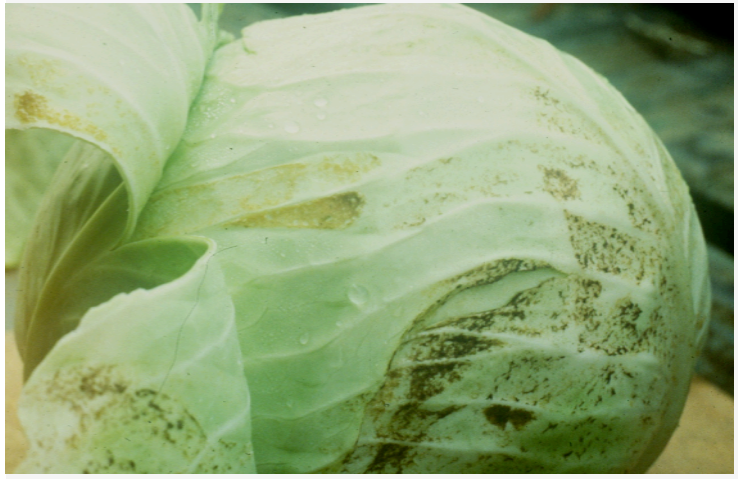
Managing Thrips & Other Pests on Cabbage

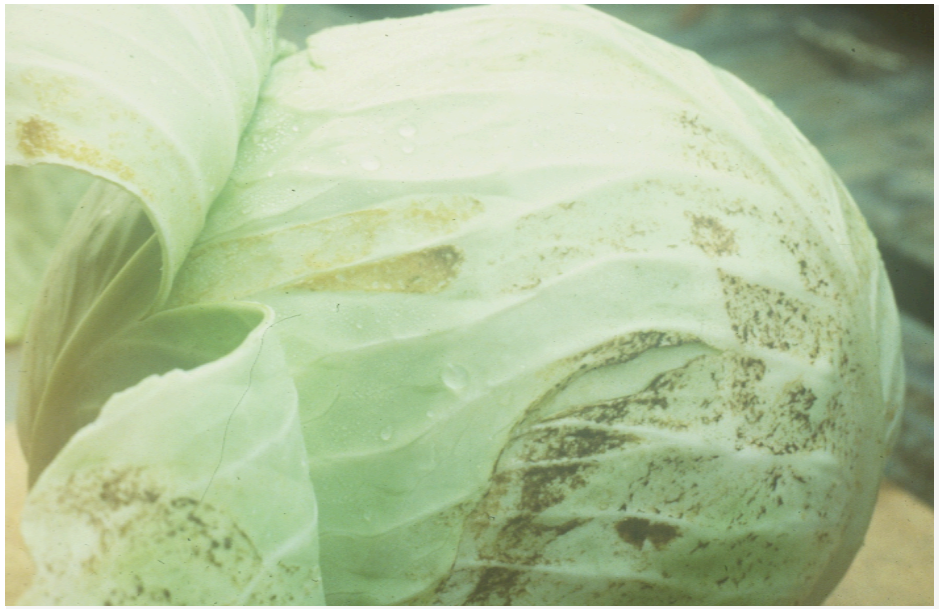


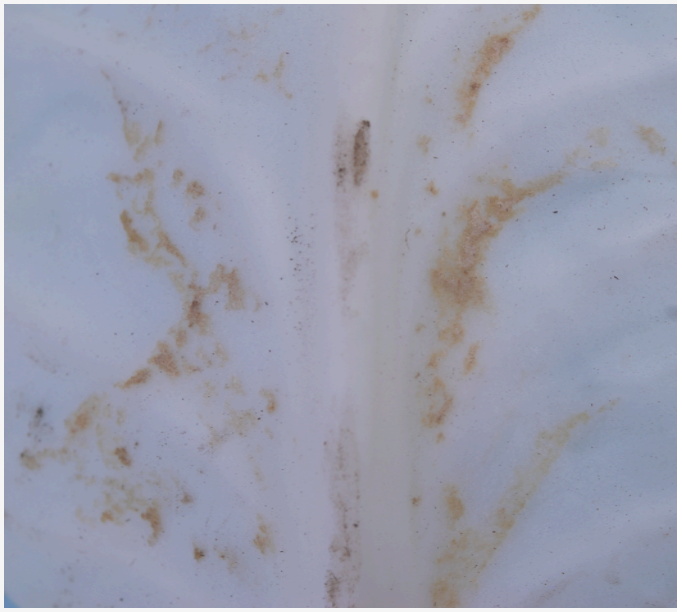
Celeste Welty
Extension Entomologist
Ohio State University
December 2014

Topics

- Thrips
- Caterpillars & parasitoids
- B.t.

Onion Thrips on Cabbage



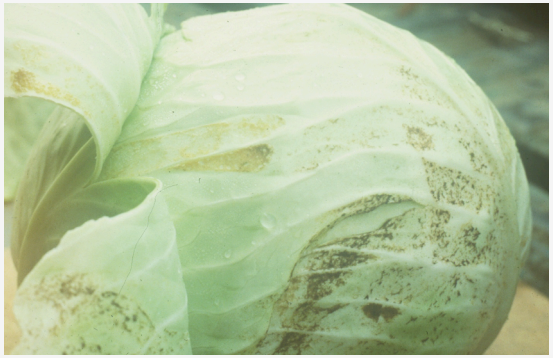


- Feed by rasping
- Brown rough patches
- Damage deeper in head in some varieties
- Damage can be trimmed after harvest
- Evaluate varieties by trim weight

Cultural controls for thrips

- **Select thrips-tolerant variety**
- **Choose winter cover crop**
  - Thrips do best in wheat
  - Thrips do poorly in rye
- **Avoid planting near wheat**
  - Thrips infestation often follows wheat harvest

Thrips on Cabbage



Less damage	More damage
Bravo	Azan
Fresco	Atria
Cheers	Coleguard
Titanic 90	Megaton
KingCole	Upton
Superkraut	Hinova
	Krautpacker
	Rodolpho
	Superdane

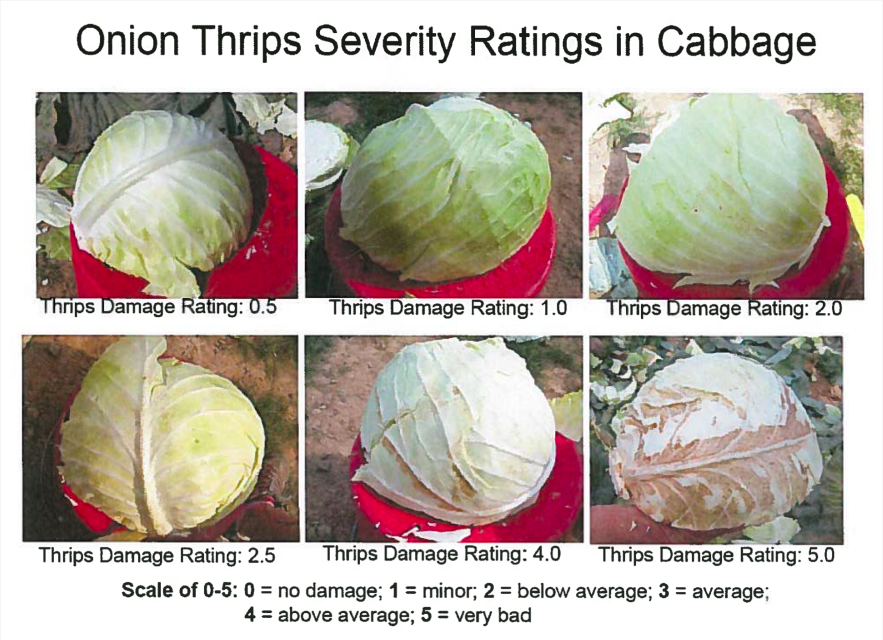
Data on >80 varieties
Trials 1987-1999
C.Hoy, K.Scaife, M.Kleinhenz

Chemical controls for thrips

- Spray at cupping stage
- Insecticides choices:
  - Some pyrethroids: Brigade, Ammo, Mustang
  - Metasystox-R
  - SpinTor, Radiant
  - Movento
  - Assail
  - Admire
- No insecticides give very good control
- Research NY: side-dress Admire best

Thrips damage rating

- Scale 1 to 5
- Rate each of outer 10 leaves of cabbage head
- Use sum of 10 ratings per head



Trial 2010
(Fremont, Ohio, 'SuperKraut'

Treatment	Thrips Damage Rating
Movento 2SC, 5 fl oz/A, + DyneAmic 0.25%, spray at cupping and 10 days later	0.41
Leverage 360, 3 fl oz/A, spray 5 times at 2 week intervals	0.42
untreated check	0.62
MSR (Metasystox-R) 2SC, 3 pt/A, spray at cupping and 10 days later	0.70
Radiant 1SC, 10 fl oz/A, spray at cupping and 10 days later	0.80
Thionex 3EC, 1.3 qt/A, spray at cupping and 10 days later	0.81
Assail 30SG, 4 oz/A, spray at cupping and 10 days later	0.83
Admire Pro 4.6F, 10.5 fl oz/A, sidedressed at cupping	0.90
	P = 0.12

Thrips on Cabbage

- Key concern in northwest Ohio
- Growers want intensive program
  - We needed to define a standard
  - 2012: 6 sprays at 14-day interval
  - 2013: 8 sprays at 10-day interval

