



College of Agriculture and Life Sciences
Department of Agriculture, Landscape,
and Environment

On-Farm Innovations for Colorado Potato Beetle Management Beyond Entrust

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Colorado Potato Beetle (*Leptinotarsa decemlineata*)

- Destructive Feeding
- Rapid Resistance Development
- Impact on Crop Yield
- Broad Host Range: potatoes, tomatoes, eggplants
- Adaptability
- Economic Impact



CPB Lifecycle

Generations:

- One in northern New England, two in southern New England.
- Transition from egg to adult in 30 to 50 days

Eggs:

25-35 bright yellow
hatch in 7-10 days

Adult:

Feed, Mate
Lay eggs for 4 to 5 weeks

Adult:

search for food plants in
spring by walking or flying

Adult:

Overwinter in soil
near host crops

Larvae:

four instars
hump-backed
rusty red
10 days to up to a month
feed heavily during the last stage

Pupae:

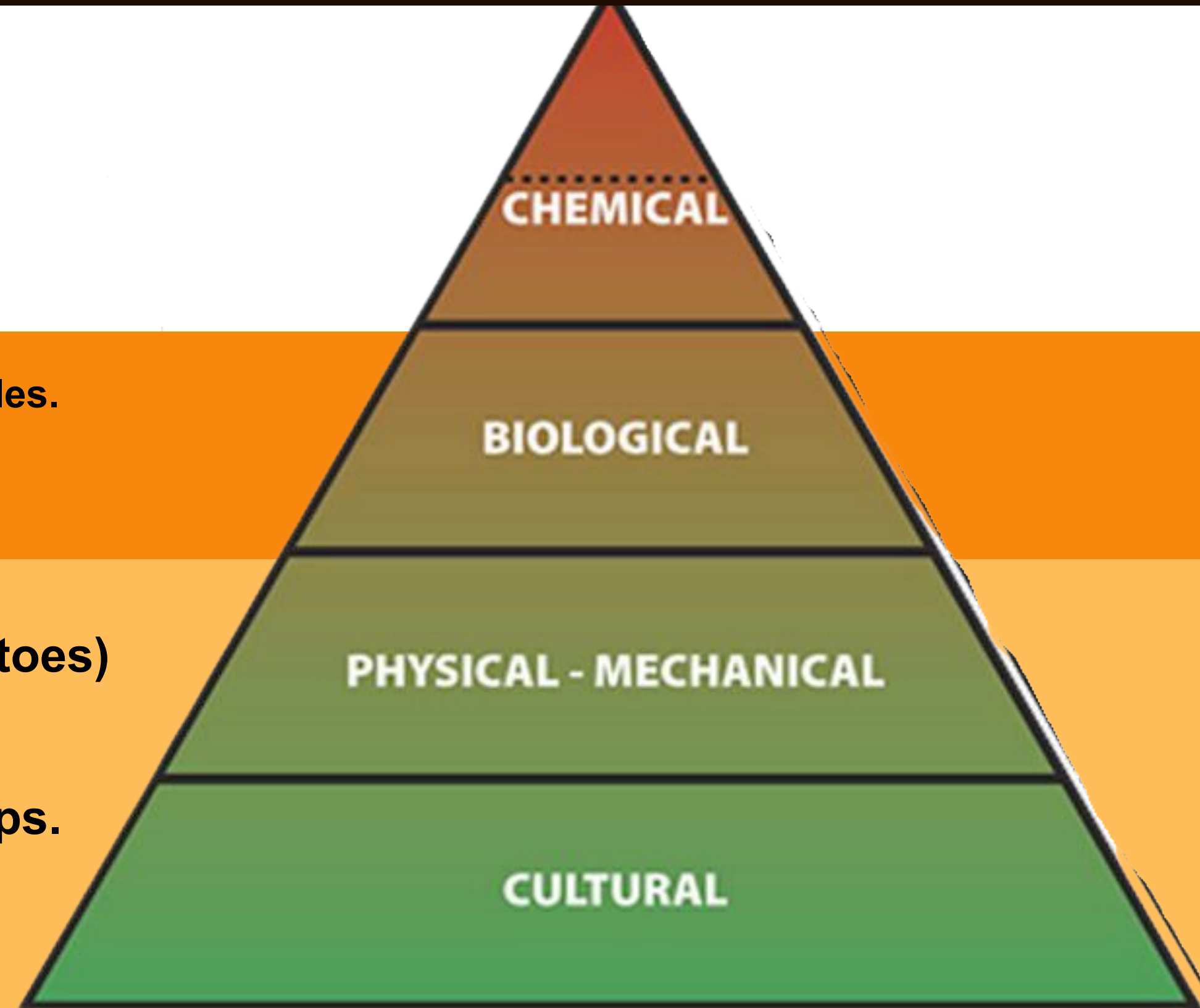
develop in soil
10-14 days



CPB IPM

- **Predators:** Ladybeetles, spined soldier bugs, carabid beetles.
- **Parasitoids:** Tachinid flies.
- **Pathogens:** bacteria, fungi

- **Rotate solanaceous crops (e.g., potatoes, tomatoes) at least 200 yards.**
- **Barriers (e.g., roads, rivers) and mechanical traps.**
- **Trap crops and straw mulch**
- **Late planting**



CPB Predators



Spined soldier bugs

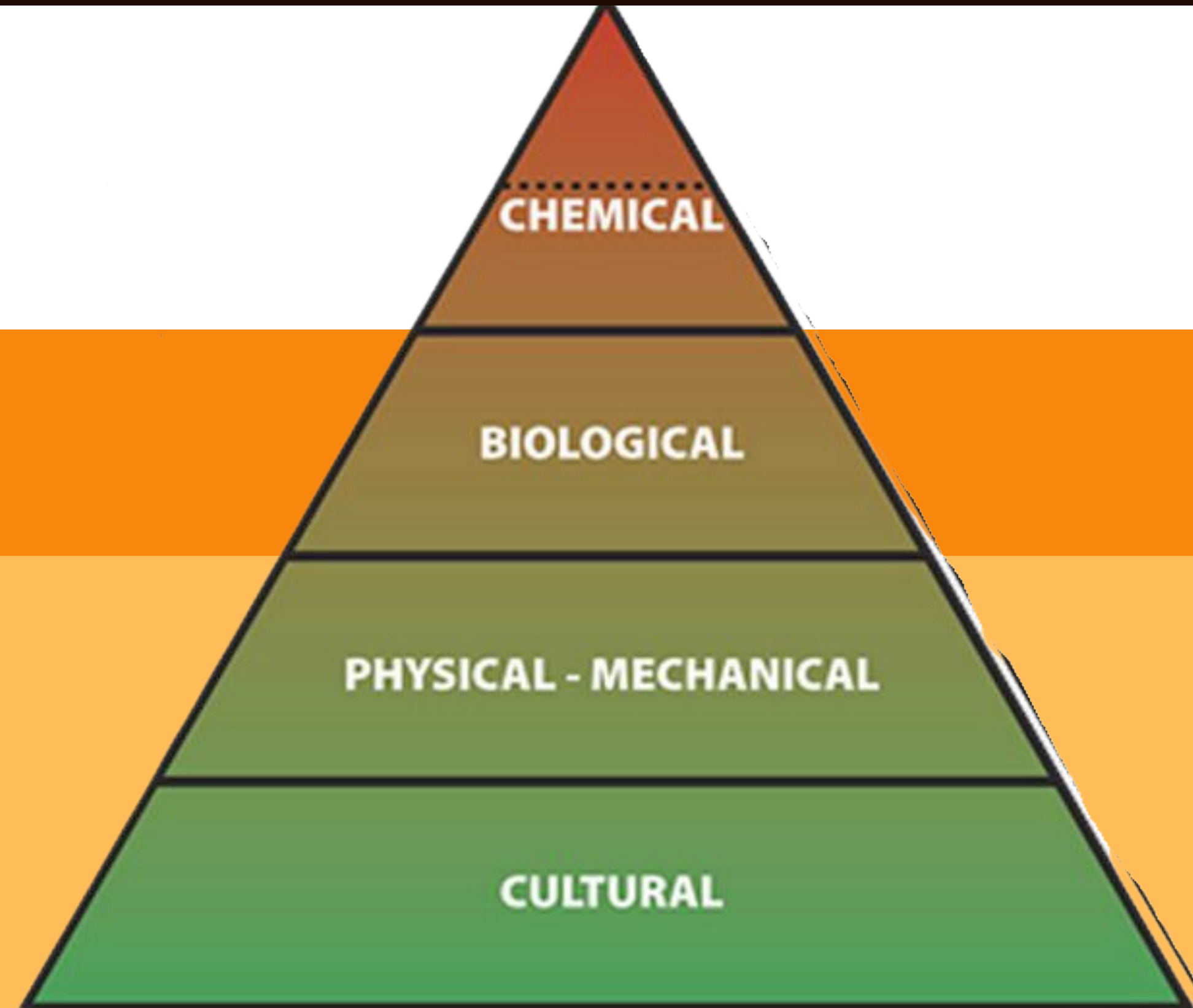


Spotted lady beetle

CPB IPM

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- Parasitoids: Tachinid flies.
- **Pathogens:** bacteria, **fungi**

