

Exploring the influence of cover-crop termination in annual cropping systems on predator communities and predation

Jared S. Adam, John F. Tooker, and John M. Wallace

3/10/2024

Key points

Conservation biological control in agronomic systems

Slugs of the corn

Cover crops can promote prey consumption

Predator x slug interactions



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What is no-till farming?

Tilling: turning over top 6-10 inches



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What is no-till farming?

Tilling: turning over top 6-10 inches

No-Till: You guessed it; the opposite of tilling



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What are cover crops and how do I “plant green”?

Cover crops: a plant grown in between cash crops



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What are cover crops and how do I “plant green”?

Cover crops: a plant grown in between cash crops

Planting green: no-till planting into **actively** living cover crops



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Why would I plant cover crops and no-till?

Benefits

- Slow erosion of soil and nutrients
- Improve soil health
- Enhance water availability



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- Smother weeds
- Help control pests and diseases



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Concerns

- Increase in insect and slug pests and disease



Preventative Pest Management in corn



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Question 1

What happens when we remove insecticides?

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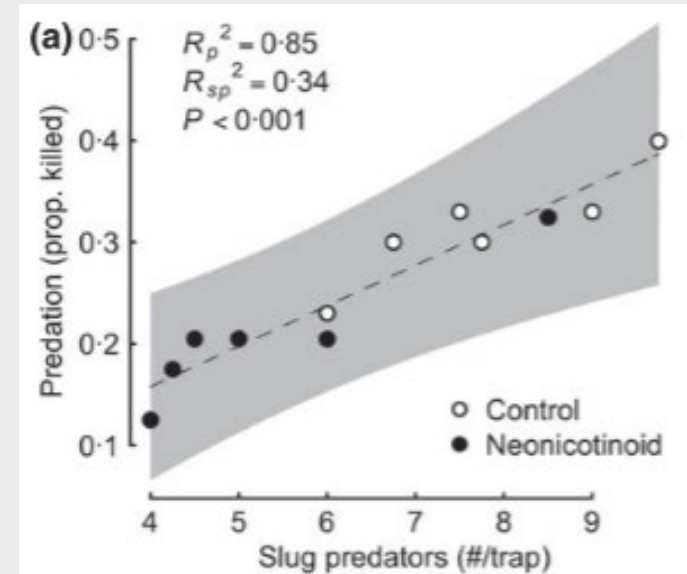
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EDITOR'S CHOICE: Neonicotinoid insecticide travels through a soil food chain, disrupting biological control of non-target pests and decreasing soya bean yield

Margaret R. Douglas✉, Jason R. Rohr, John F. Tooker

Decrease in insecticides = more predators



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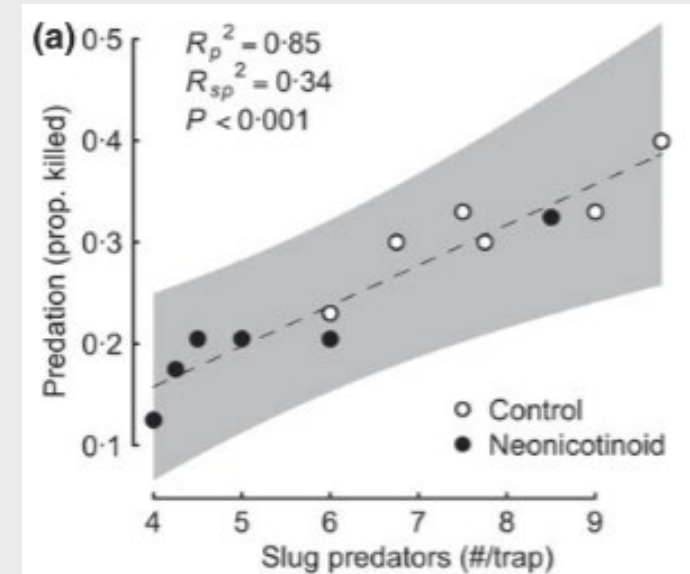
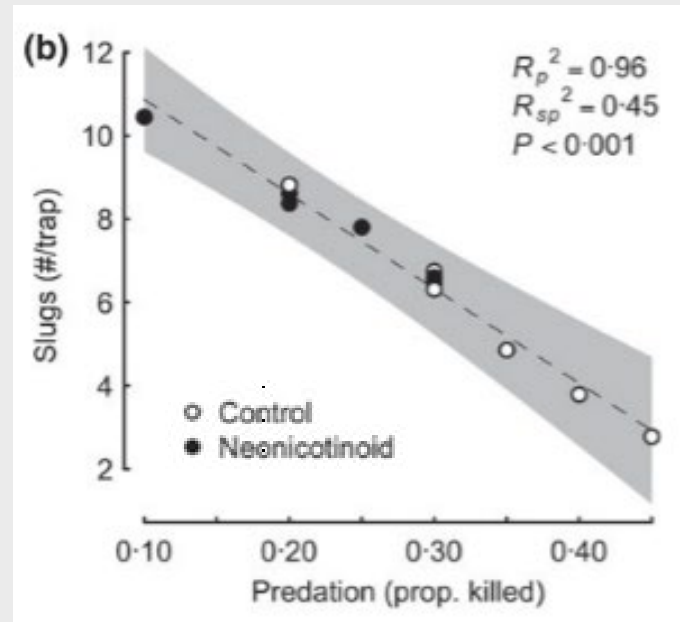
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EDITOR'S CHOICE: Neonicotinoid insecticide travels through a soil food chain, disrupting biological control of non-target pests and decreasing soya bean yield

Margaret R. Douglas✉, Jason R. Rohr, John F. Tooker

Decrease in insecticides = more predators

More predation



Question 2

What happens if we remove insecticides and combine no-till with cover crops?

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Early-season plant cover supports more effective pest control than insecticide applications

Elizabeth K. Rowen¹  | Kirsten A. Pearsons¹ | Richard G. Smith² | Kyle Wickings³ | John F. Tooker¹

3-year study in corn-soy rotations evaluating cover crop, insecticide, and predator interactions

Predators did as well or better than insecticide treatments in protecting crops

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Question 3

Are there ways to manage cover crops to promote predators?