Thrips trials on cabbage

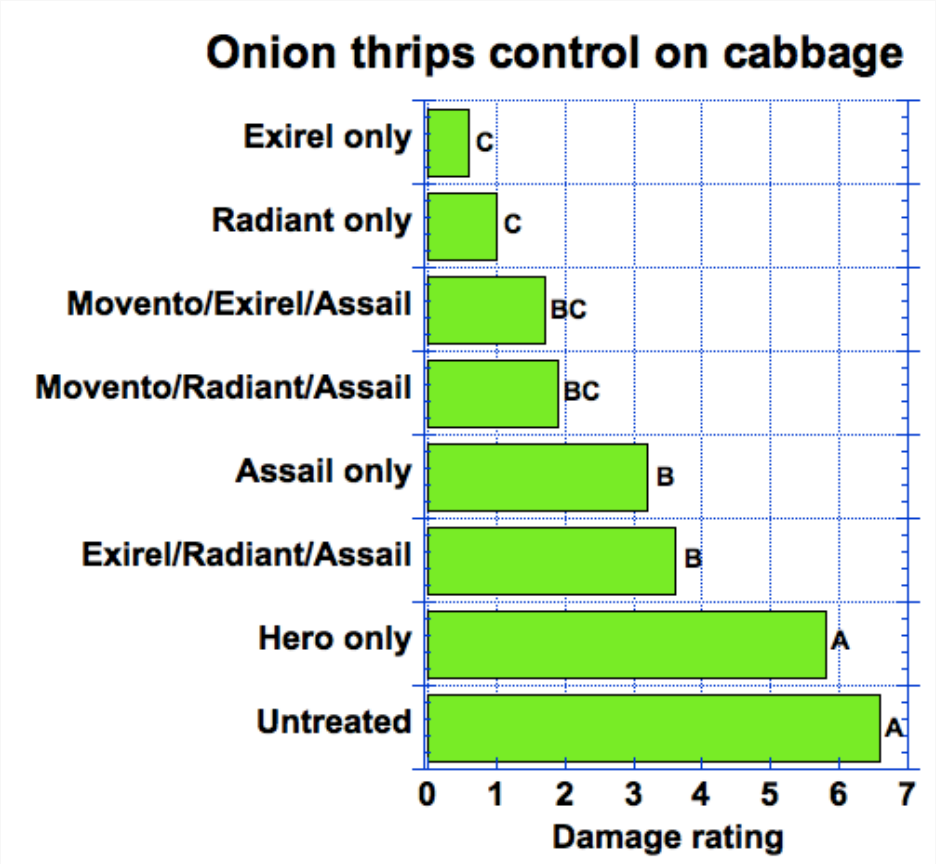
- Test Exirel
  - a.i. = cyazypyr
  - from DuPont
  - Registered January 2014

Thrips treatments in 2012:

Sequence of 3 products @ 2 sprays, spray every 2 weeks

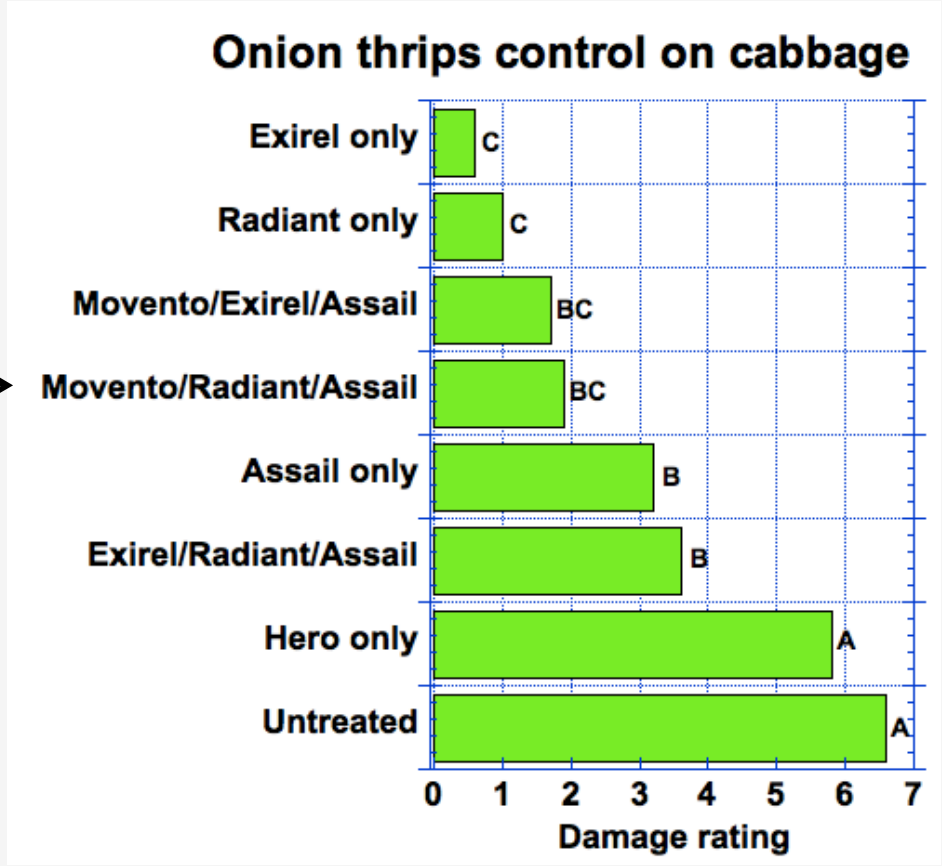
Treat-ment	Spray 1 (& 2)	Spray 3	Spray 4	Spray 5	Spray 6
1 (stan-dard)	Movento + Dipel	Radiant	Radiant	Assail	Assail
2	Movento + Dipel	Exirel	Exirel	Assail	Assail
3	Exirel	Radiant	Radiant	Assail	Assail
4	Exirel	Exirel	Exirel	Exirel	Exirel
5	Radiant	Radiant	Radiant	Radiant	Radiant
6	Hero	Hero	Hero	Hero	Hero
7	Assail	Assail	Assail	Assail	Assail
8 (untrt)	-	-	-	-	-