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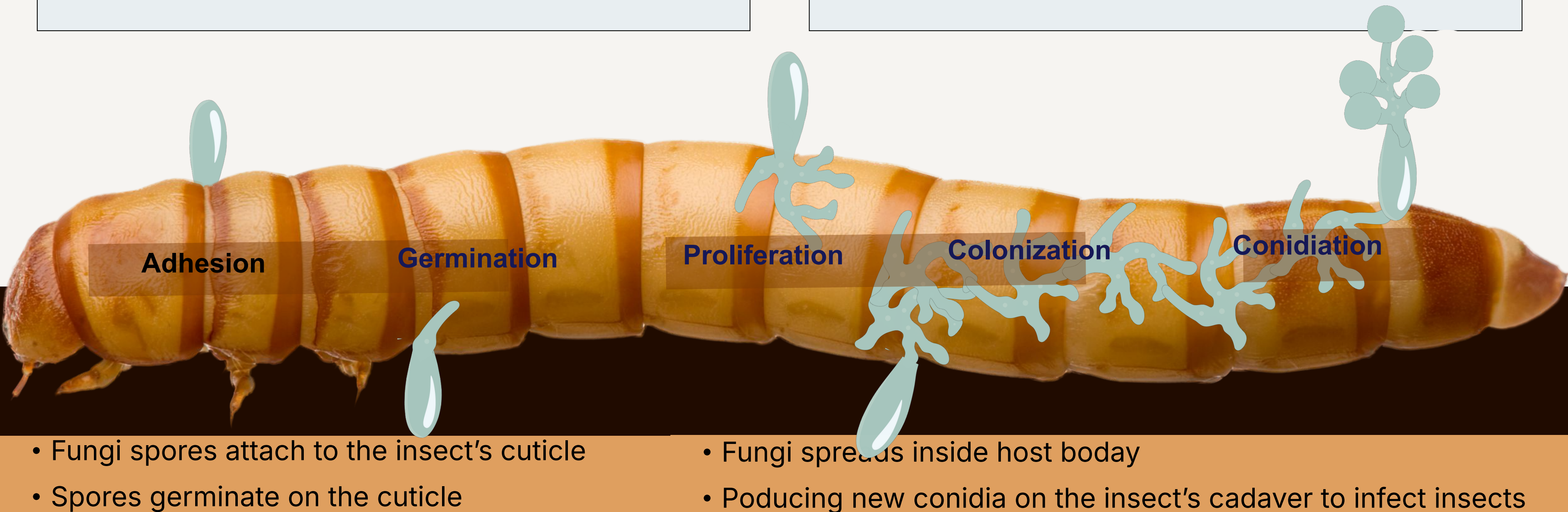
Organic-Approved Pesticides and Their Challenges

Azadirachtin (Azatin 00G)	Azadirachtin & Pyrethrins (Azera0G)	Pyrethrin (PyGanic EC5.00G)	Spinosad	Bacillus thuringiensis subsp. tenebrionis (Trident0G)	Beauveria bassiana (Mycotrol ES00G)
Effectiveness: Acts as a growth regulator, not providing quick control for large infestations.	Residual Effect: Short and degrades rapidly in sunlight.	UV Degradation: Rapid degradation under UV light limits residual activity.	Toxicity to Bees: Highly toxic when wet, requiring careful application timing.	Target Species: Larvae only.	Effectiveness Timeline: 7-10 days for visible effects.
Application: Requires thorough spray coverage for effectiveness.	Impact on Beneficial Insects: Can harm pollinators if not applied carefully.	Broad-spectrum Action: Can harm non-target insects, including natural predators of CPB.	Effectiveness: Less effective against adult beetles compared to larvae.	Mechanism of Action: Requires ingestion to be effective.	Environmental Requirements: High humidity is needed for spore germination and pest infection.
Persistence: Limited persistence in the environment, requiring frequent reapplication.	Effectiveness: Decreases against older larvae or adult stages.	Frequent Applications: May be necessary, increasing costs.	Resistance Development: Resistance can develop with repeated use, requiring rotation	Application Timing: Best results with young larvae, requiring precise timing.	Effectiveness on High Populations: Less effective due to slower action.

Entomopathogenic Fungi

- Natural pathogens that infect and kill insects
- An eco-friendly alternative to chemical pesticides

- Common species include *Beauveria bassiana* and *Metarhizium anisopliae*
- Effective against a range of agricultural pests



Experimental Design

Plot

Control (no treatment)
BotaniGard (label instruction)

Application Frequency

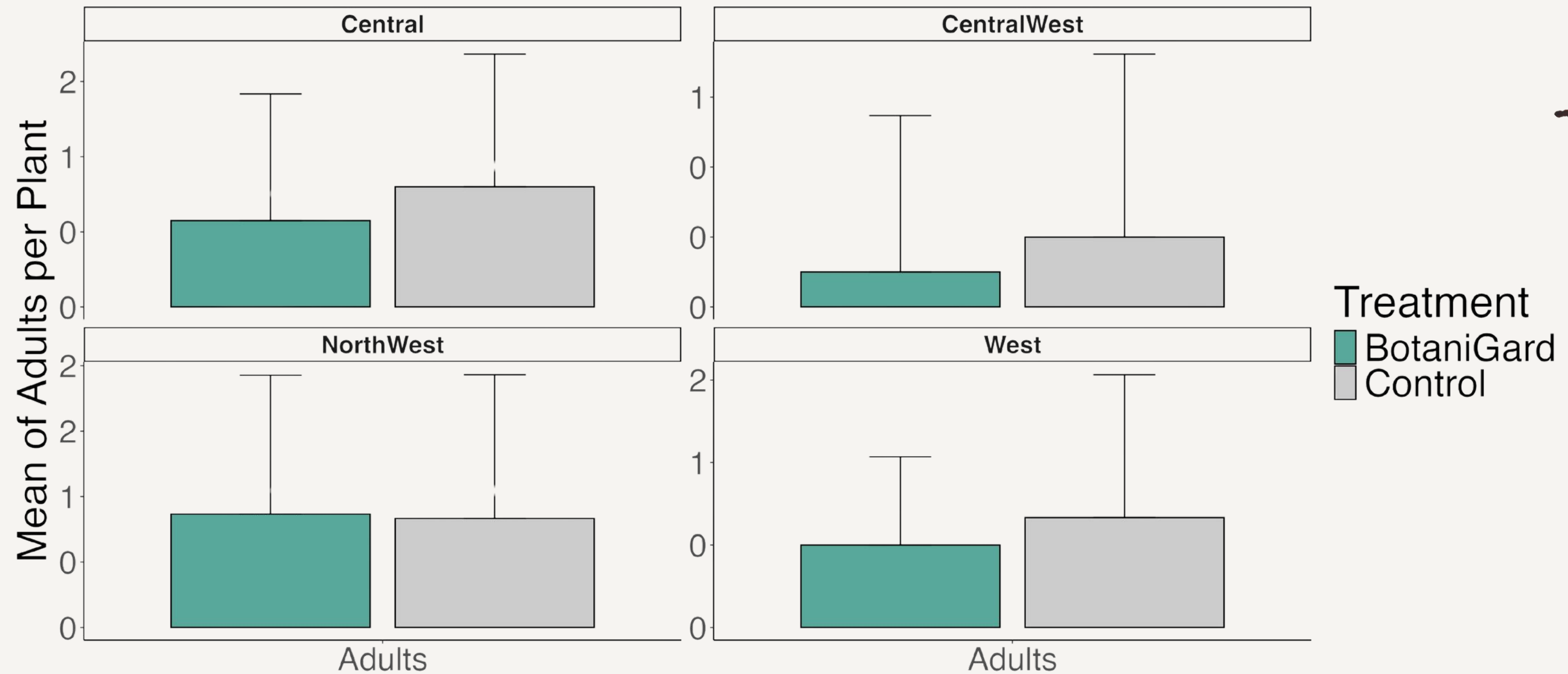
Three applications
7-8 days intervals

Collected Data

Number of egg masses
Number of different stages of larvae
Number of adults
Defoliation rank (0 to 10)
Yield weight (g)