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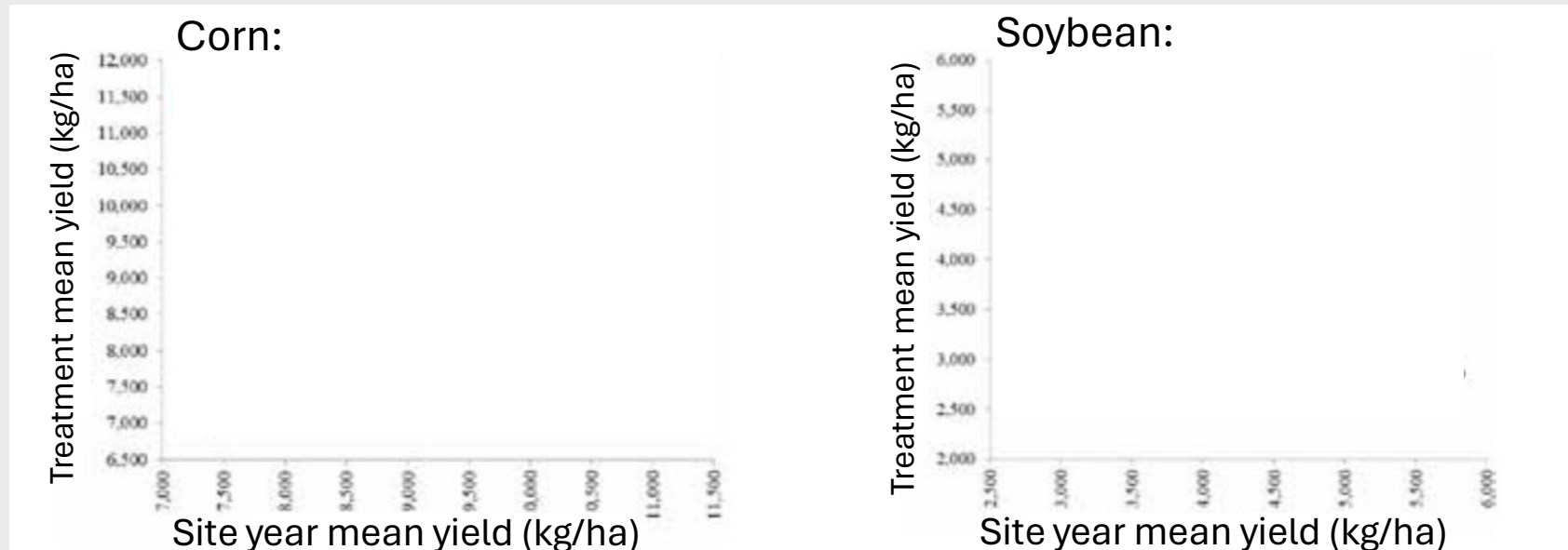
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Planting Green Effects on Corn and Soybean Production

Heidi K. Reed,* Heather D. Karsten, William S. Curran, John F. Tooker, and Sjoerd W. Duiker

Planting green (post-plant cc termination) vs **Pre-plant** cc termination



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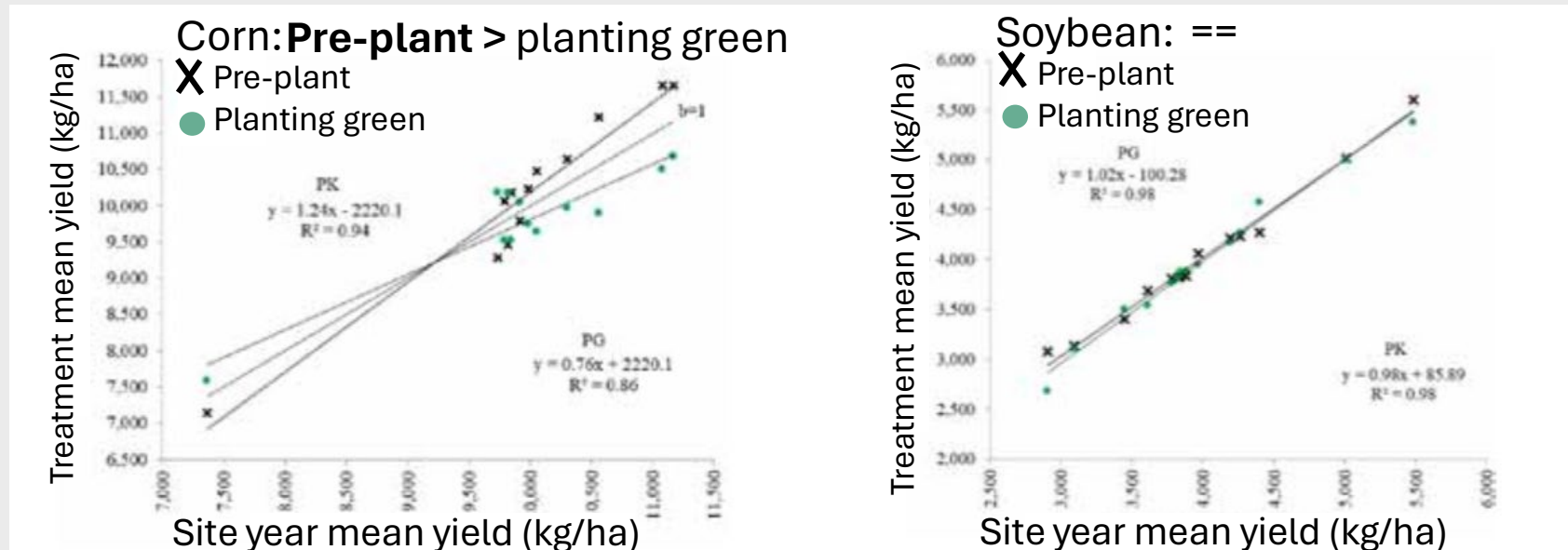
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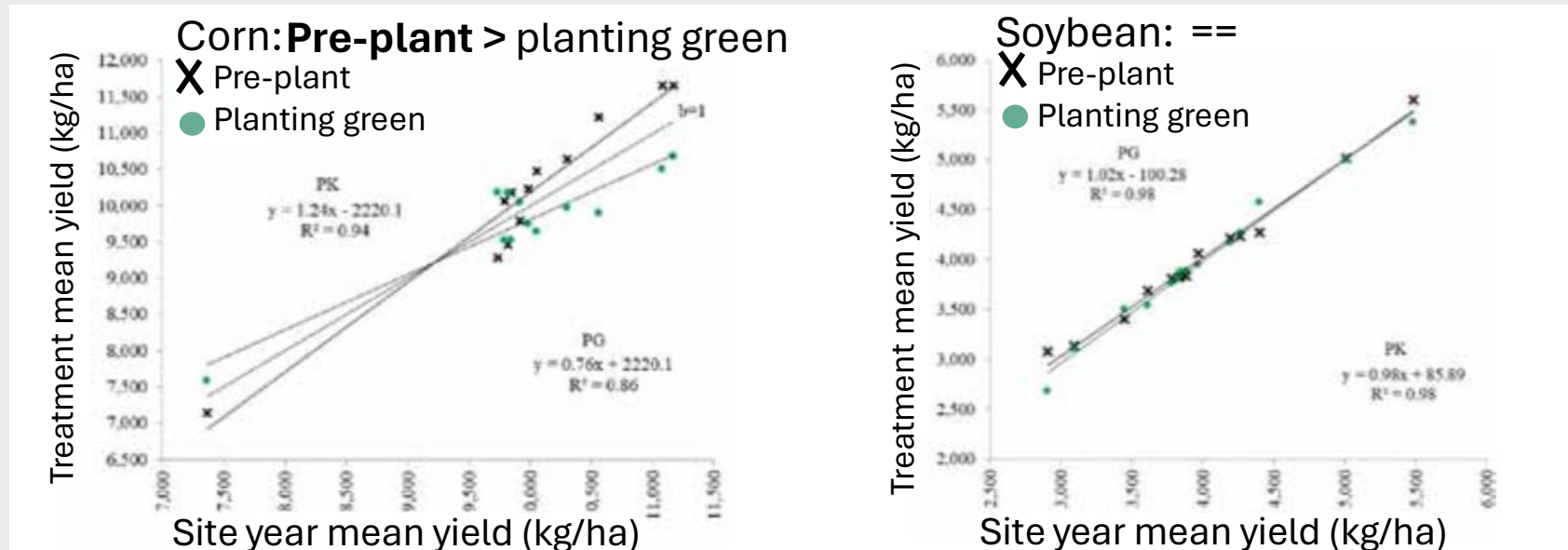
Planting green (post-plant cc termination) vs Pre-plant cc termination