Thrips on cabbage, Fremont, 2012



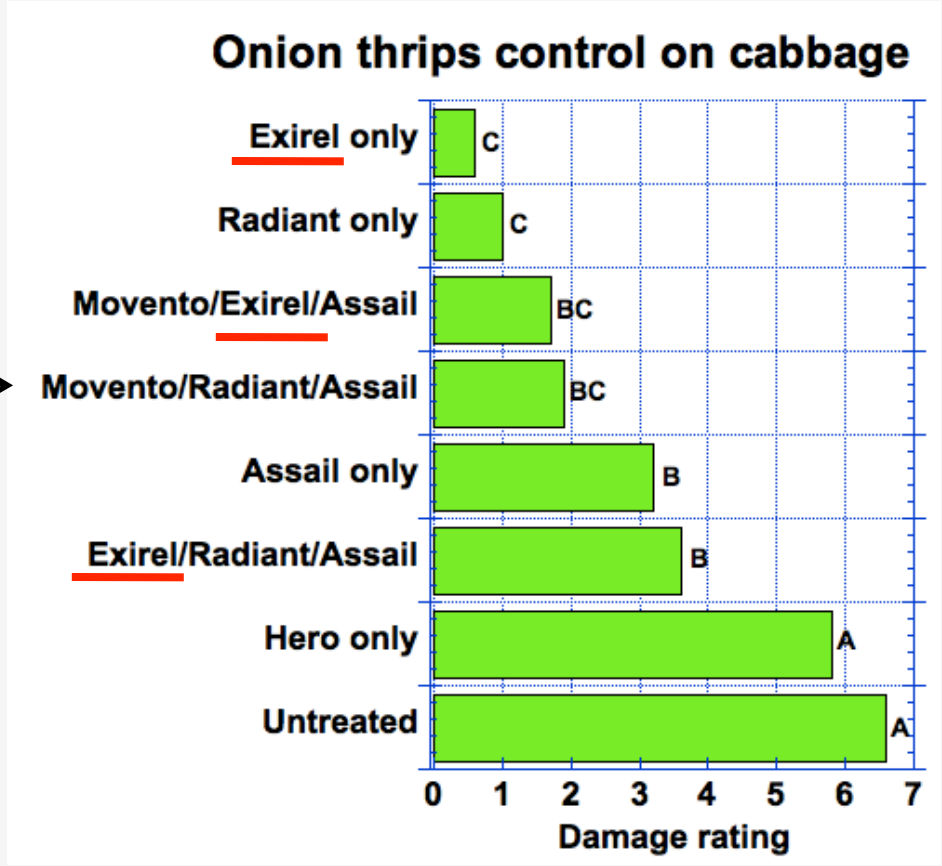
Thrips on cabbage, Fremont, 2012

‘standard’ →



Thrips on cabbage, Fremont, 2012

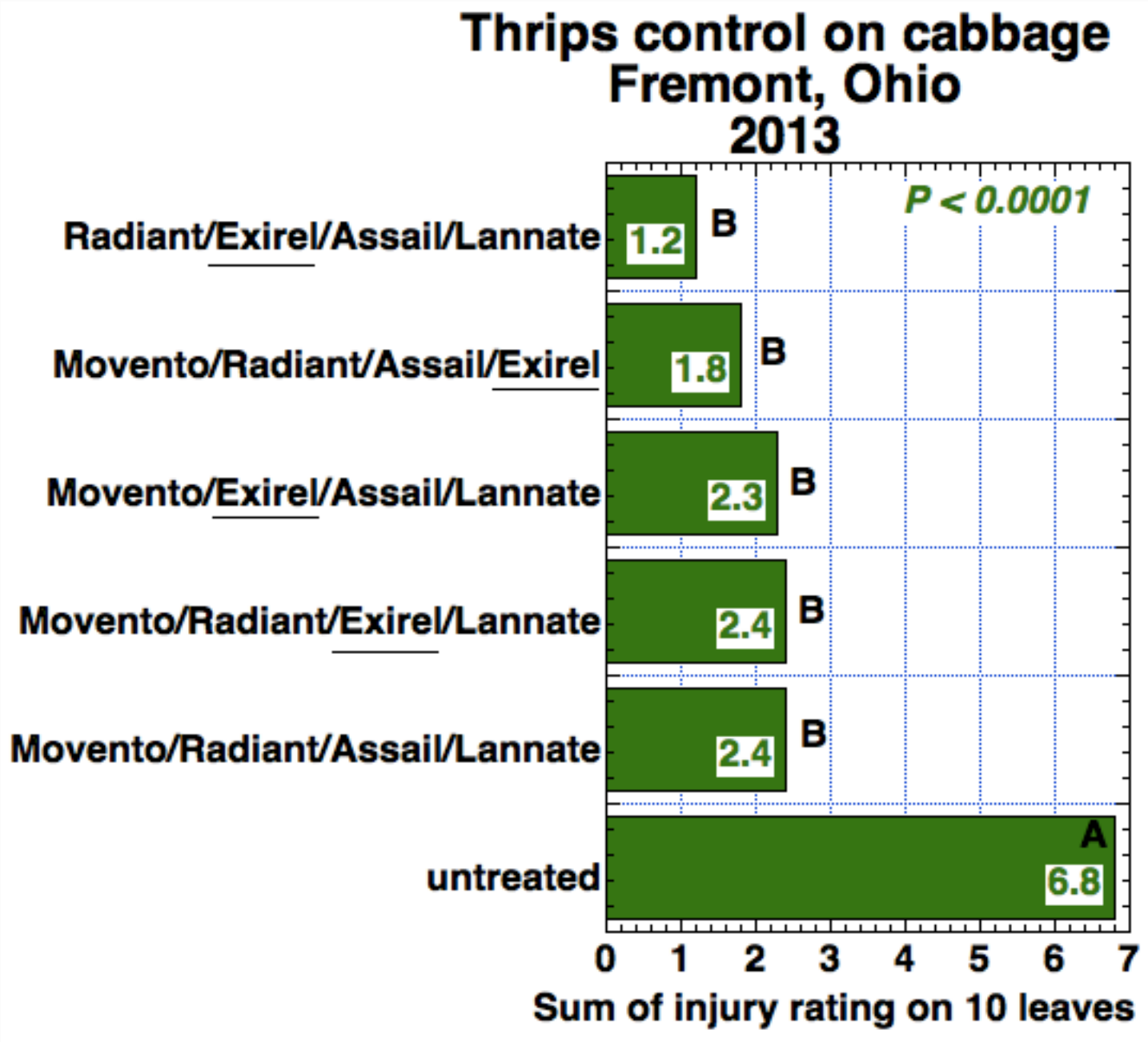
‘standard’ →

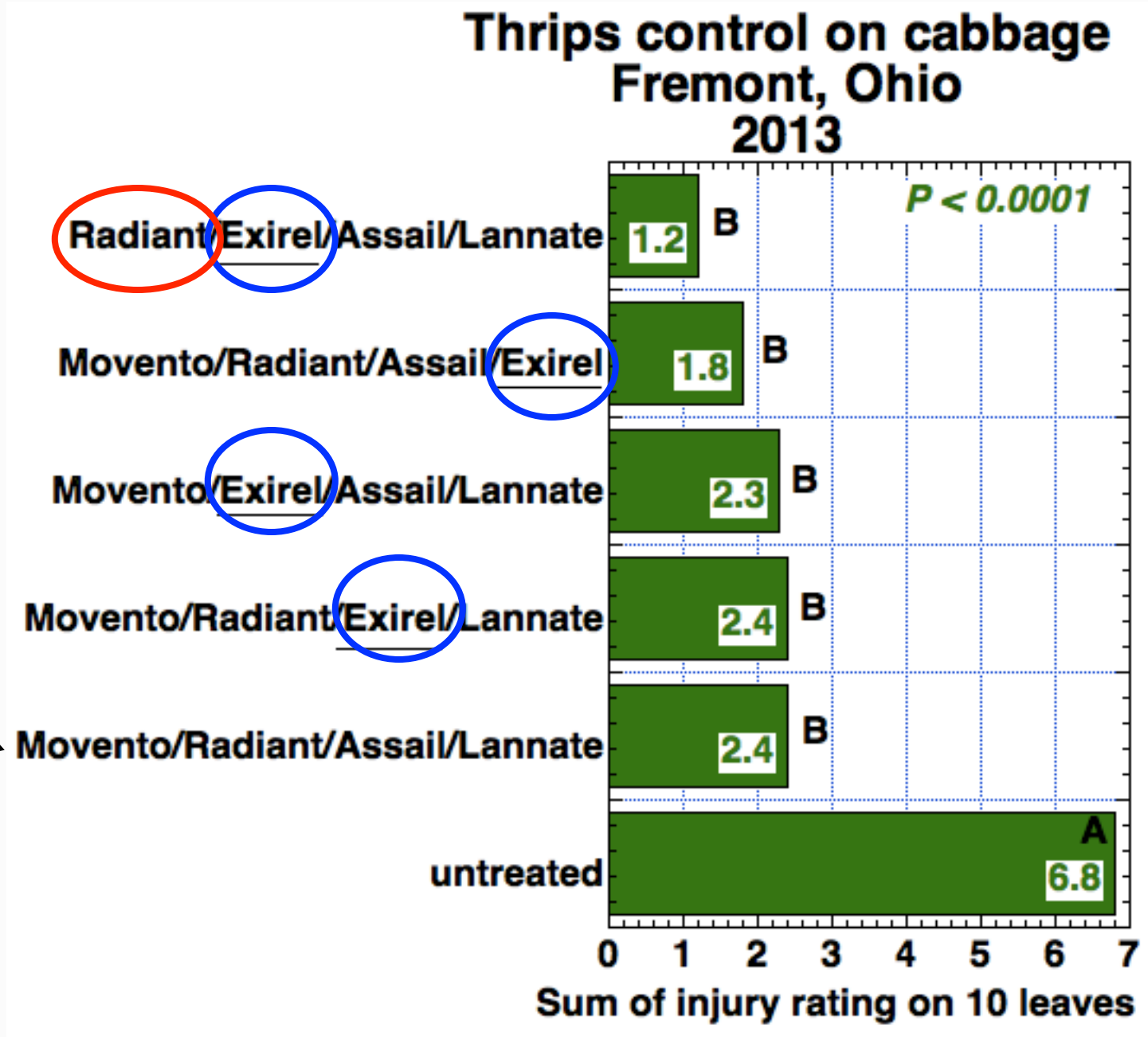


Thrips treatments in 2013:

Sequence of 4 products @ 2 sprays, spray every 10 days

Treatment	Sprays 1 & 2	Sprays 3 & 4	Sprays 5 & 6	Sprays 7 & 8	Spray 9
1 (standard)	Movento + Dipel	Radiant	Assail	Lannate	Baythroid
2	Movento + Dipel	Exirel	Assail	Lannate	Baythroid
3	Movento + Dipel	Radiant	Exirel	Lannate	Baythroid
4	Movento + Dipel	Radiant	Assail	Exirel	Baythroid
5	Radiant	Exirel	Assail	Lannate	Baythroid
6 (untrt)	-	-	-	-	


Thrips control on cabbage
Fremont, Ohio
2013
P < 0.0001
Radiant/Exirel/Assail/Lannate
1.2
B
Movento/Radiant/Assail/Exirel
1.8
B
Movento/Exirel/Assail/Lannate
2.3
B
Movento/Radiant/Exirel/Lannate
2.4
B
Movento/Radiant/Assail/Lannate
2.4
B
untreated
A
6.8
0 1 2 3 4 5 6 7
Sum of injury rating on 10 leaves


Thrips control on cabbage
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B
Movento/Exirel/Assail/Lannate
2.3
B
Movento/Radiant/Exirel/Lannate
2.4
B
Movento/Radiant/Assail/Lannate
2.4
B
untreated
A
6.8
0 1 2 3 4 5 6 7
Sum of injury rating on 10 leaves

'standard'

Developing parasitoid enhancement as a component of cole crop management

Emily Linkous
(M.S. Student)
& Celeste Welty
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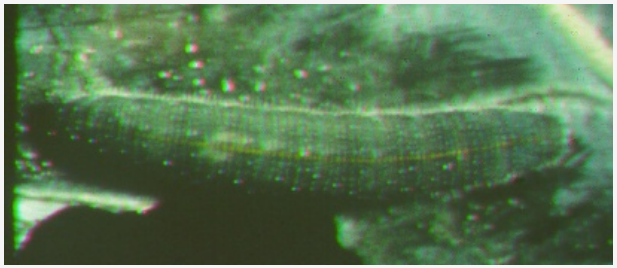
Caterpillars on cabbage

