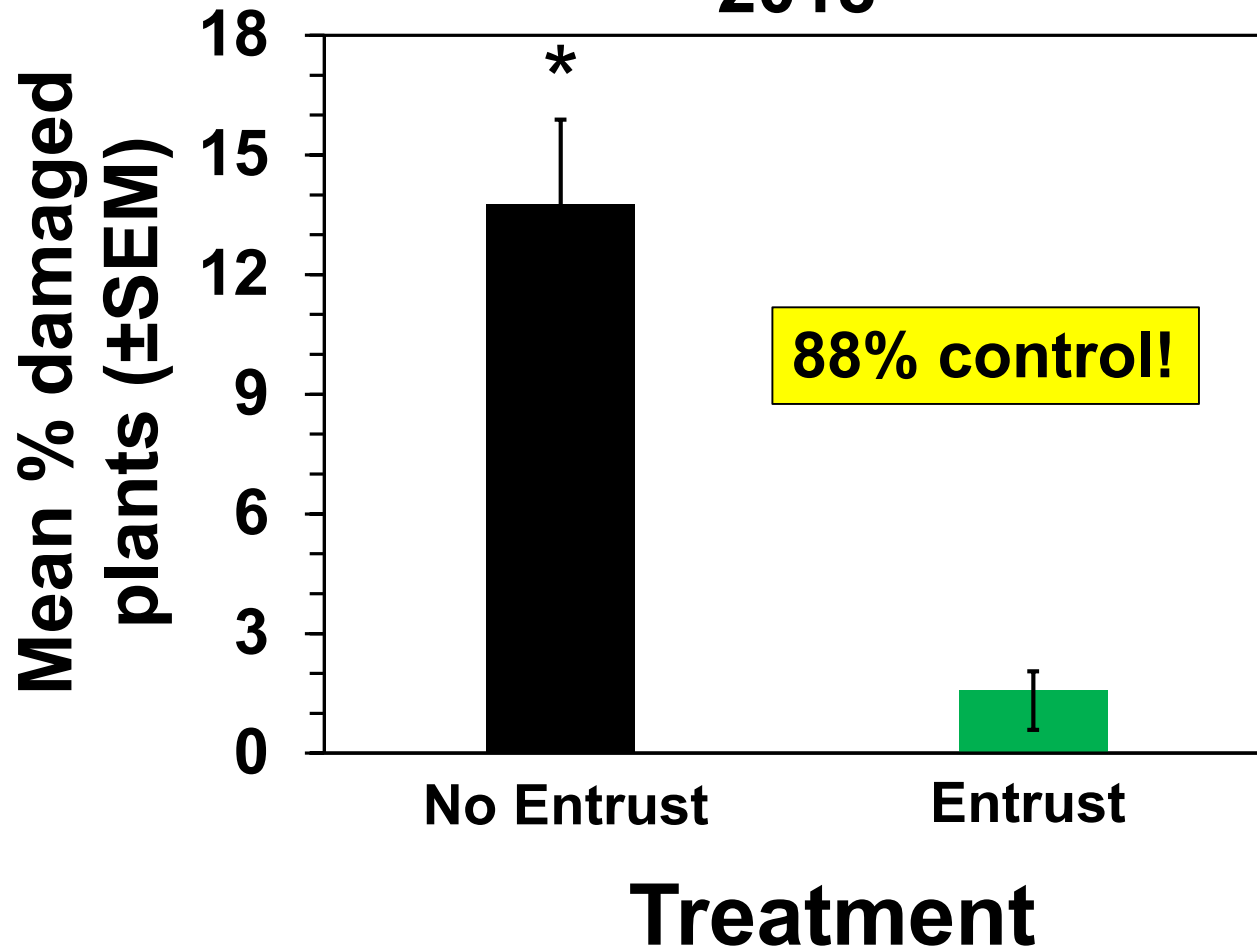


Plug plant



RESULTS: Transplant application strategy (bare-root dip) for *Allium* leafminer control in bulb onions