Planting Green Effects on Corn and Soybean Production

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Planting green (post-plant cc termination) vs **Pre-plant** cc termination



Planting green, on average, had **more** slug damage

The Project

Interdisciplinary approach investigating affects of delaying cover crop termination on pest interactions

Quantify and explain the effects of cover crop termination on insect populations, diseases, and weeds

3-year experiment

Cereal rye (*Secale cereale*) cover crop

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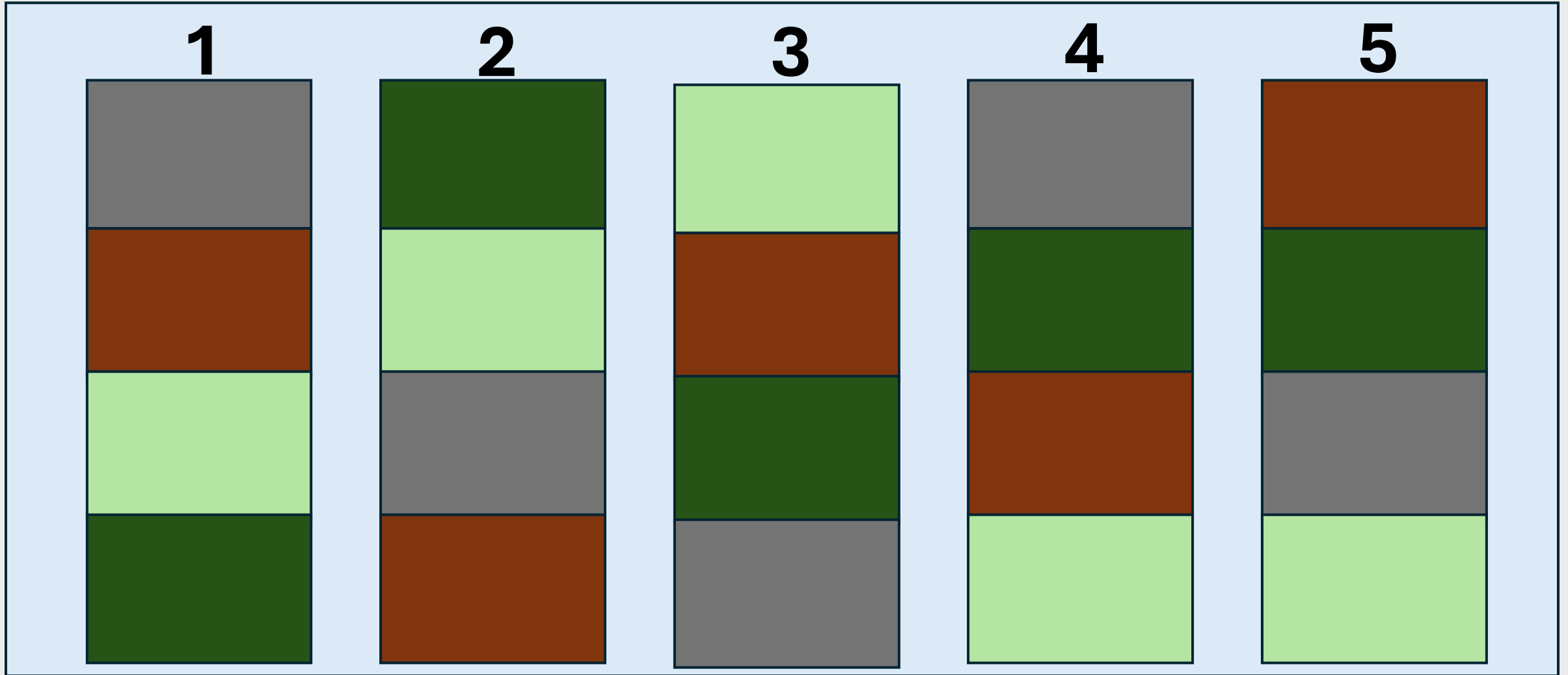
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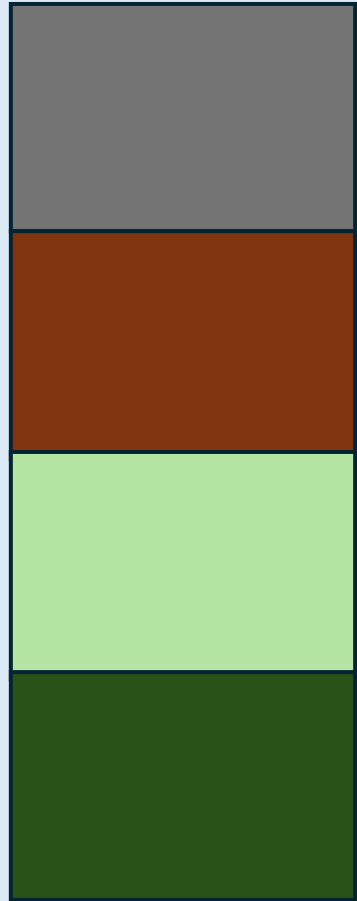
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Treatments