- Diamondback moth

- Imported cabbageworm

- Cabbage looper

Parasitoid wasps attack caterpillars

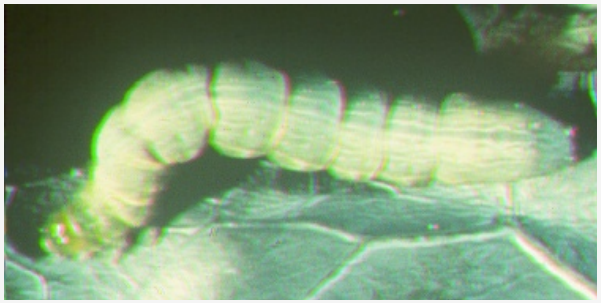


Imported cabbageworm

Cotesia larvae spinning cocoons

Cotesia adults emerging

Cotesia adult wasp



Cabbage looper

Copidosoma floridanum wasps emerging from one cocoon

Diamondback moth

Diadegma insulare oviposits on larvae

Floral resources help biocontrol

- Provide nectar (food for adult parasitoids)
- Attracts some biocontrol agents
- Can be scarce in conventional fields
- Can be reservoir for pests

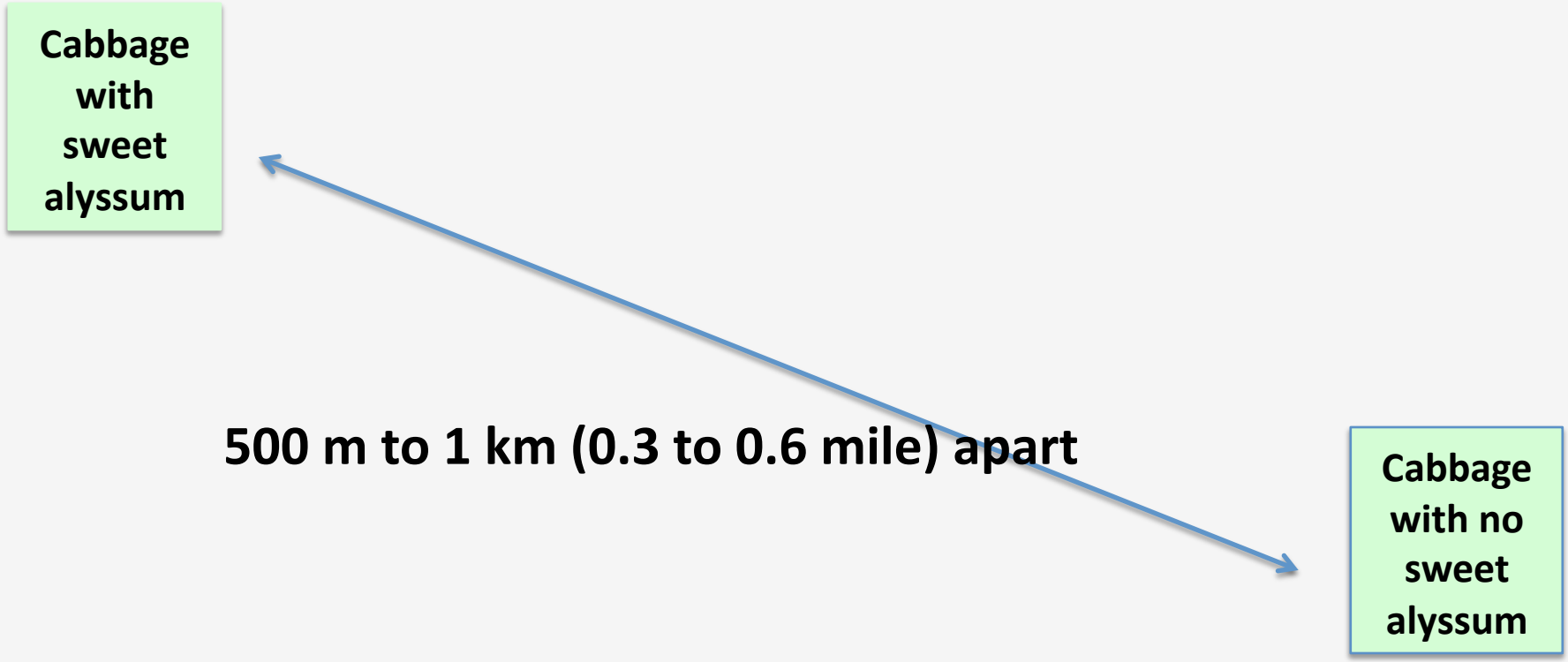



Floral resources: Sweet Alyssum

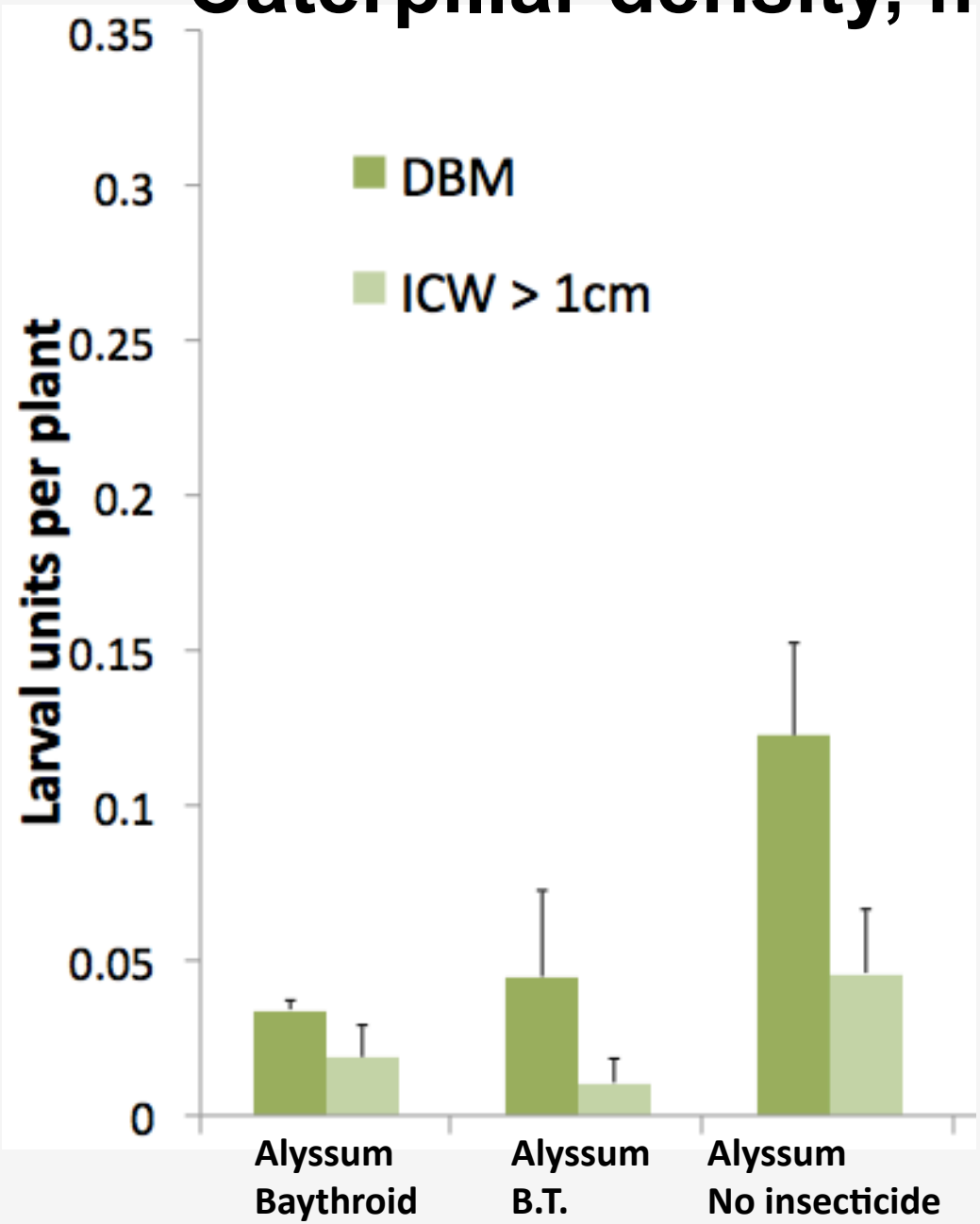
Field Trial on Parasitoid Enhancement

- **Main plot treatments**
  - **Cabbage with sweet alyssum**
  - **Cabbage without sweet alyssum**
- **Sub-plot treatments**
  - **Pyrethroid every 14 days (Baythroid)**
  - **B.t. every 7 days (Dipel, Xentari)**
  - **No insecticide**