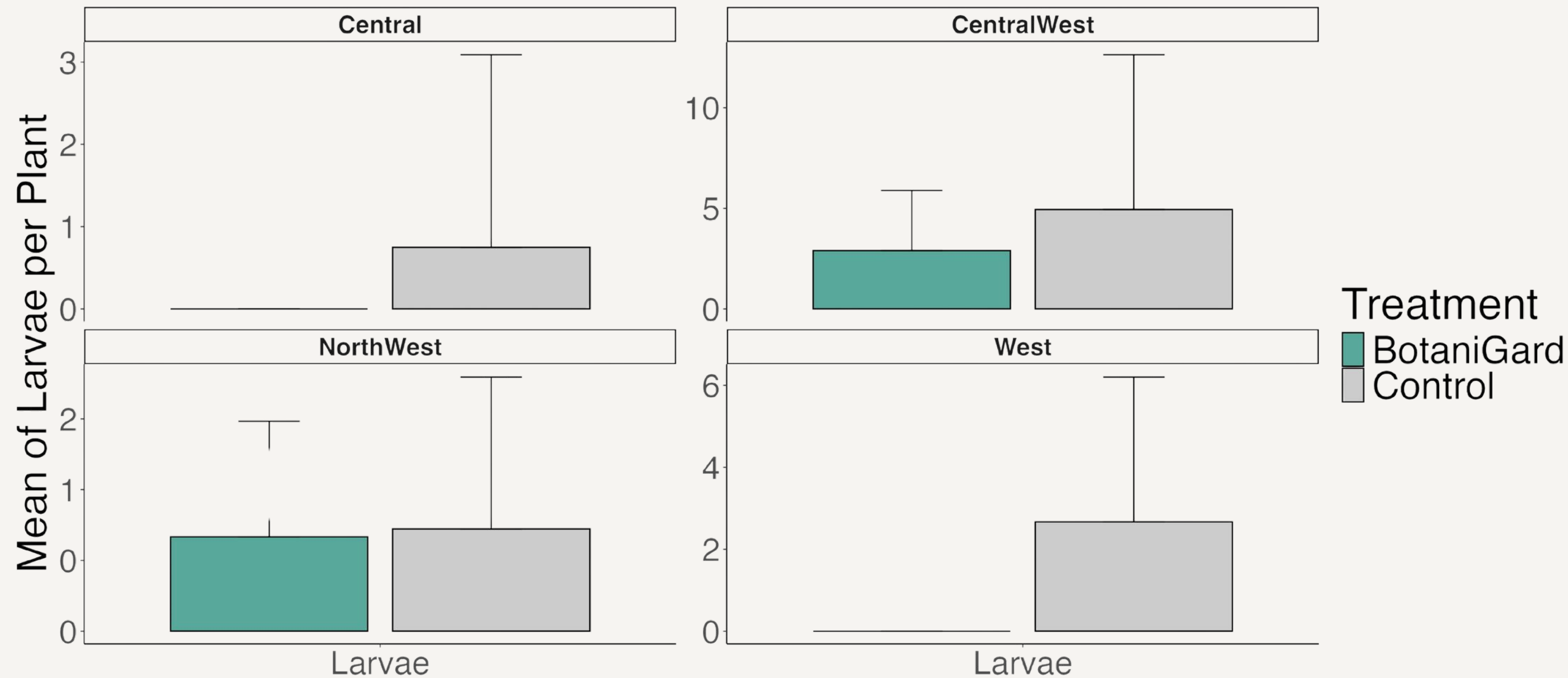


Number of CPB Adults on Final Day



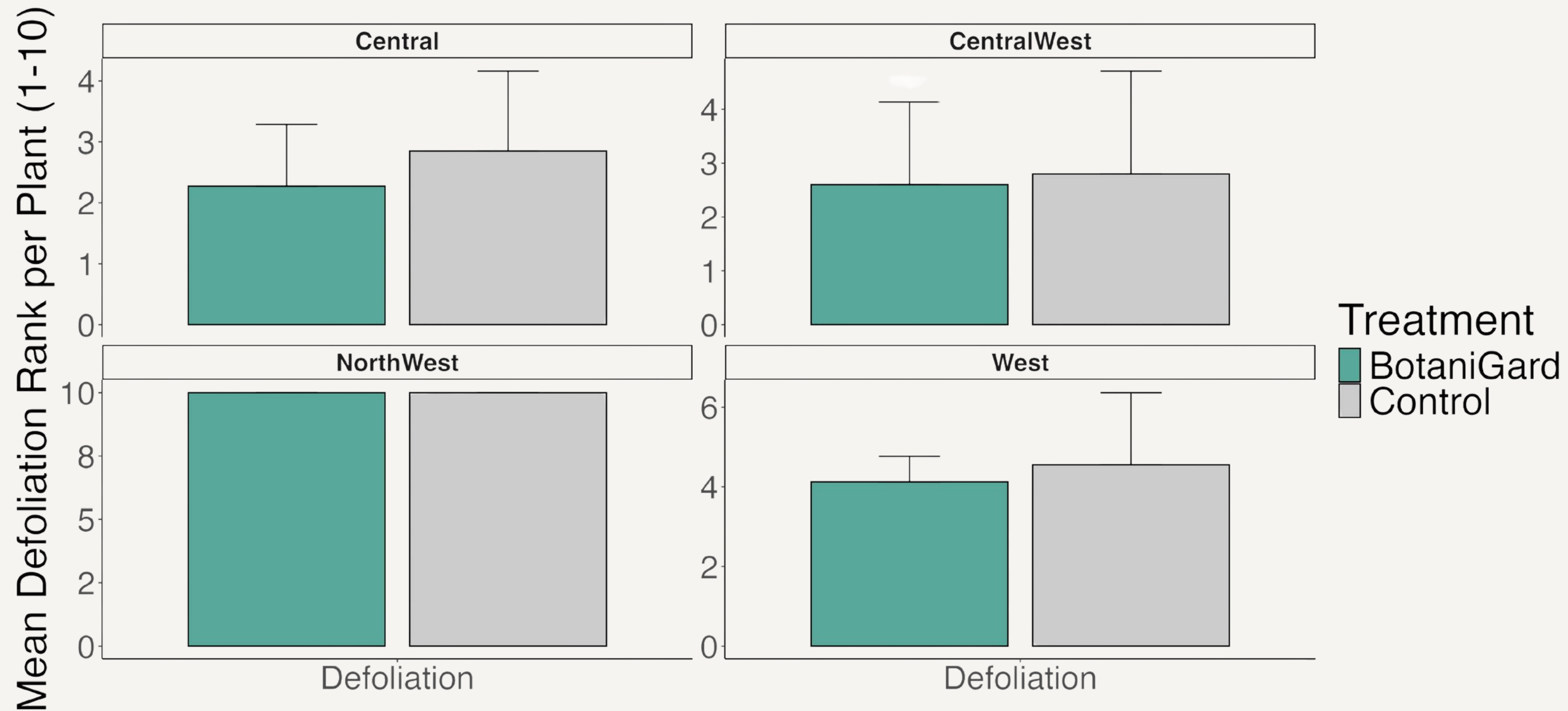
Lower adult beetle counts in 3 out of 4 locations in BotaniGard treatment