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No cover crop (No CC) check

14-28 Day pre-plant (DPP) cover crop termination

3-7 DPP cover crop termination

1-3 Day after-plant (DAP) cover crop termination

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The data collected

Damage incidence



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Damage incidence

Damage type



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Damage type

Sentinel prey



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Slug counts



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Damage incidence

Damage type

Sentinel prey

Slug counts

Pitfall (2022-2023)



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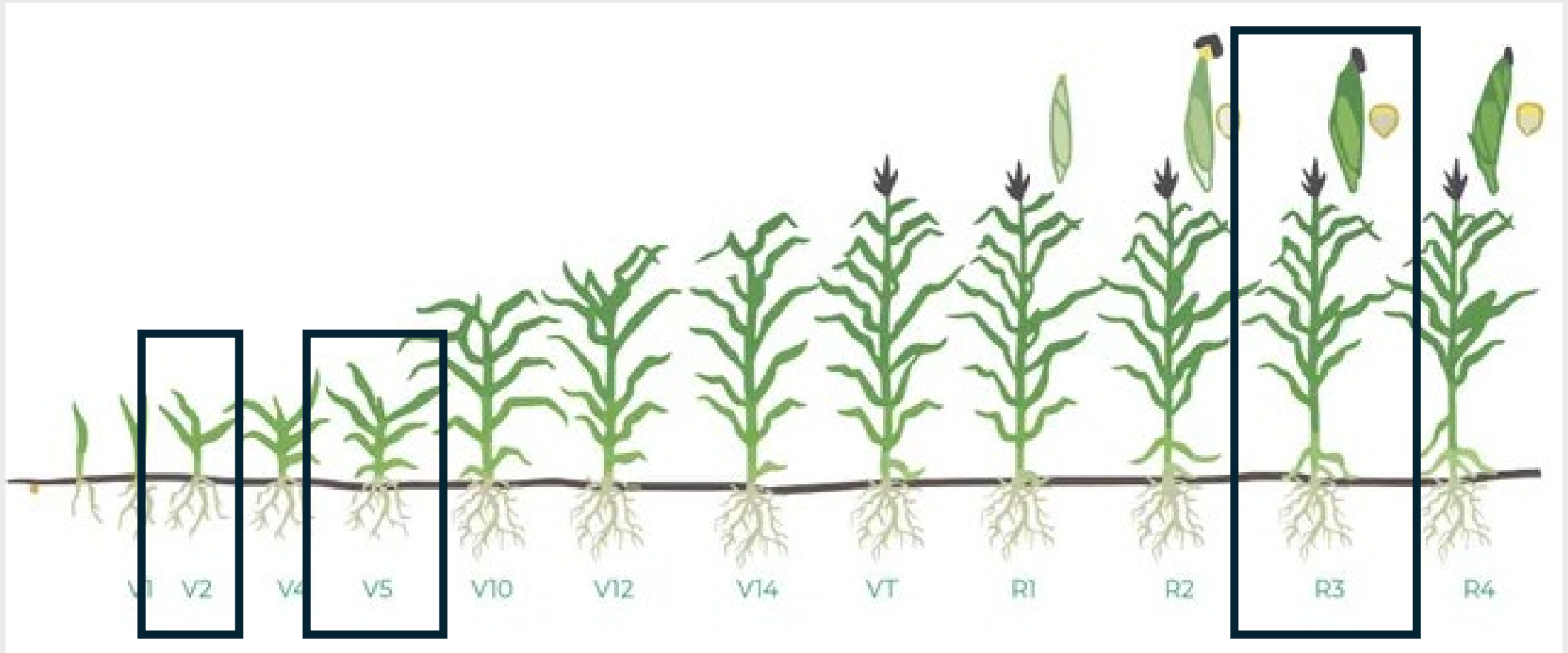
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Corn growth stages