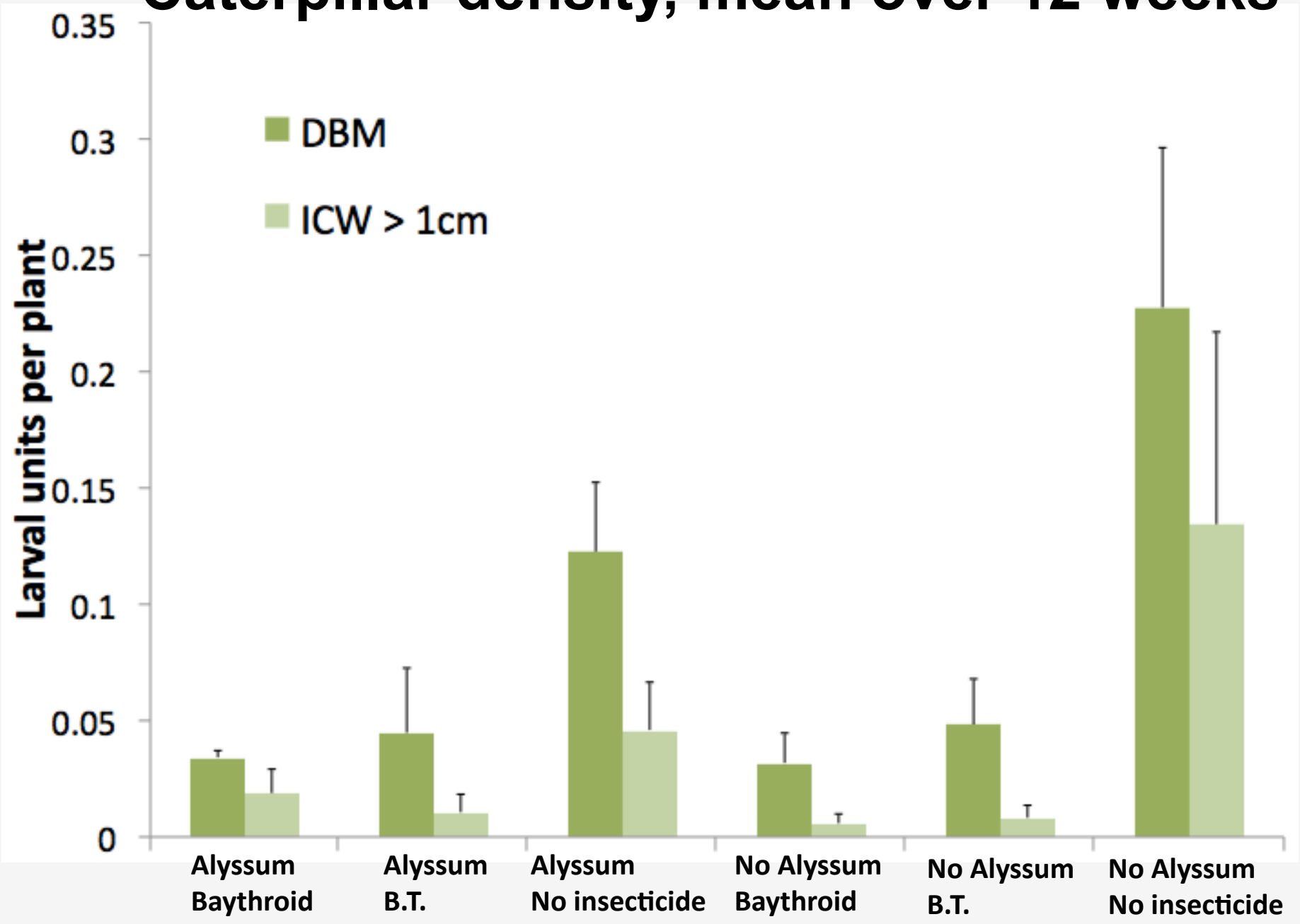
Experimental Design:
2 main plots per farm,
at 3 farms (Fremont, Celeryville, Columbus)