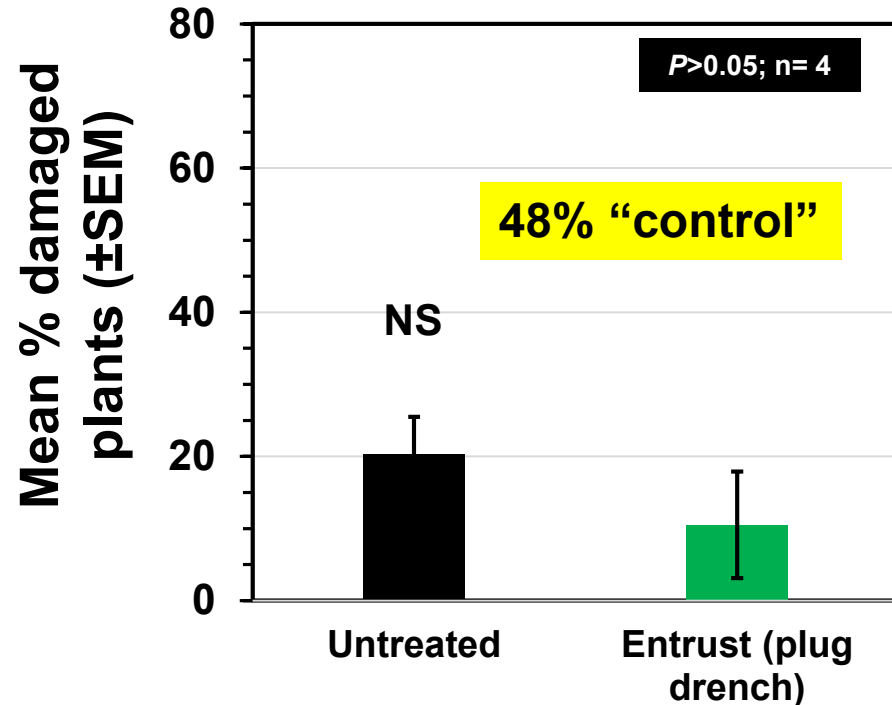
2018



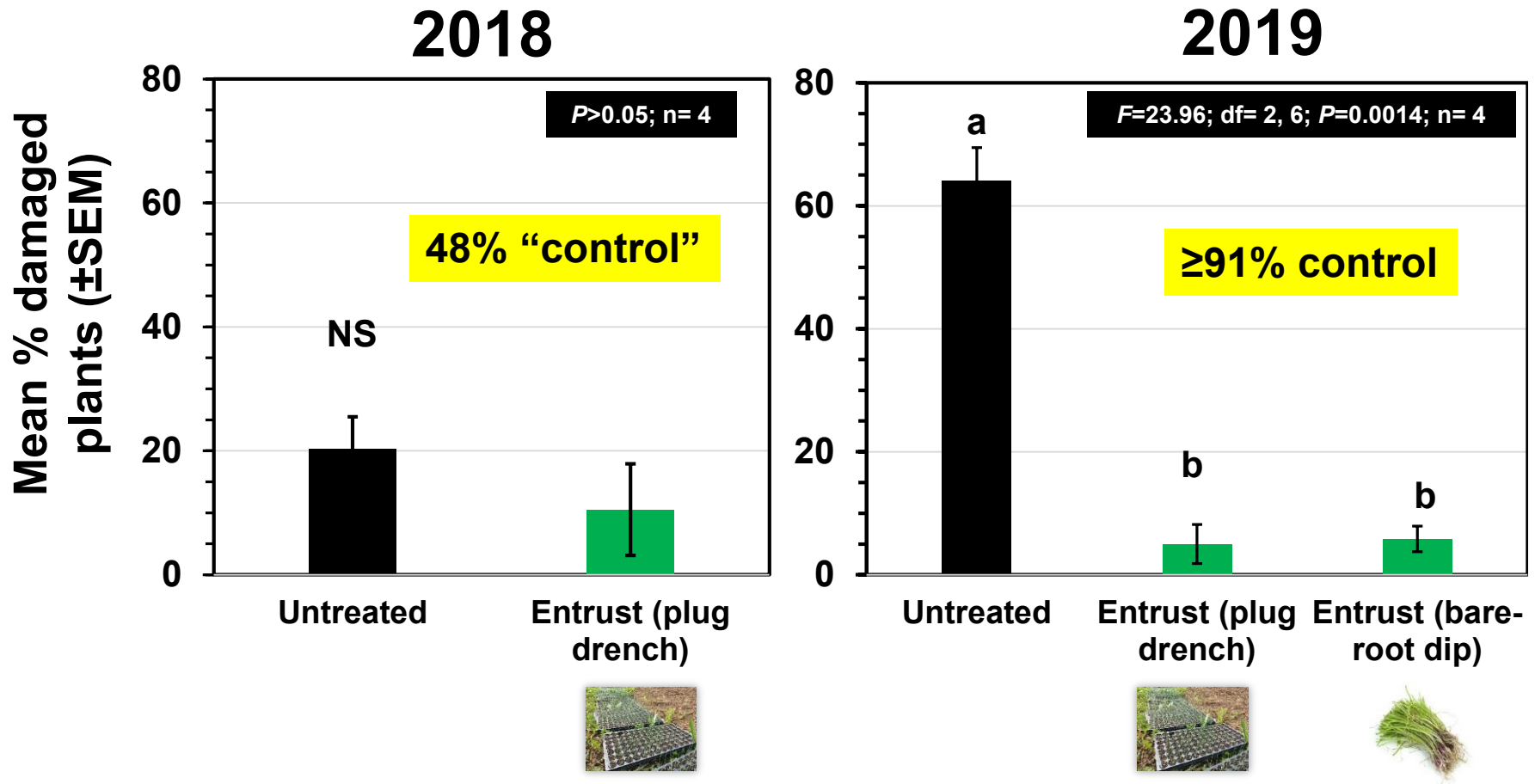
$F=90.6$; $df= 1, 45$; $P<0.0001$

RESULTS: Transplant strategies (plug plant) for Allium leafminer control in scallions

2018



RESULTS: Transplant strategies (plug plant & bare-root) for Allium leafminer control in scallions





Allium leafminer control summary

- Transplanted onions at greater risk than direct-seeded
 - Most consistently effective foliar-applied insecticides
 - cyantraniliprole (Exirel)
 - dinotefuran (Scorpion 35SL)
 - spinetoram (Radiant SC)
 - spinosad (Entrust) (best OMRI-Listed product evaluated)
 - **Note:** all are labeled for leafminers on bulb vegetables; Scorpion is not labelled in NY
 - **Spinosad (Entrust SC)** was effective as a bare-root dip and plug plant drench treatment (*but not labeled for this use...yet*)
-

Acknowledgements

Cornell Entomology

Riley Harding Ashley Leach
Lindsay Iglesias Erica Moretti
Mason Clark Karly Regan
Kellie Damann
Dylan Doeblin
Erin Equinozzi
Nate Hesler
Megan Kelly

Cornell Coop. Extension

Ethan Grundberg
Teresa Rusinek
Sarah Elone
Nate Mengaziol
Andy Galimberti
Natasha Field
Laura McDermott

Funding:



United States Department of Agriculture
National Institute of Food and Agriculture