Number of CPB Larvae on Final Day



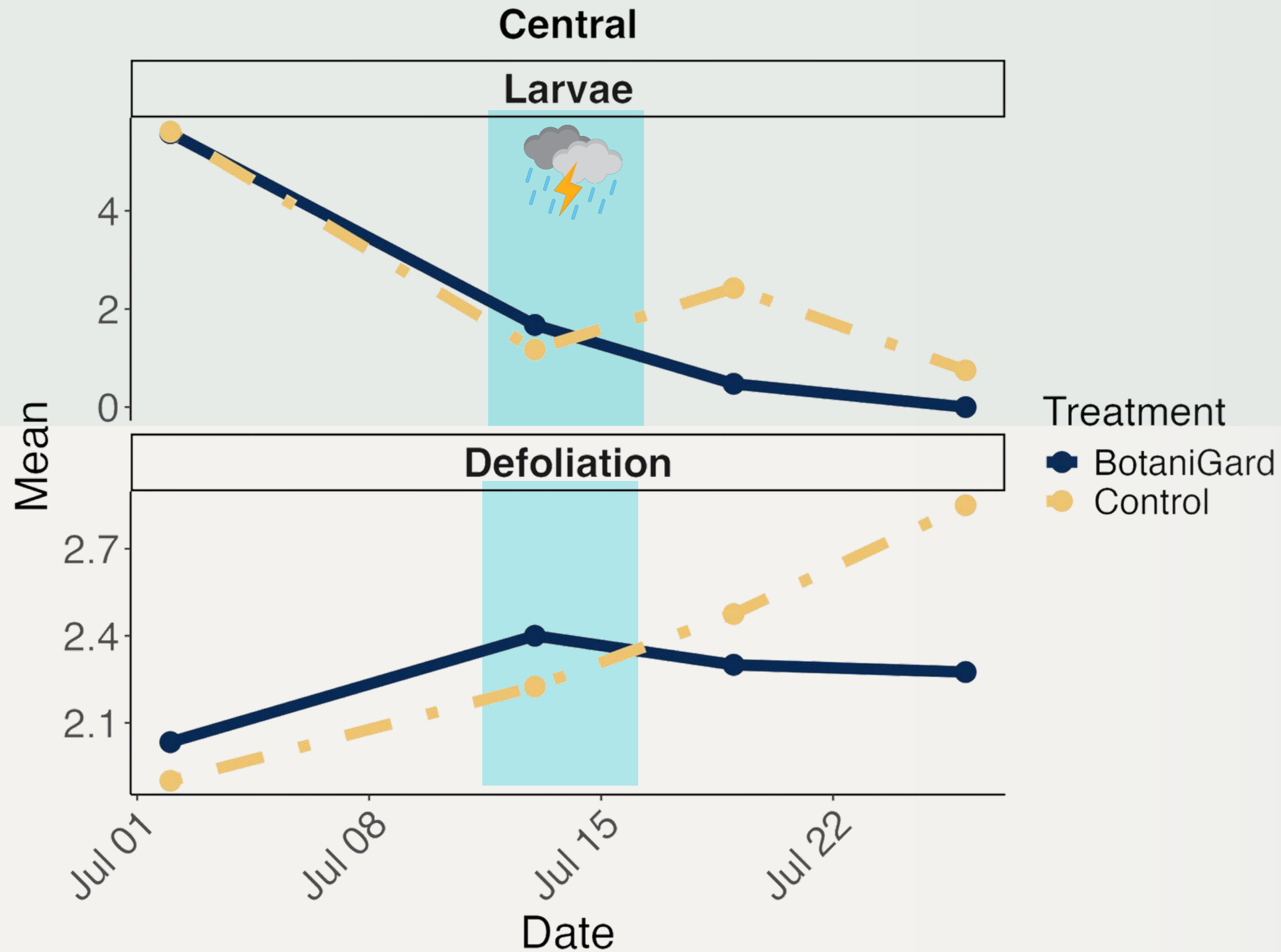
Lower larvae counts in 3 out of 4 locations in BotaniGard treatment