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Hypothesis



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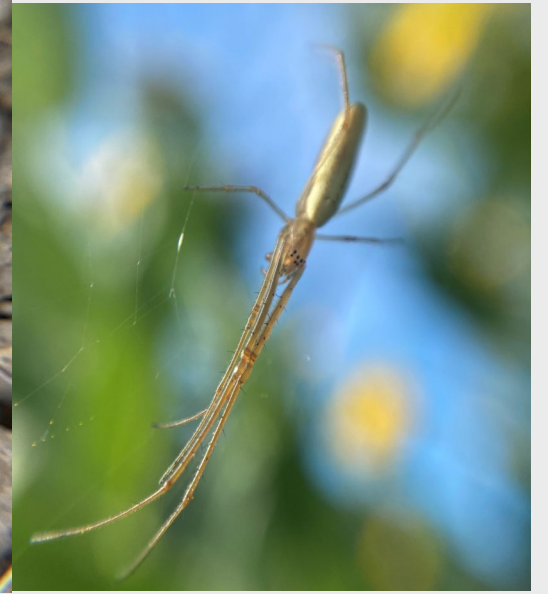
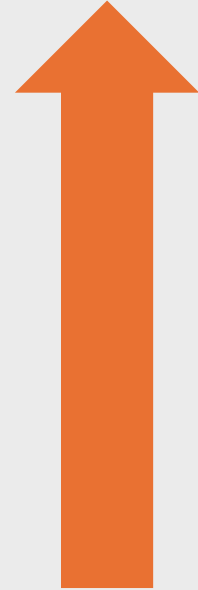
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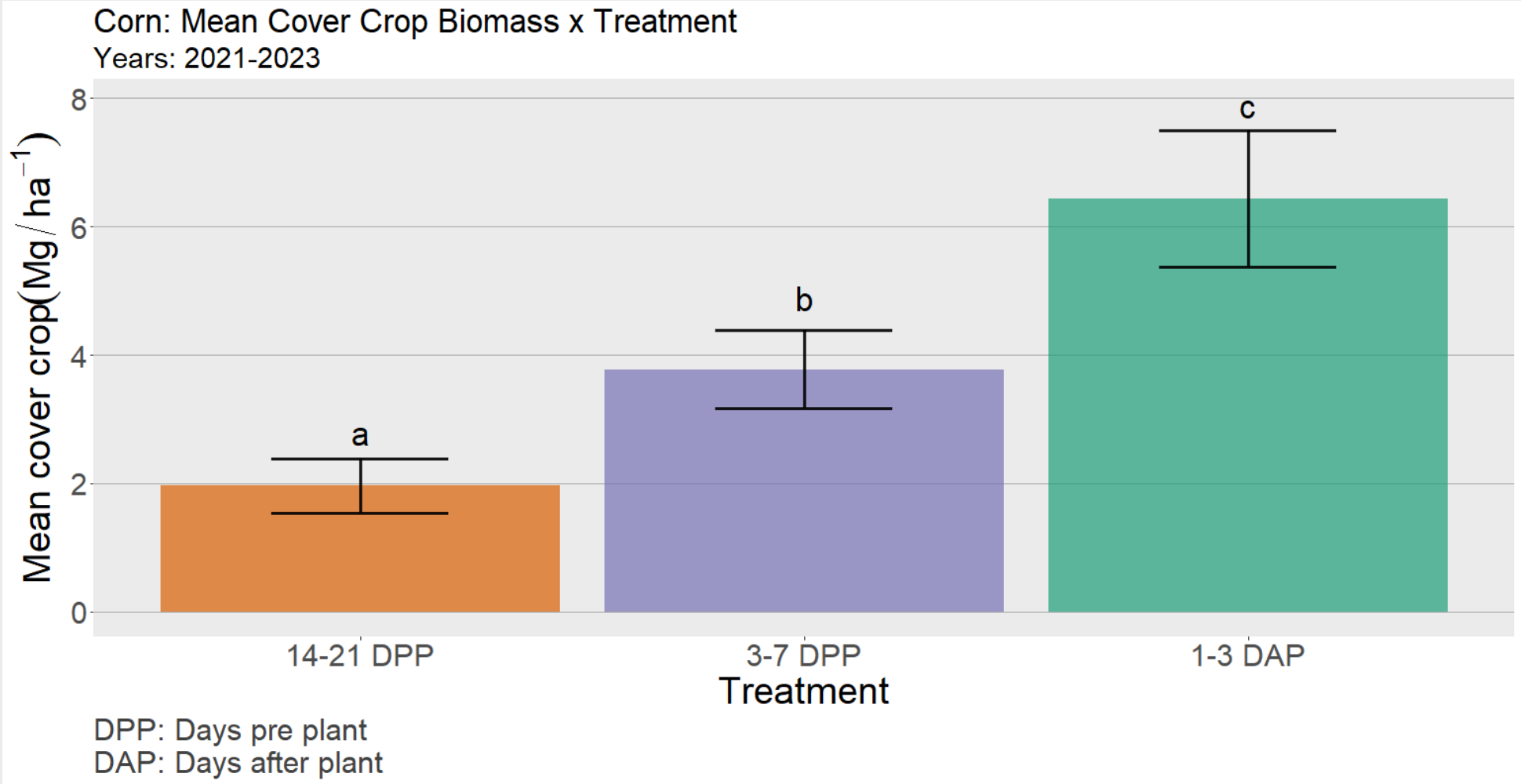
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More cover crop biomass with later termination