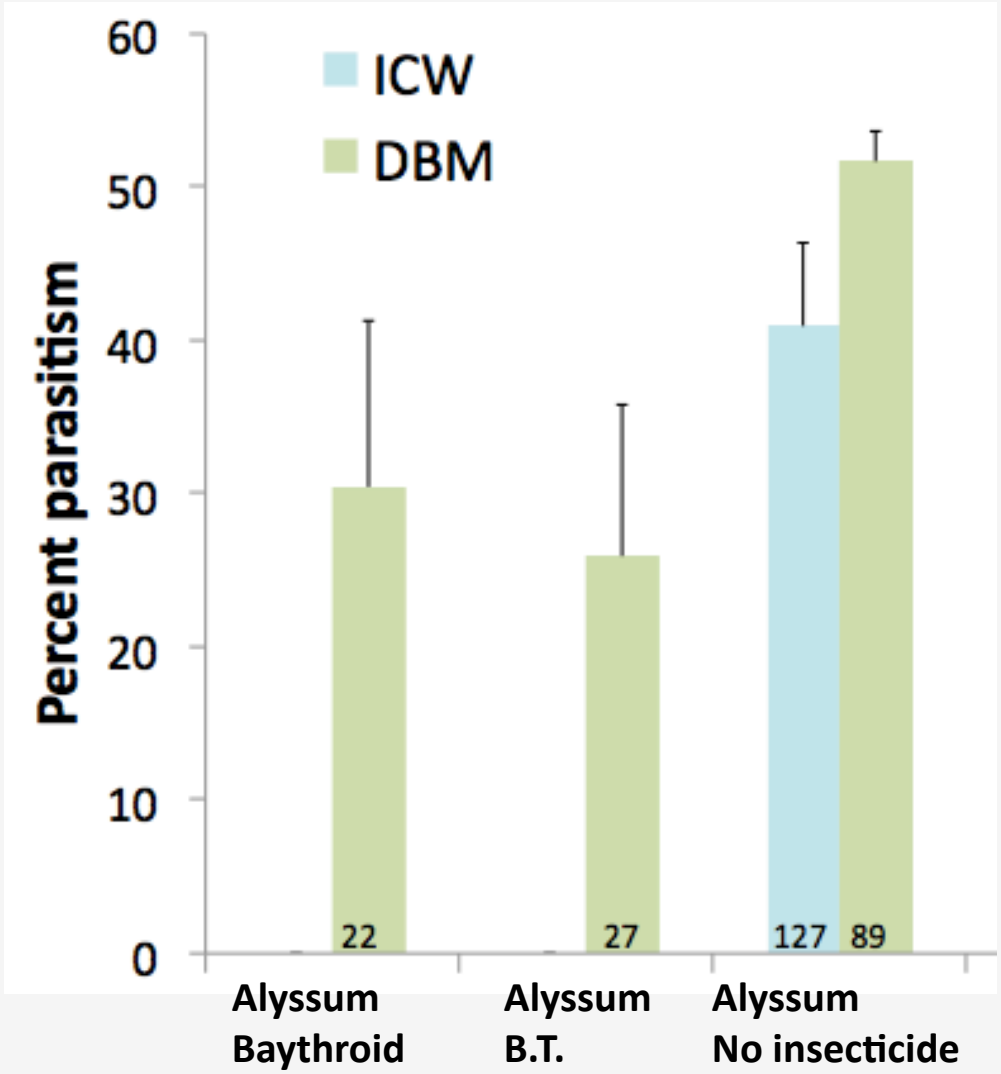
Caterpillar density, mean over 12 weeks



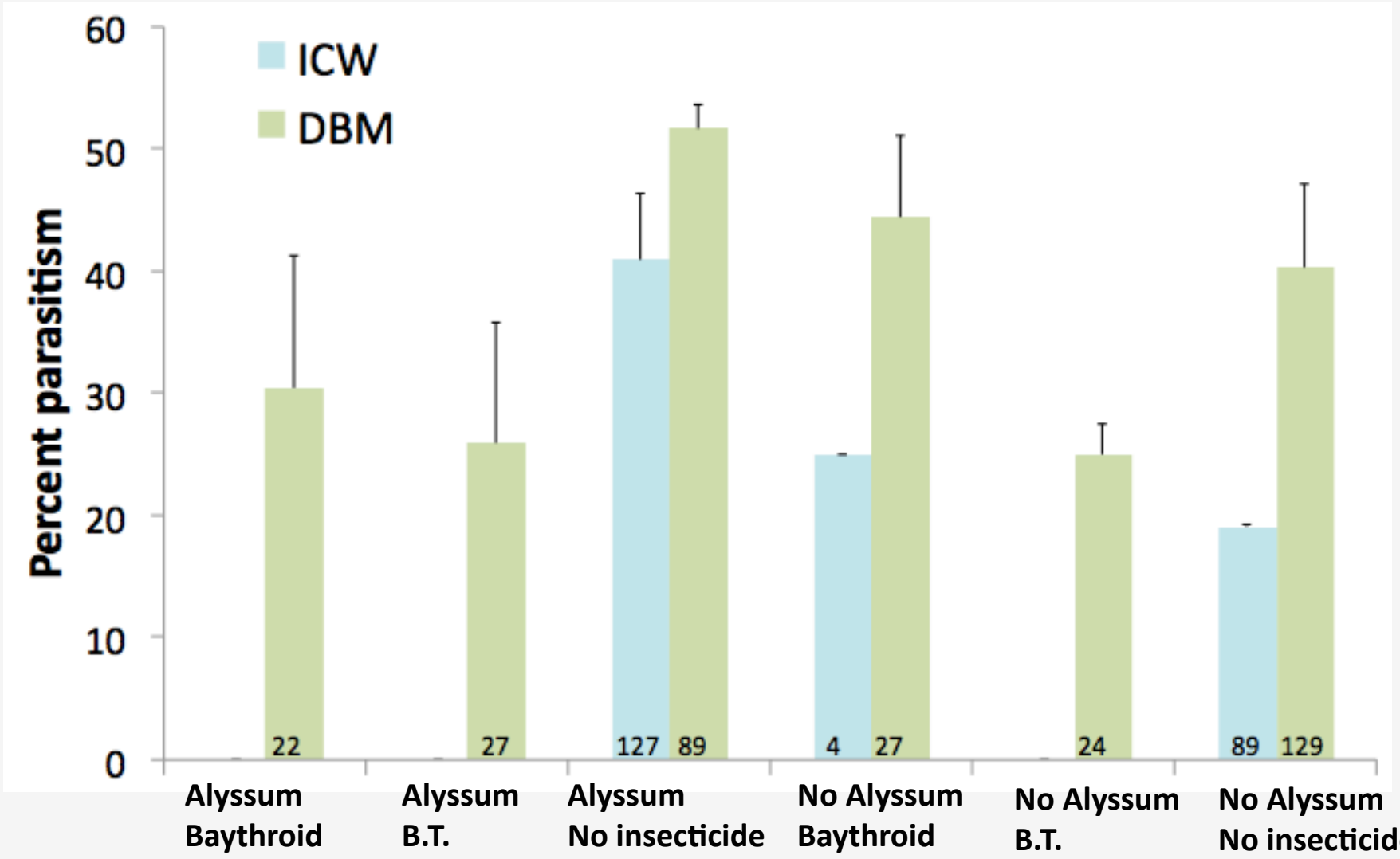
Caterpillar density, mean over 12 weeks



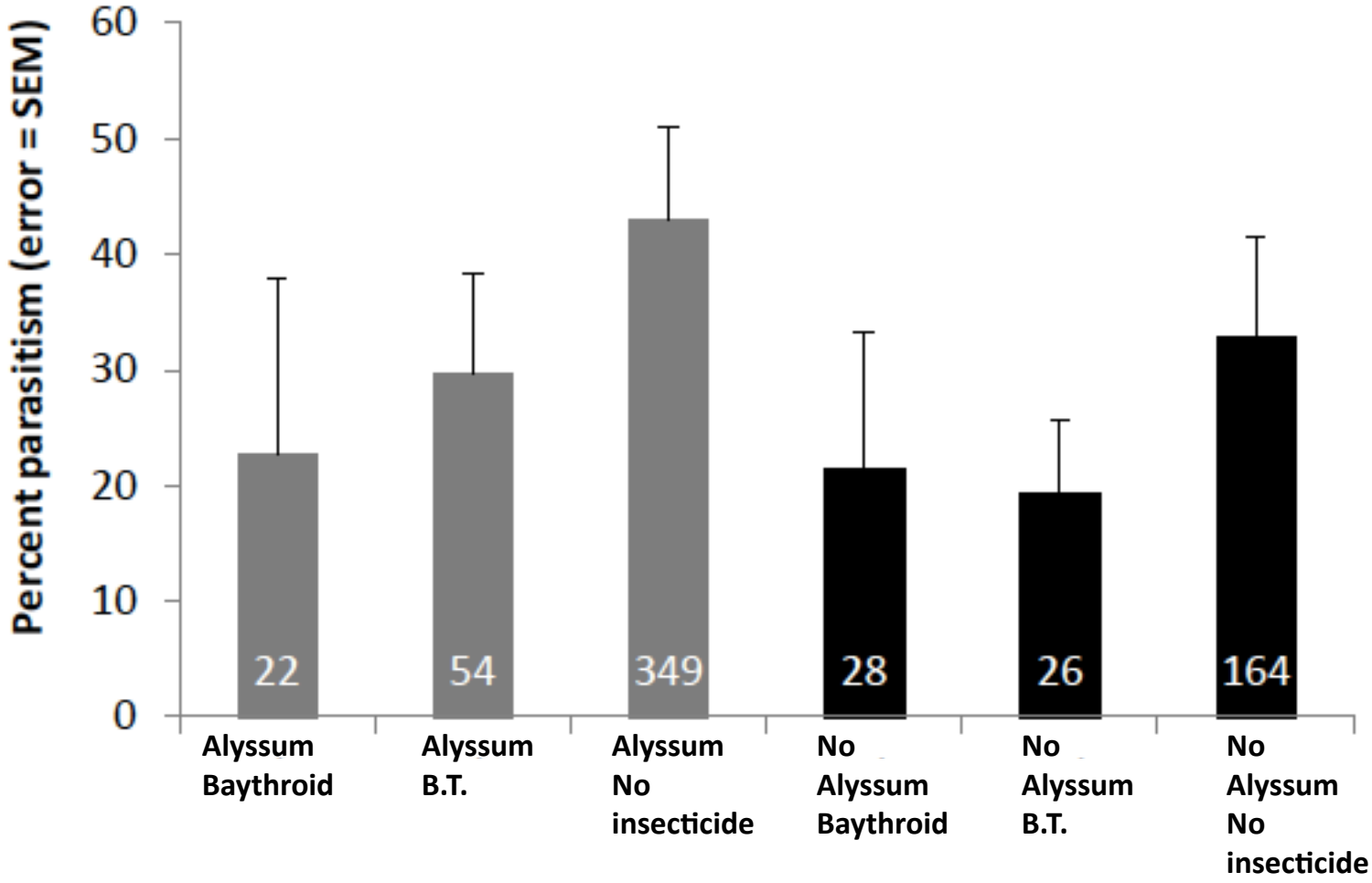
% parasitism by treatment, mean over 12 weeks



% parasitism by treatment, mean over 12 weeks, 2011



Parasitism of diamondback moth larvae, 2012



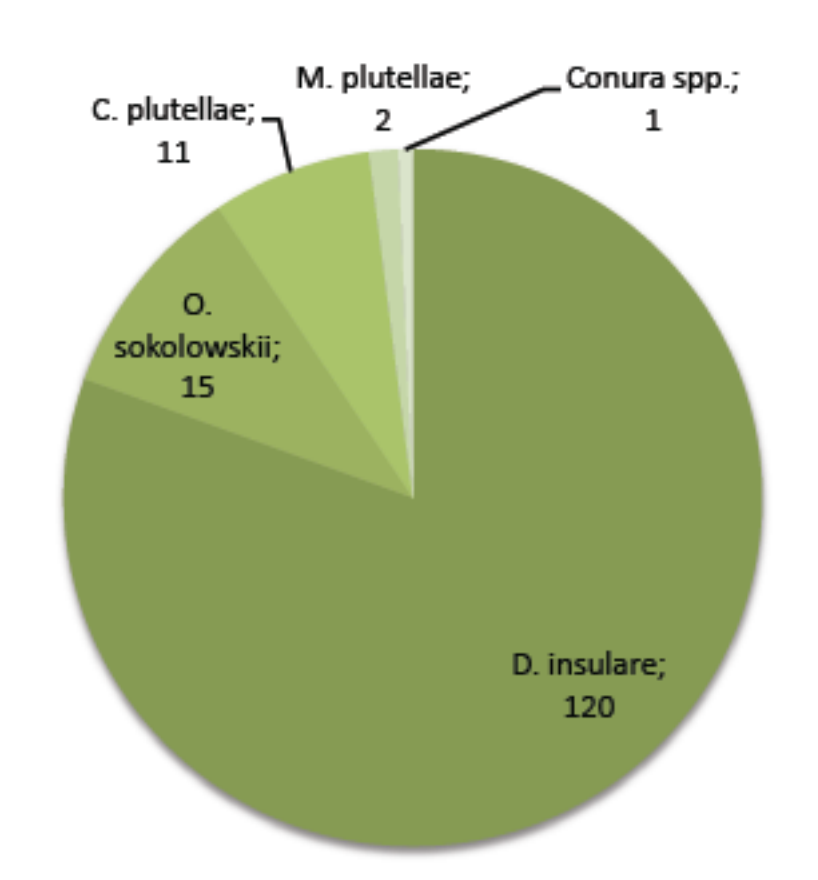
Parasitoid surveys on farms

- 8 - 12 fields of commercial cabbage
- Once per month, July to Sept.
- Searched for 40 person-minutes per field
- Follow-up: see if parasitism related to insecticide choice

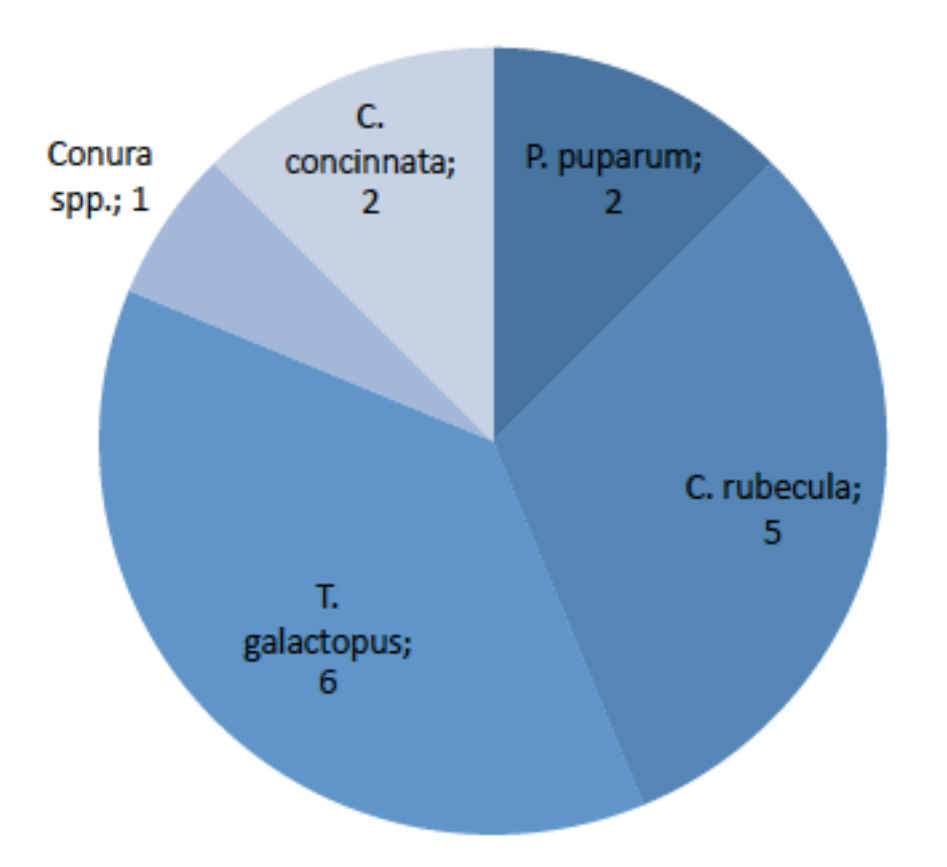
Results of farm surveys

Species	Parasitism	
	2011	*2012*
Diamondback	46%	24%
Imported cabbageworm	15%	22%
Cabbage looper	0%	37%