Defoliation Rank on Final Day



Slight difference in defoliation in 3 out of 4 locations

Comparing Number of Larvae and Defoliation Over Time

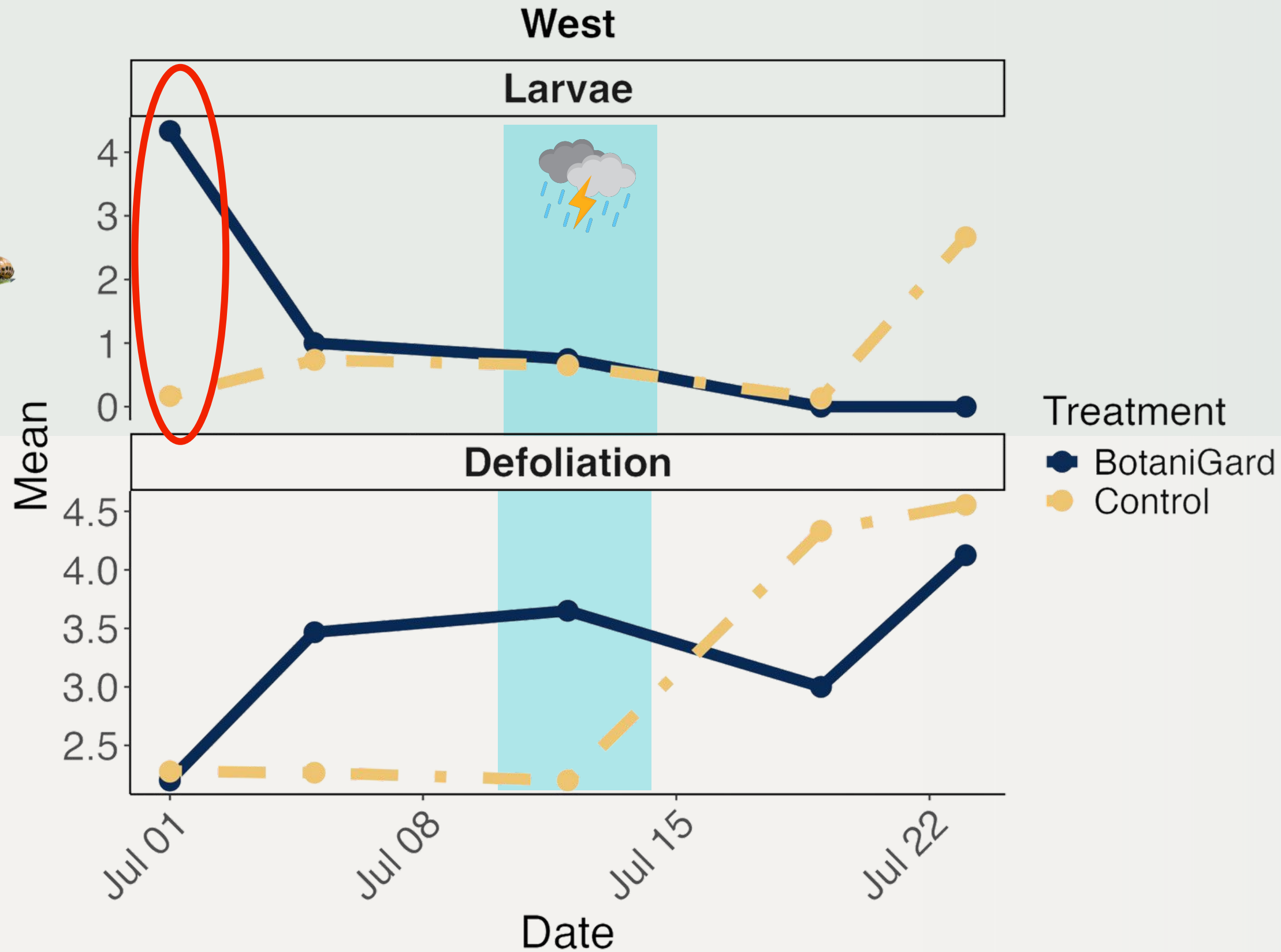


No significant difference in the number of larvae per plant

Significantly lower defoliation in BotaniGard treatment

Infected individuals may become sick and feed less,

Comparing Number of Larvae and Defoliation Over Time

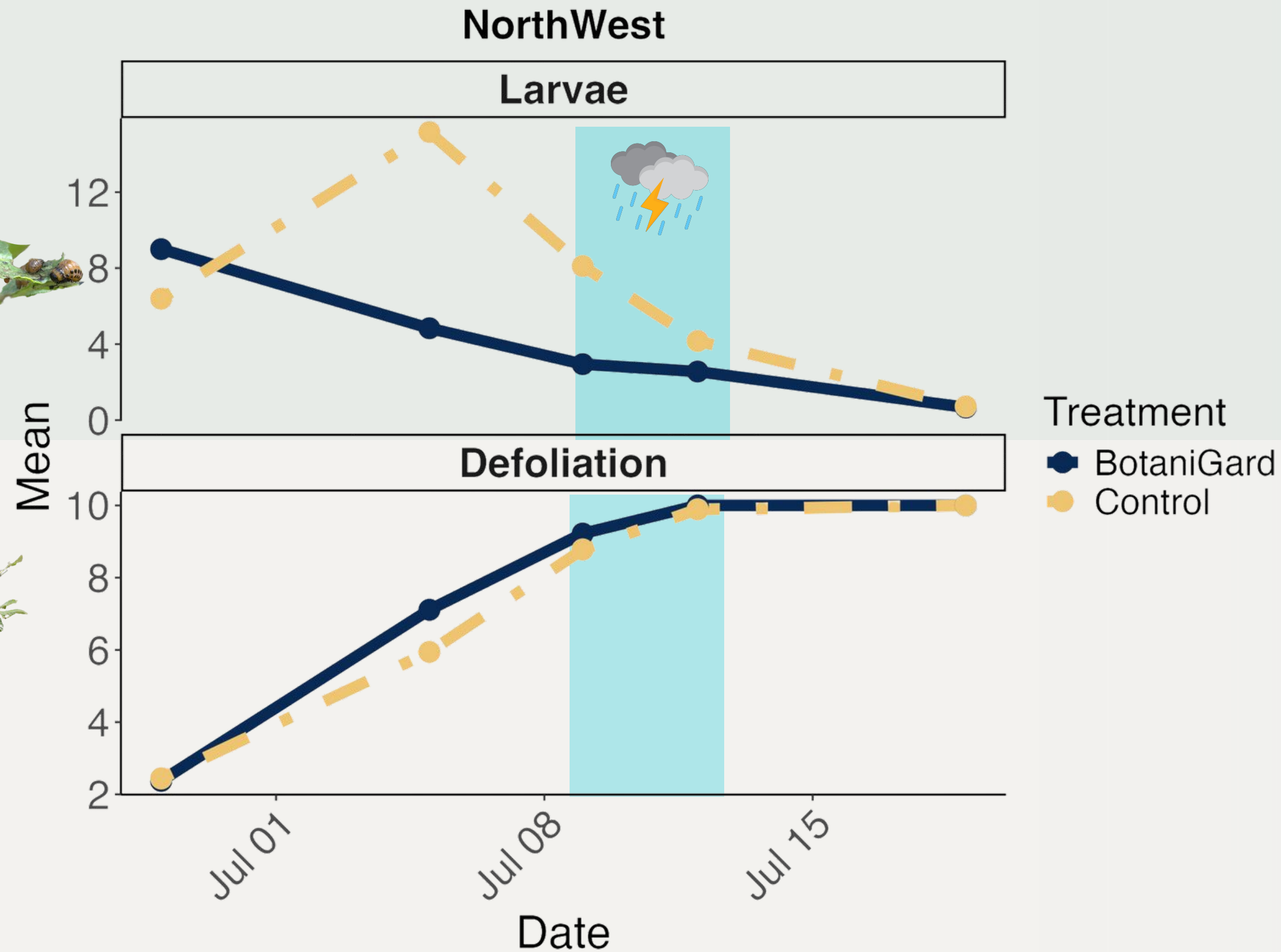


BotaniGard plots started with higher CPB pressure compared to the control plot.

After BotaniGard treatment, larval numbers decreased and remained low for the rest of the season.

In BotaniGard-treated plots, defoliation stabilized

Comparing Number of Larvae and Defoliation Over Time



After application, CPB numbers dropped in the treatment compared to the control.

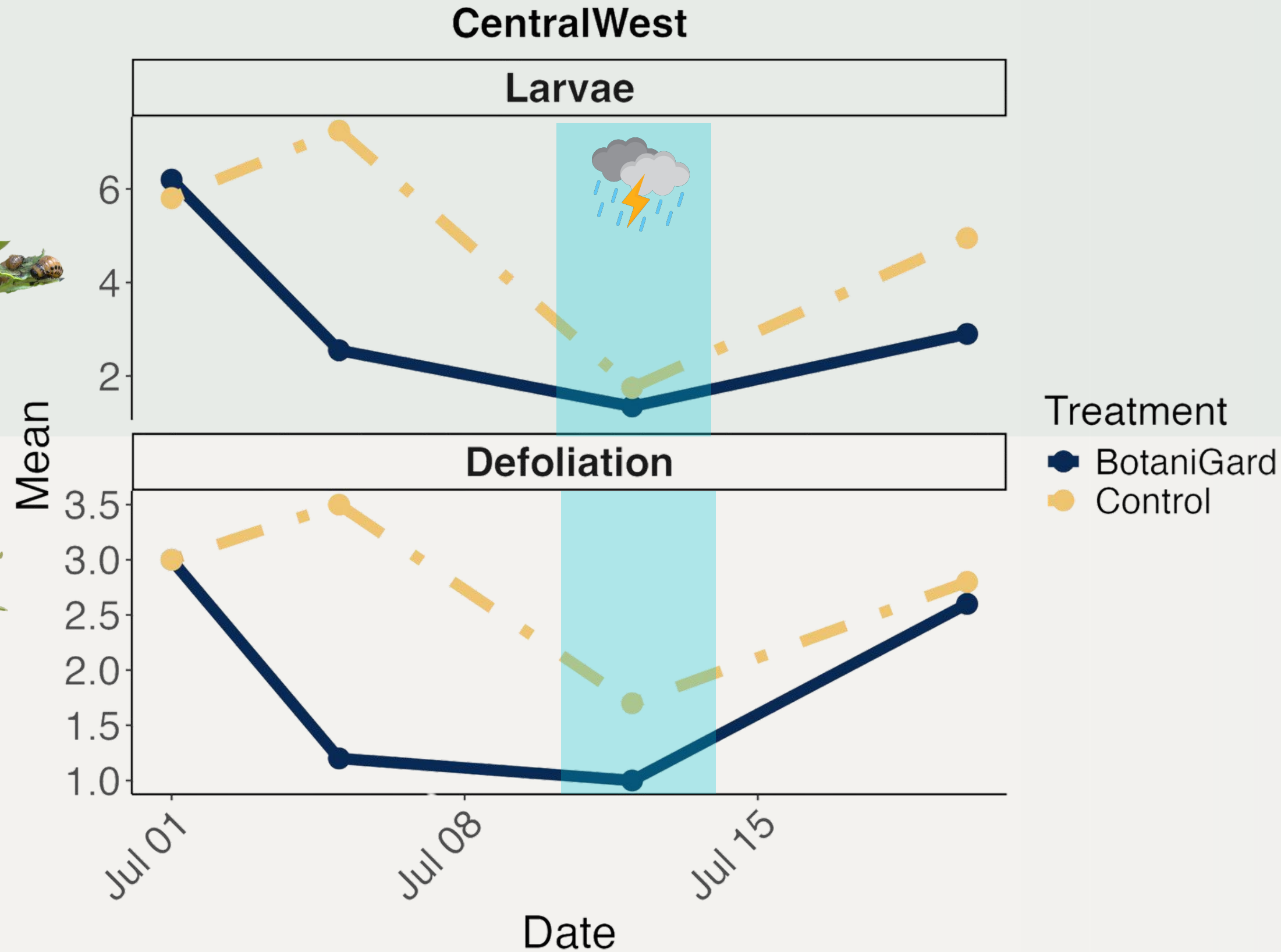
The storm caused CPB numbers to equalize between treatment and control.

Plants were small and weak because of a fungal infection in the seed potatoes, leading

Potato white mold (*Sclerotinia sclerotiorum*)



Comparing Number of Larvae and Defoliation Over Time



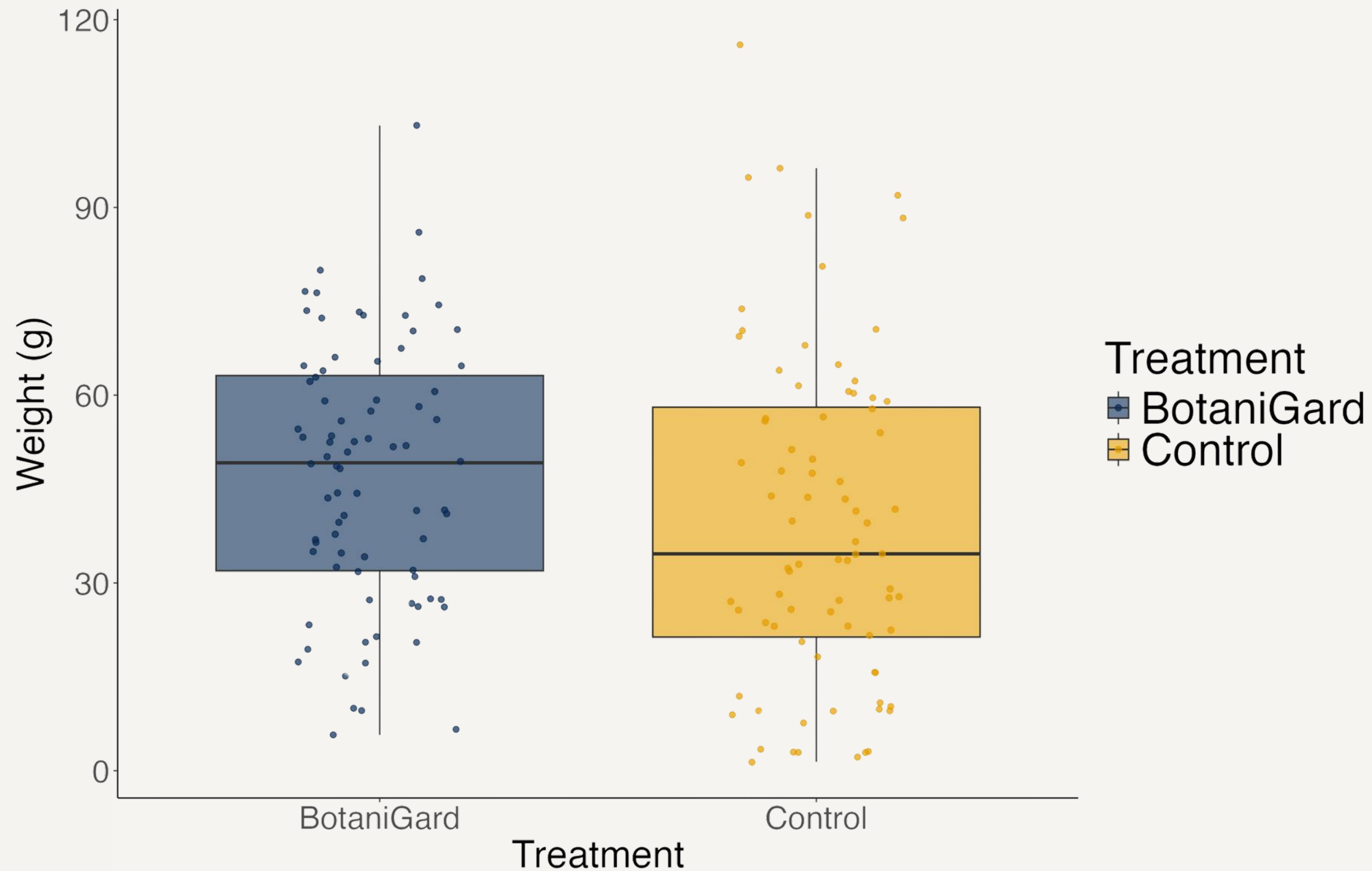
Significant reduction in both larval numbers and defoliation after BotaniGard application.