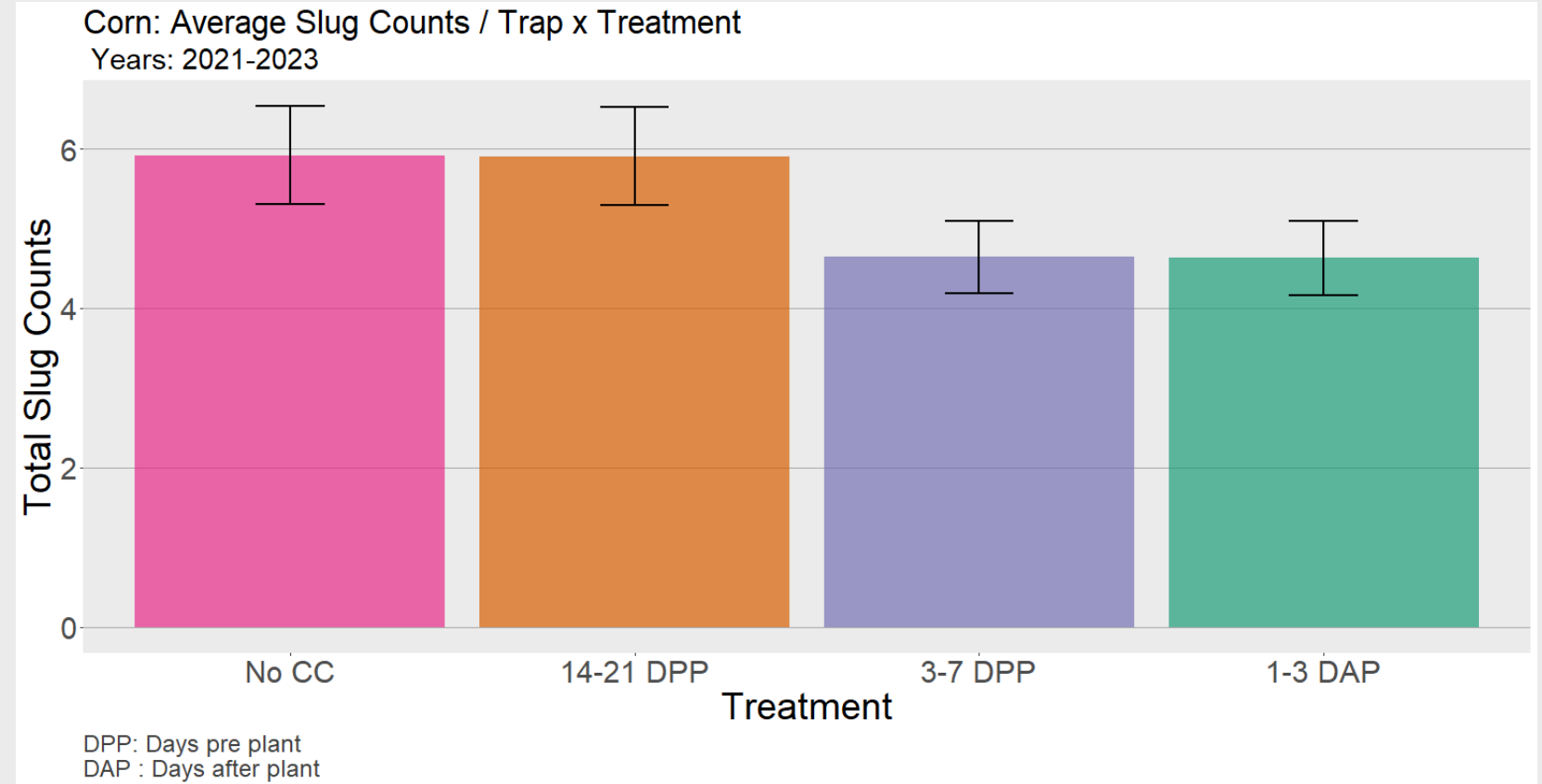


Slug populations are driven by precipitation

Conditional R2 : 0.813

Marginal R2: 0.002

Random R2 = 0.811



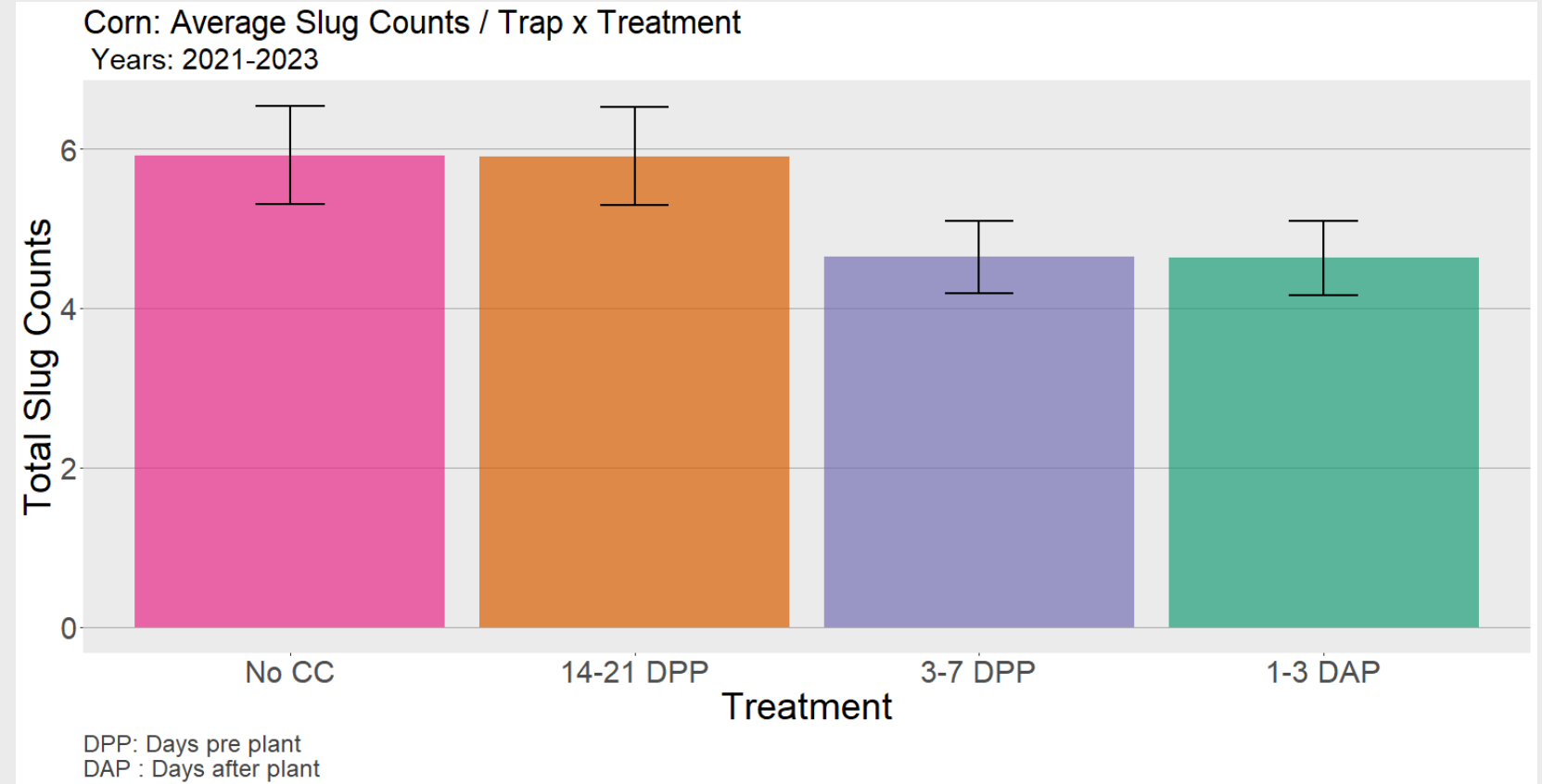
Slug populations are driven by precipitation