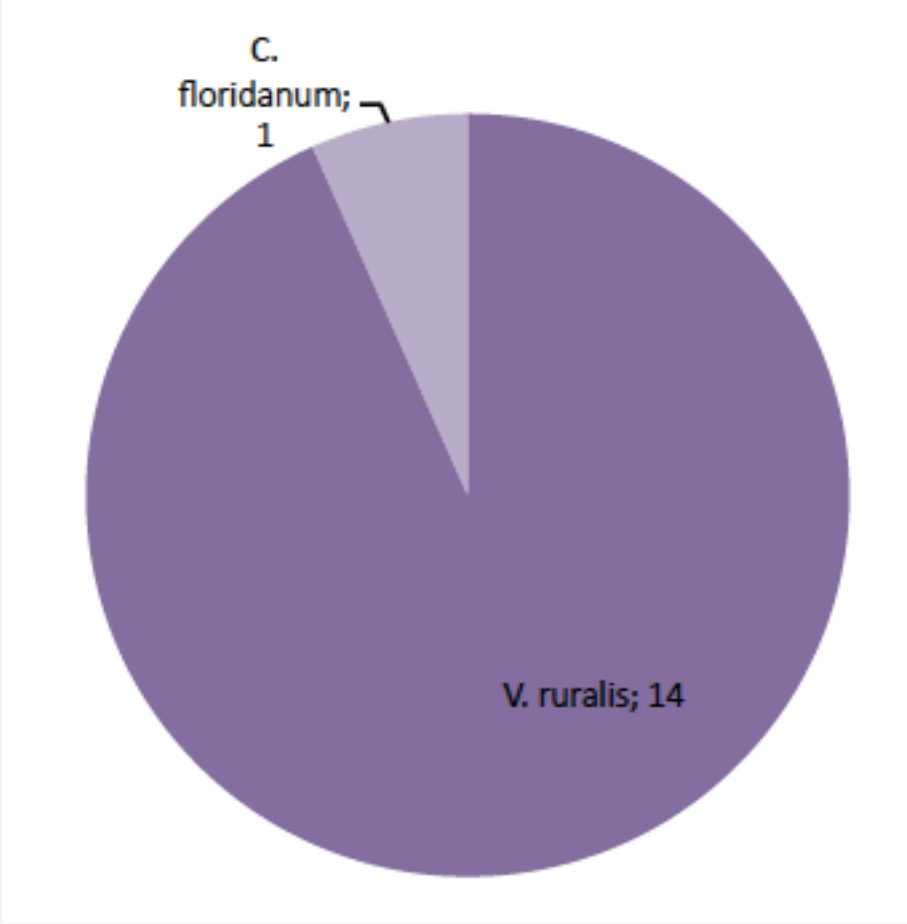
Parasitoids from diamondback moth larvae, 2011 & 2012 (N = 149)



Parasitoids from imported cabbageworm larvae, 2011 & 2012 (N = 16)



Parasitoids from cabbage loopers, 2011 & 2012 (N = 15)



B.t. for control of caterpillars on cabbage

What is B.t.?

- **A natural soil-borne bacterium**
- **Species: *Bacillus thuringiensis***
- **This bacterium produces crystal-like proteins that kill certain insects**
- **Found world-wide**
- **Produced by fermentation methods**
- **Discovered 1915; used since 1957**

How does B.t. work?

- B.t. must be eaten by target insect
- B.t. contains toxins that are activated by insect's gut enzymes
- toxins paralyze digestive tract
- feeding stops within 2 hours
- death takes 1 - 5 days

B.t. products

- For caterpillar control:
  - DiPel, XenTari, Biobit (Valent)
  - Javelin, Agree, CryMax, Deliver (Certis)
- For Colorado potato beetle:
  - Novodor (Valent)

B.t. performance

- **Sometimes erratic:**
  - **Breakdown in U.V. light**
  - **Reduced toxicity against older larvae**
  - **Incomplete spray coverage**
  - **Too long a spray interval**
- **Best if:**
  - **Target young larvae**
  - **Apply at frequent intervals**
  - **Get thorough coverage**
    - **Lot of water (>35 gal/A)**
    - **Good pressure (60 psi)**

How are B.t. sprays most effective?

- Rate?
- Frequency?
- Time of day?

Field trial, 2012

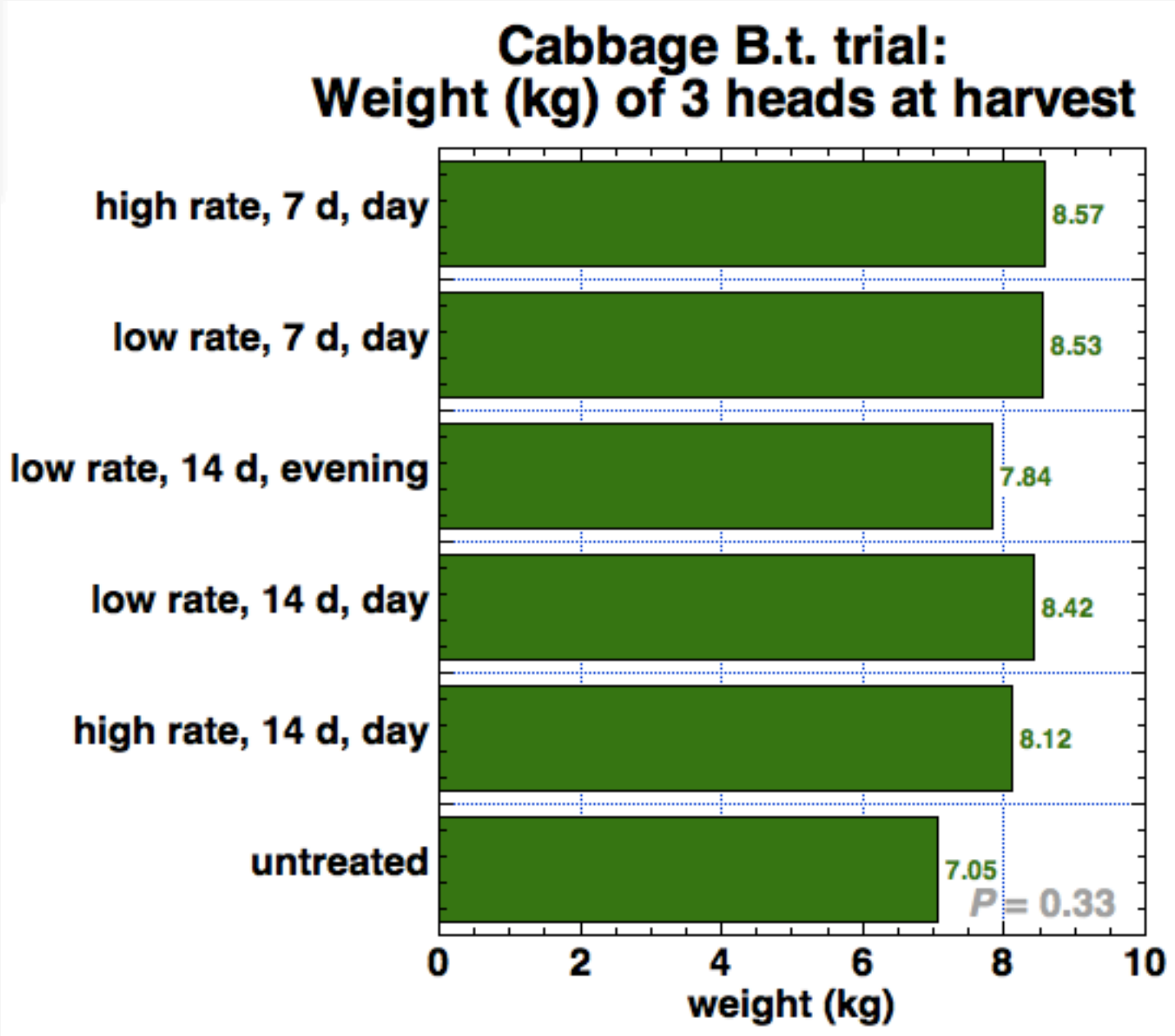
- cv ‘Bravo’
- Transplanted 18 May
- Scouted weekly for insects
- 1st spray 18 days after planting
- Sprays for 11 weeks
- Harvest 20 August