After the storm, defoliation increased in both treatment and control.

Despite the storm and defoliation, the yield

Potato Weight at Central West Location

Significantly higher potato yield in BotaniGard treatment compared to Control.

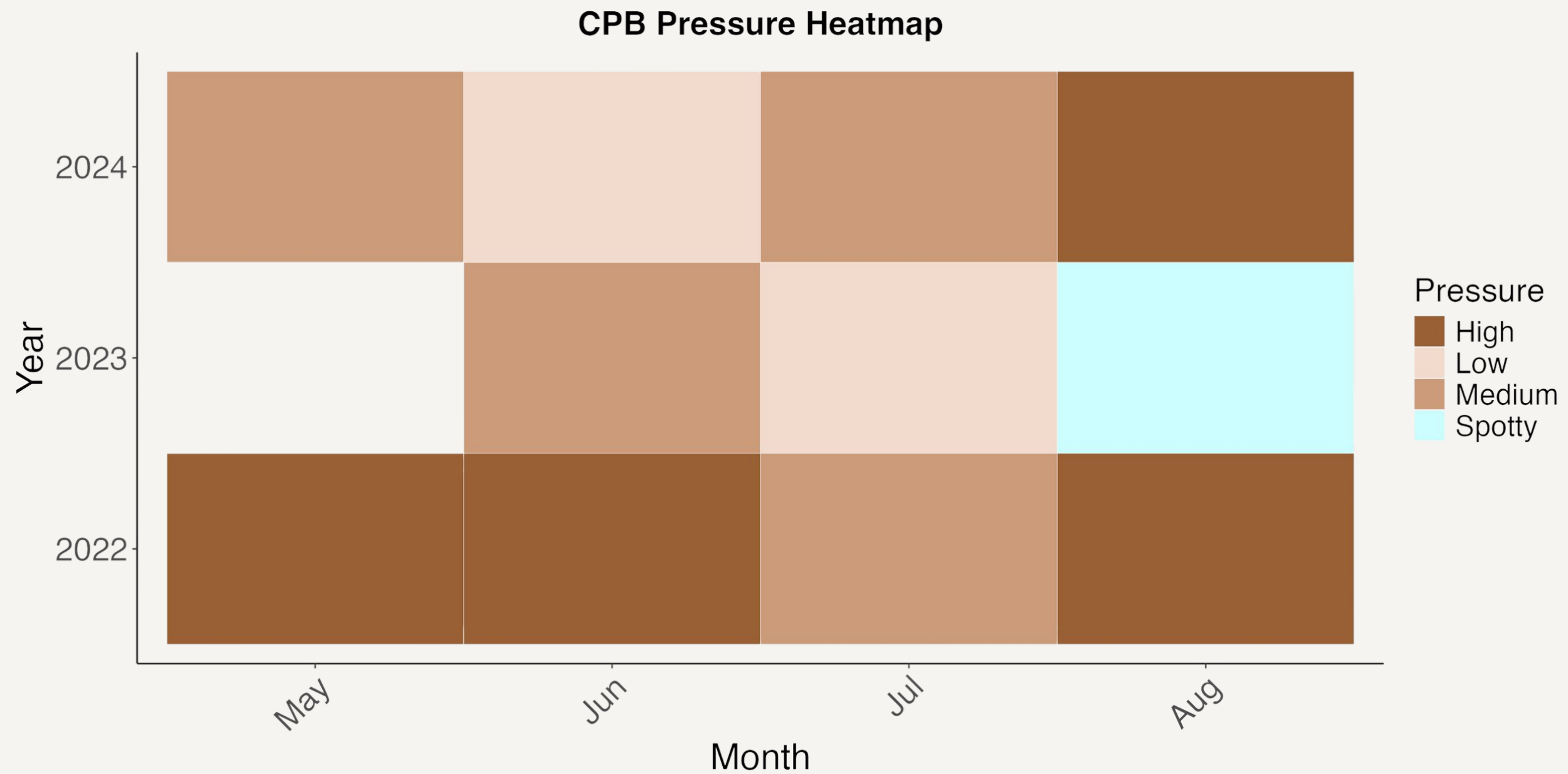


CPB Population Monitoring in Vermont 2022-2024

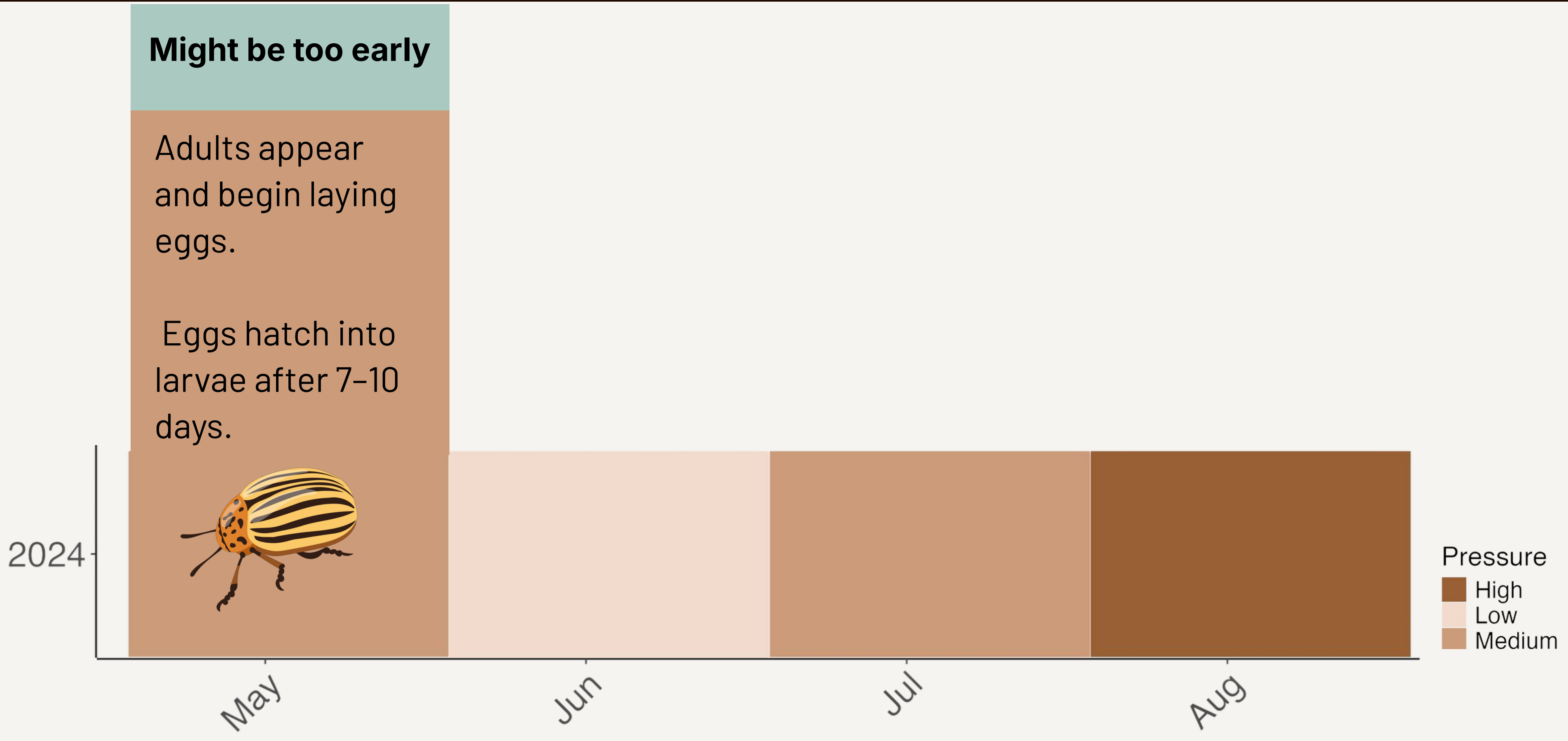
Izzo et al.