Without precipitation

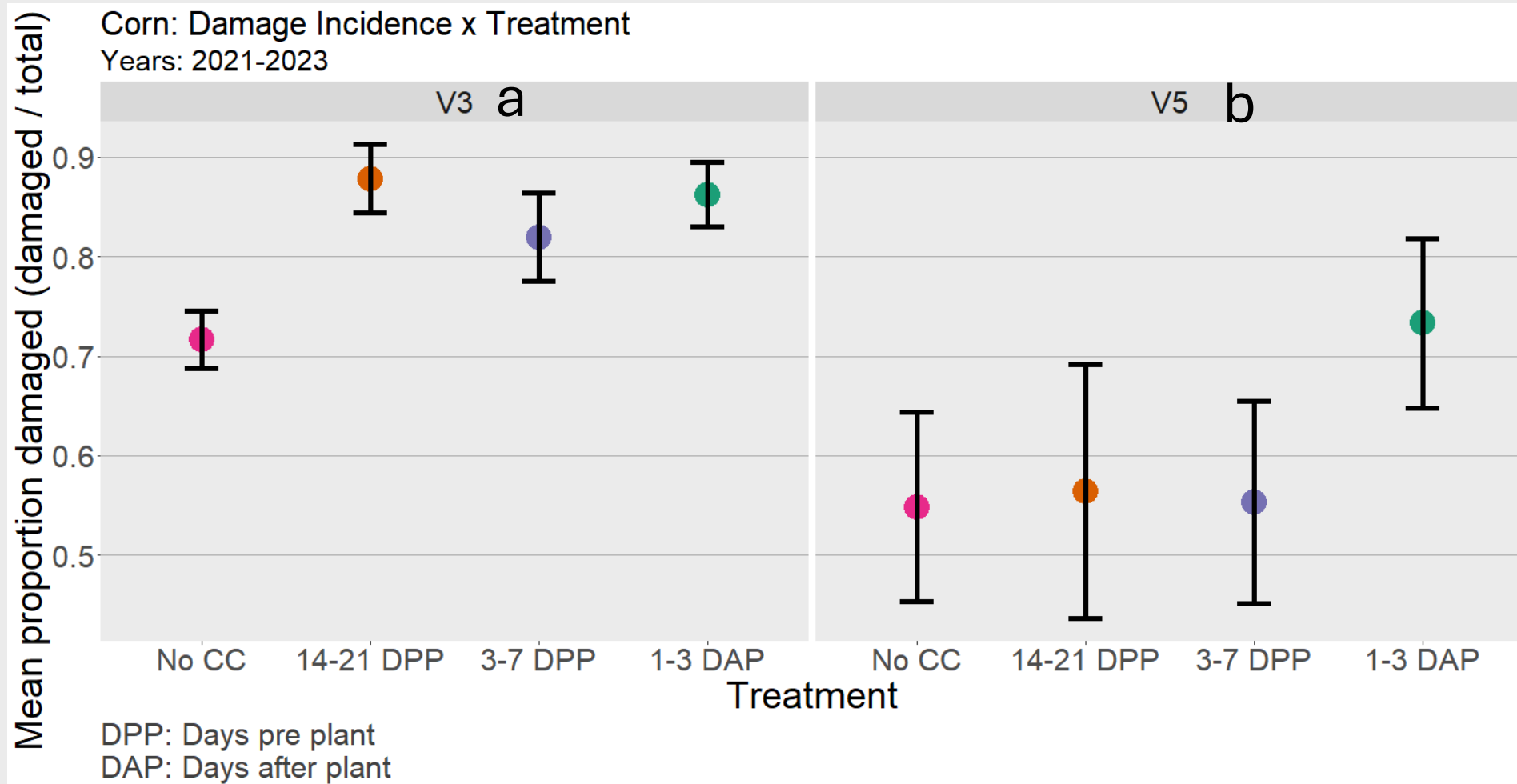
Conditional R2: 0.035

Marginal R2: 0.007

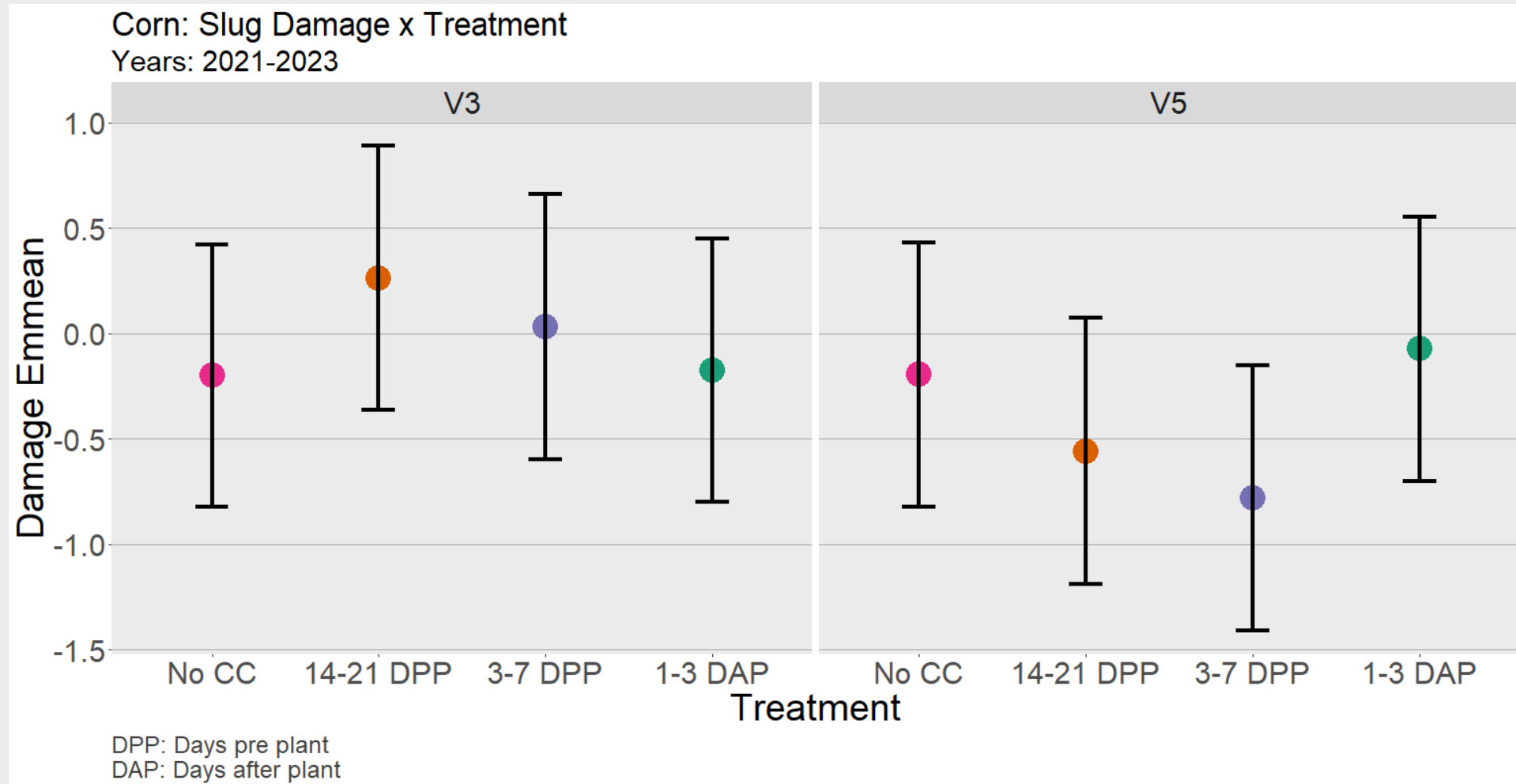
Random R2: 0.028



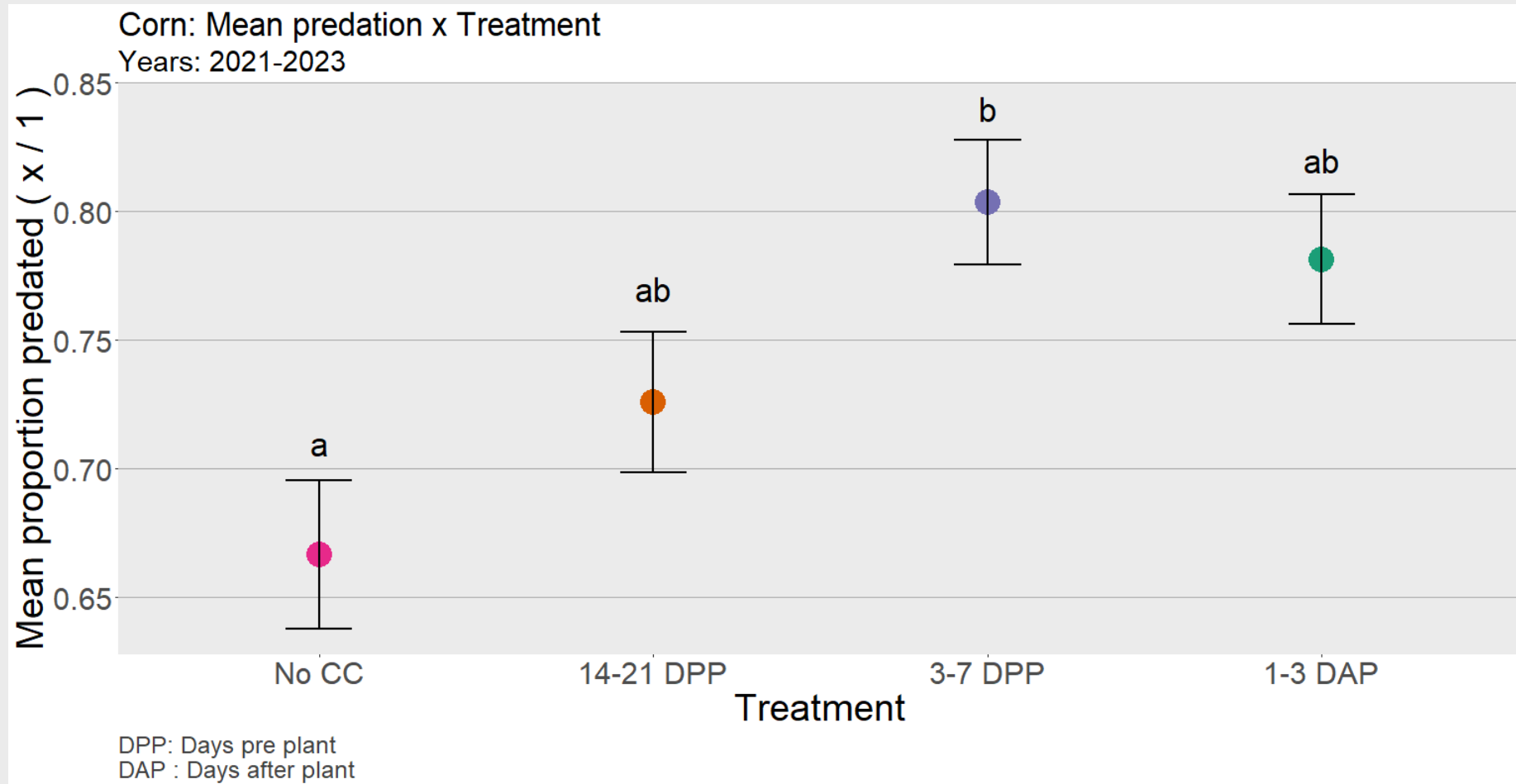