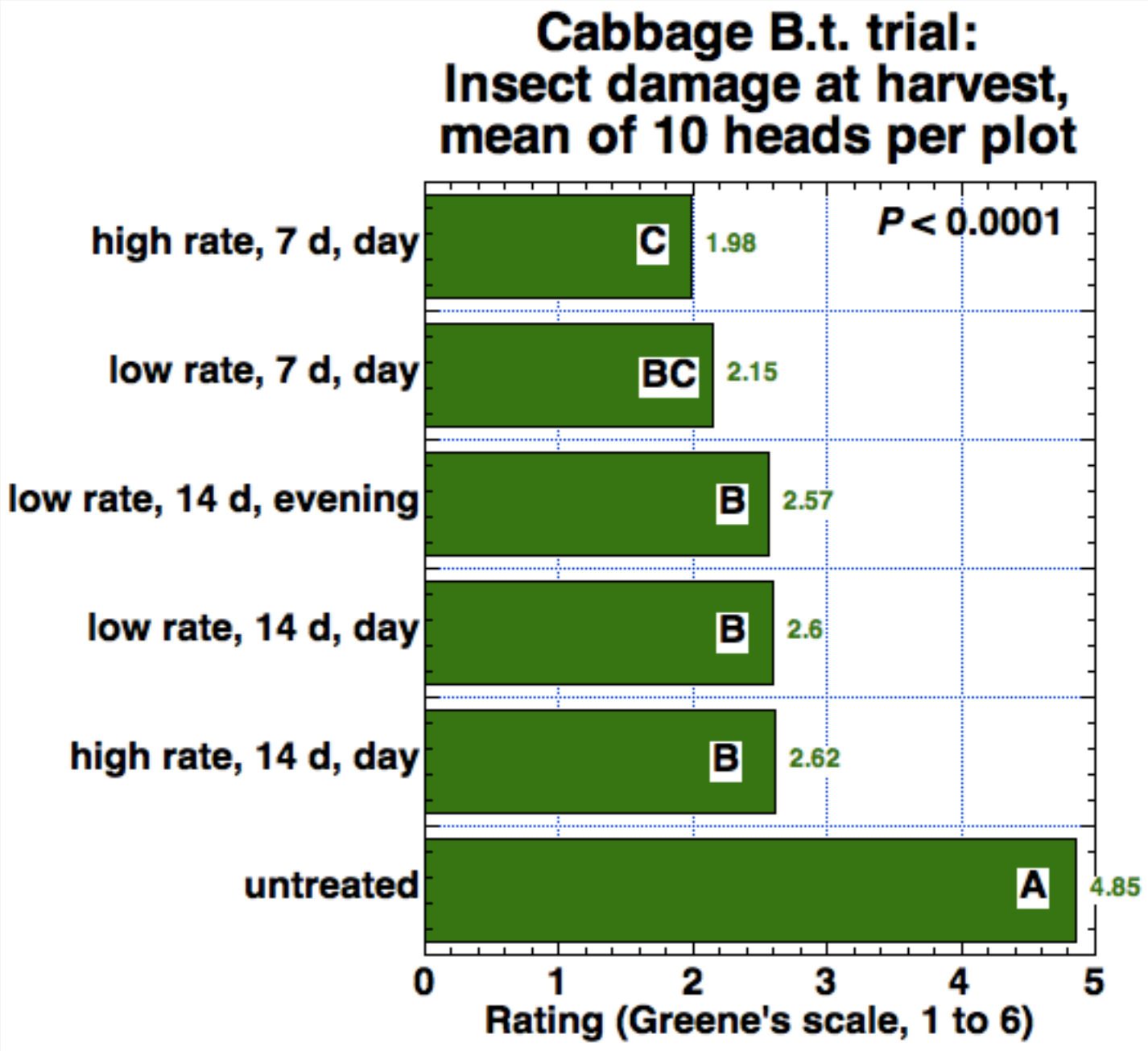
Treatments

Treat-ment	Rate of Dipel DF	Frequency	Time
1	-	-	-
2	Low (0.5 lb/A	Every 7 days	daytime
3	Low (0.5 lb/A)	Every 14 days	daytime
4	High (1.0 lb/A)	Every 7 days	daytime
5	High (1.0 lb/A)	Every 14 days	daytime
6	Low (0.5 lb/A)	Every 14 days	evening

Results

- Caterpillar density, weekly
- Harvest
  - Yield: weight of heads
  - Quality: insect damage rating by Greene's scale


Cabbage B.t. trial:
Weight (kg) of 3 heads at harvest
high rate, 7 d, day
8.57
low rate, 7 d, day
8.53
low rate, 14 d, evening
7.84
low rate, 14 d, day
8.42
high rate, 14 d, day
8.12
untreated
7.05
P = 0.33
0
2
4
6
8
10
weight (kg)


Cabbage B.t. trial:
Insect damage at harvest,
mean of 10 heads per plot
P < 0.0001
high rate, 7 d, day
C
1.98
low rate, 7 d, day
BC
2.15
low rate, 14 d, evening
B
2.57
low rate, 14 d, day
B
2.6
high rate, 14 d, day
B
2.62
untreated
A
4.85
0
1
2
3
4
5
Rating (Greene's scale, 1 to 6)

Conclusions

- **Frequency more important than rate**
  - **Every 7 days better than every 14 days**
  - **Low rate as effective as high rate**
- **Daytime spray as effective as evening spray**

Integration of chemical control & biological control

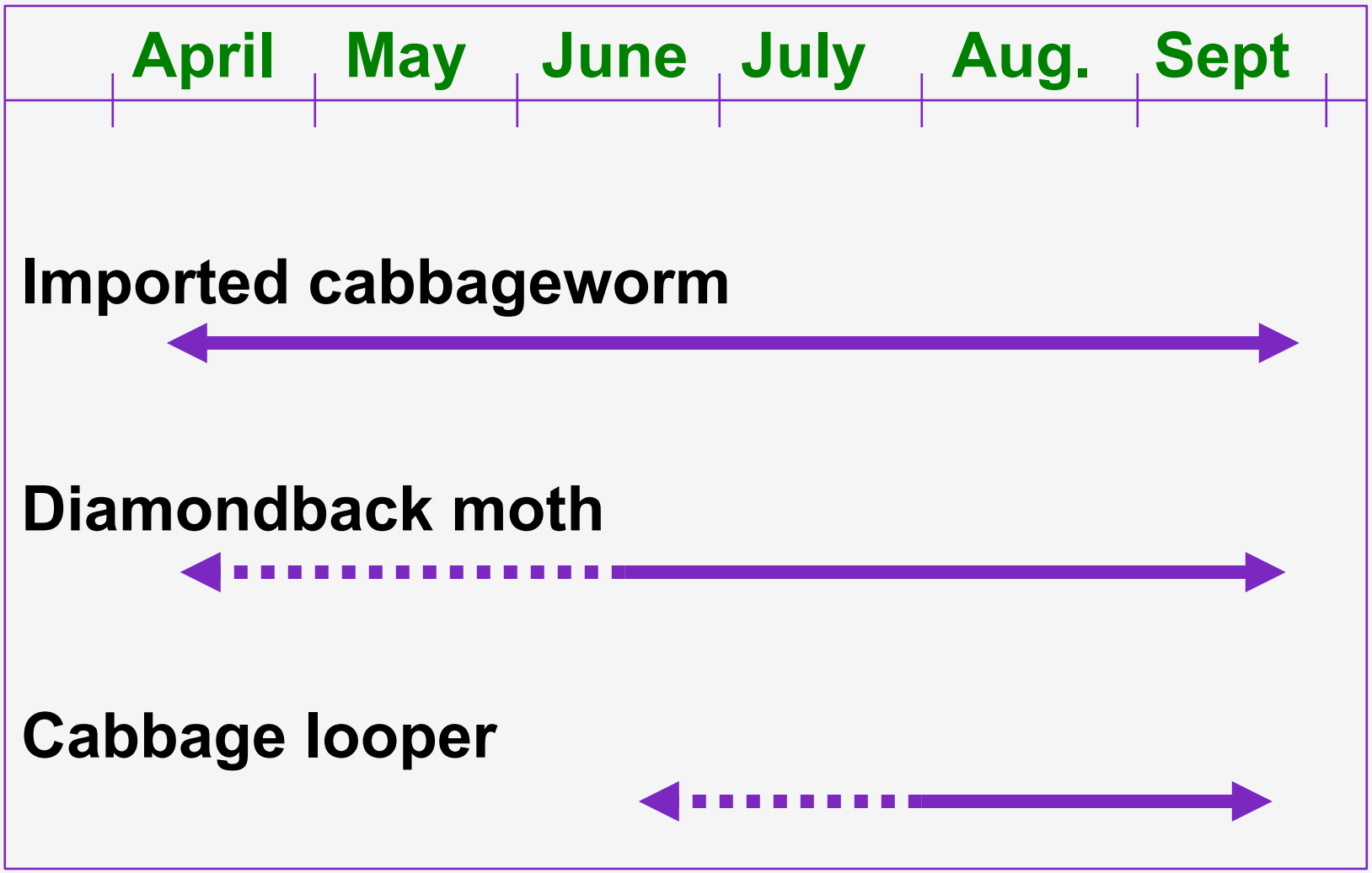
- **Depends on choosing a selective insecticide**
  - **Kills caterpillars**
  - **Does not kill parasitoids**
  - **Use microbial insecticide, BT**
    - **‘DiPel’, ‘Javelin’, ‘XenTari’ etc.**

Insecticides for caterpillar management on cole crops

Insecticide	*Imported cabbage-worm*	*Diamond-back moth*	*Cabbage looper*	*Natural enemies*
Conventional	Excellent control	Fair control	Good control	Poor survival
B.t.	Good control	Good control	Fair control	Excellent survival

Thus B.t. works best when diamondback moth or imported cabbageworm is dominant pest

Caterpillar Calendar



Cabbageworm IPM calendar

- **Early & mid-season (April to July)**
  - if imported cabbageworm &/or diamondback dominant
  - use only B.t.
- **Mid- to late season (August)**
  - if cabbage looper dominant pest
  - use Confirm, SpinTor, or Proclaim
- **Late season (Sept.-October)**
  - if cabbage looper dominant pest
  - use pyrethroids

The end