Monitoring is Key:

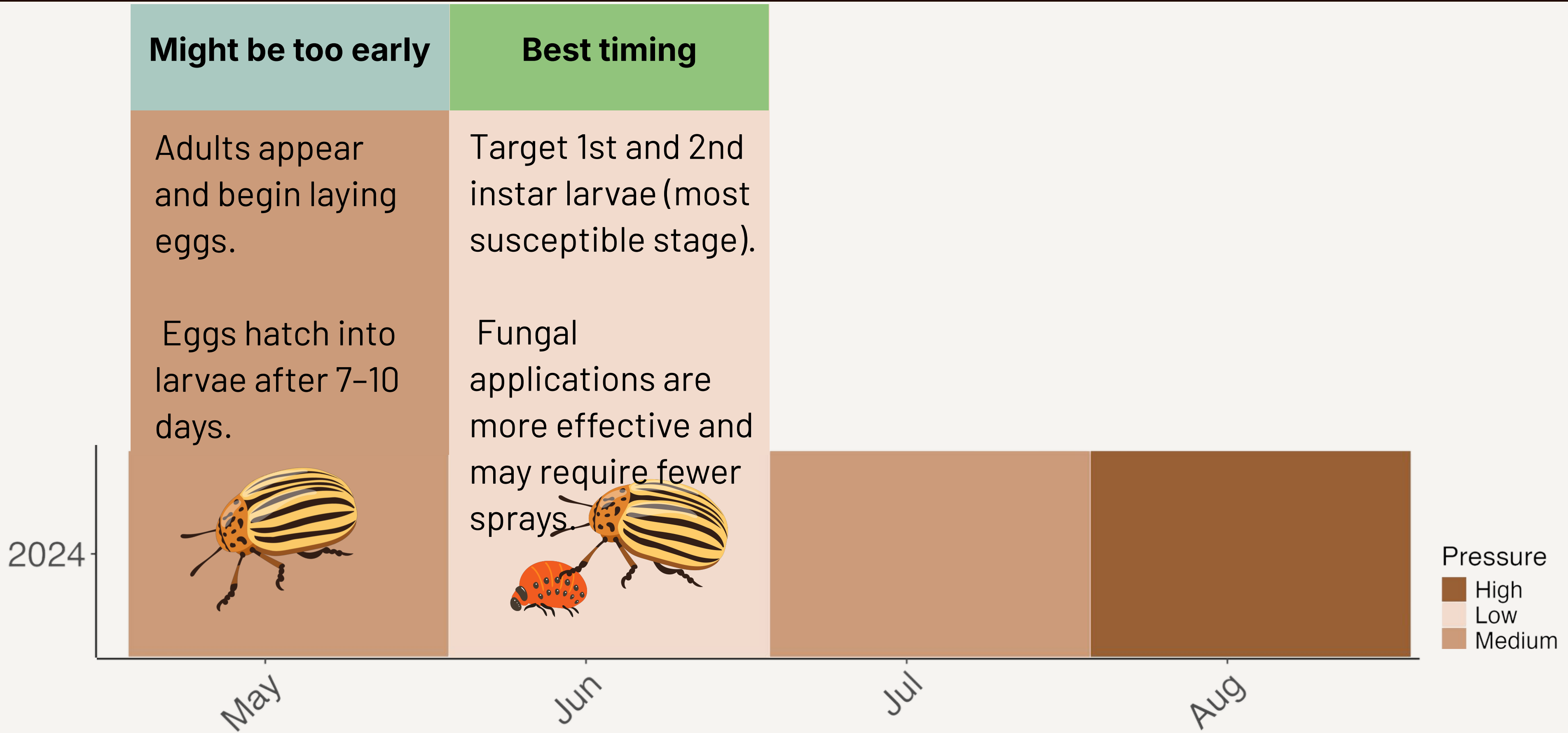
Beetle pressure can vary—some years are high, others are low.



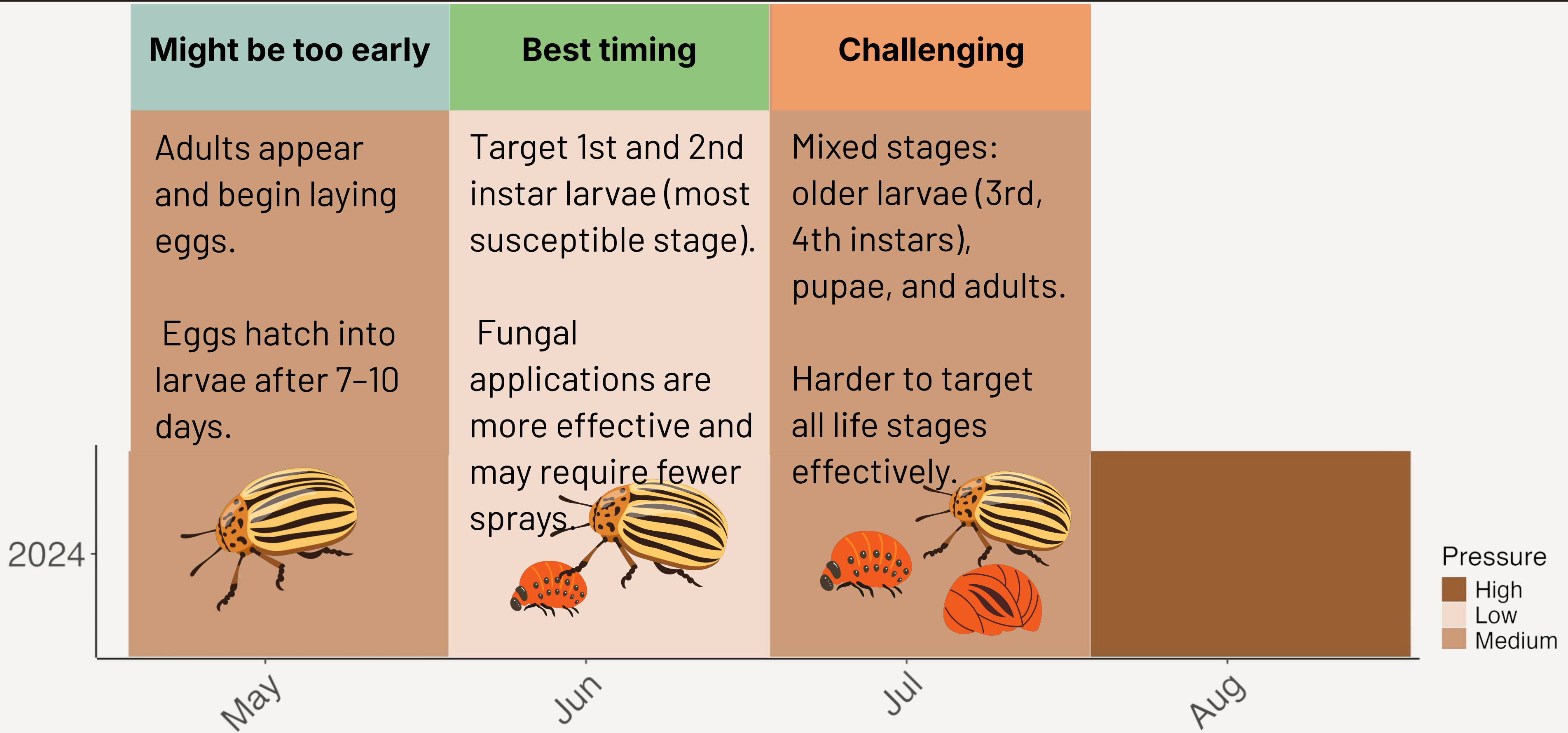
Best Timing for Fungal Applications



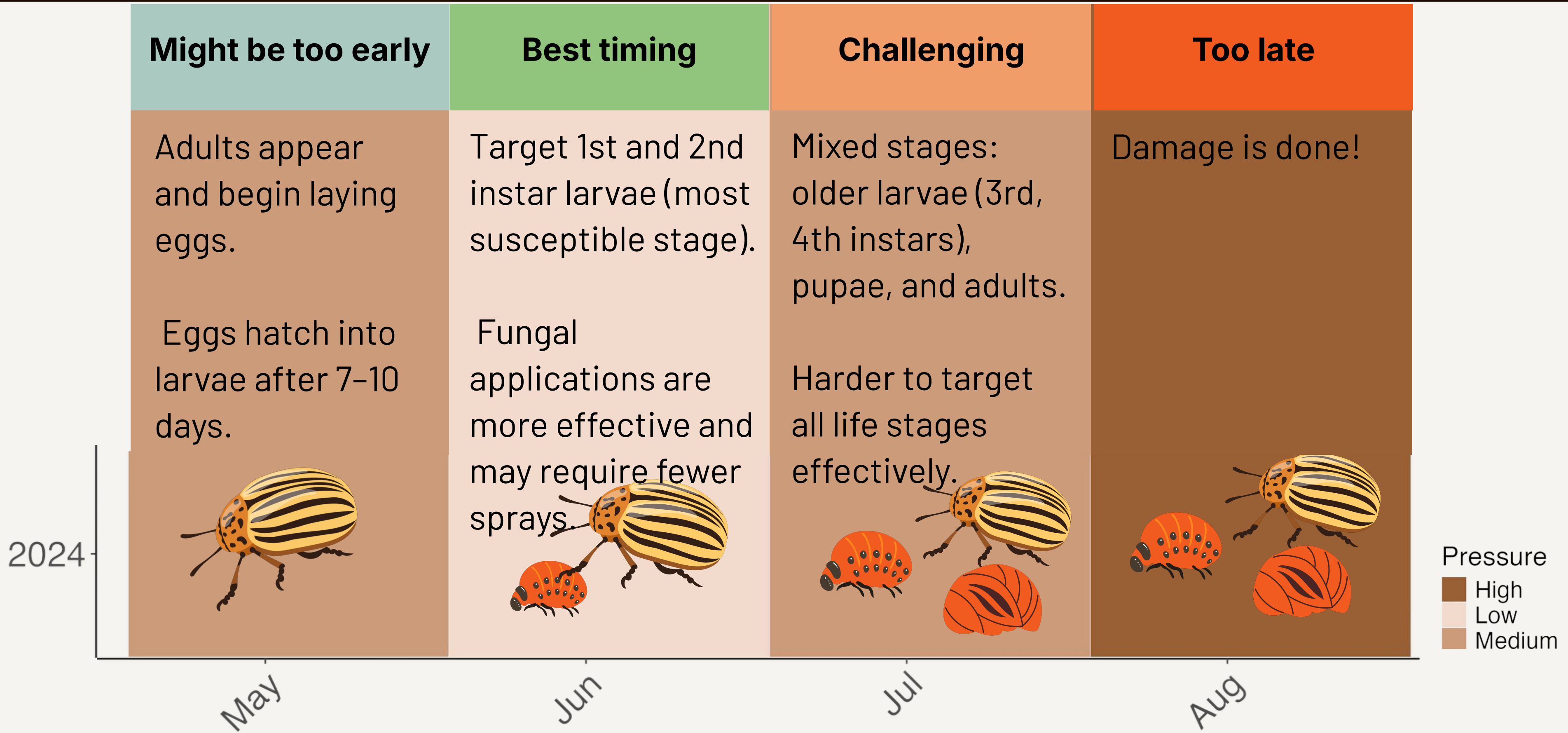
Best Timing for Fungal Applications



Best Timing for Fungal Applications



Best Timing for Fungal Applications



Delayed Planting for CPB Management

Project Overview:

Evaluates delayed planting as a strategy to reduce CPB pressure

Assesses agronomic and economic trade-offs of delayed planting

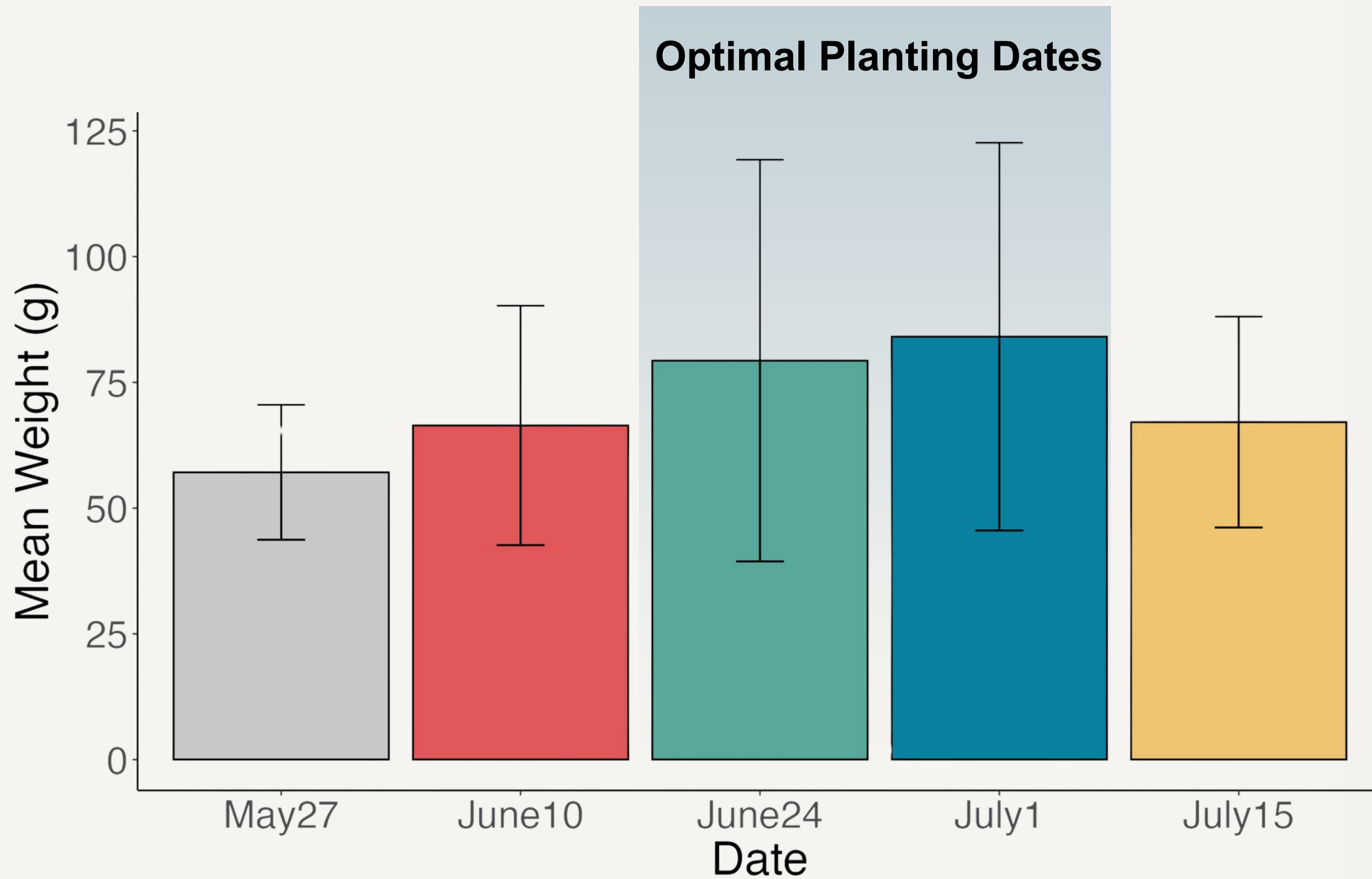
Why Delay Planting?

Reducing early feeding and egg-laying.

Decrease CPB pressure during critical crop growth stages

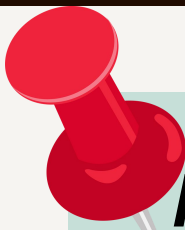


Potato Yield in Different Planting Time



Delayed planting on June 24th and July 1st resulted in the highest yields based on trial results.

Broader Takeaways



Monitoring

- **Regular monitoring** is critical to assess CPB pressure and determine the best time for intervention.
- **Early-season applications** (early June) are most effective when larvae are primarily 1st and 2nd instars.

CPB Monitoring

To use the threshold:

- Walk the field in a V-shaped pattern
- Select 50 potato stalks at intervals, e.g., every 10 to 20 paces, depending on field size.

Life Stage	No. of CPB per 50 stalks	
	Low Threshold	High Threshold
Adults	15 or fewer	25 or more
Small Larvae	75 or fewer	200 or more
Large Larvae	30 or fewer	75 or more

Broader Takeaways



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Considerations

- Fungal pesticides, may **not immediately kill** larvae but reduce their feeding behavior.
- Control becomes more challenging as the season progresses due to **mixed life stages**.
- **Multiple applications**, spaced 5-7 days apart, for effective results.

Broader Takeaways



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Considerations

- Fungal pesticides, may **not immediately kill** larvae but reduce their feeding behavior.
- Control becomes more challenging as the season progresses due to **mixed life stages**.
- **Multiple applications**, spaced 5-7 days apart, for effective results.



Delayed Planting as a Strategy

- Delayed planting can help **reduce early-season CPB pressure**.
- In Vermont, planting in **late June to early July** has shown promising results to reduce CPB damage

Acknowledgment



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Our Amazing Undergraduate Assistants

Thank
you