No treatment differences in total damage



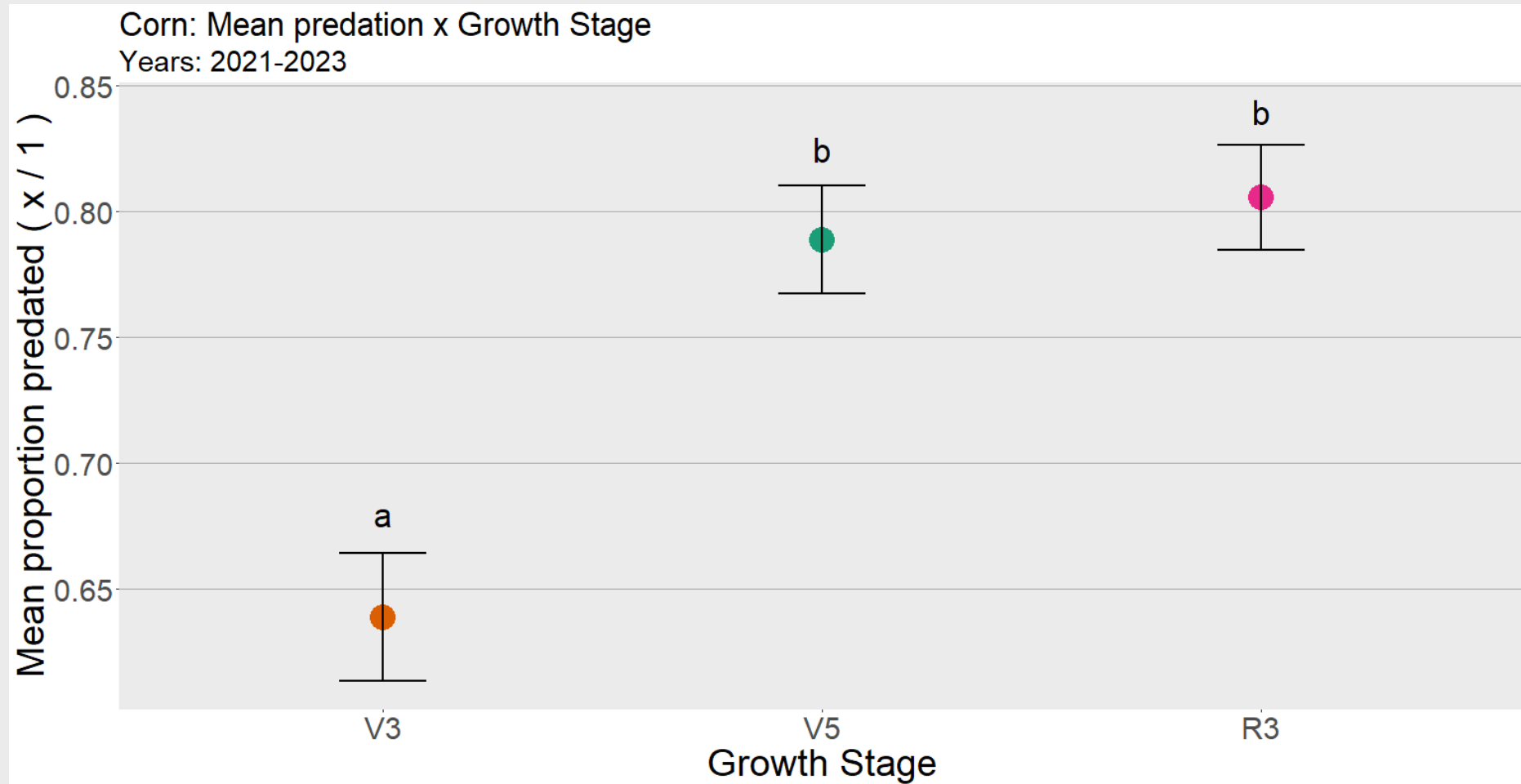
No differences in slug damage



Predators eat more prey with more cover crop



Predators eat later in the season

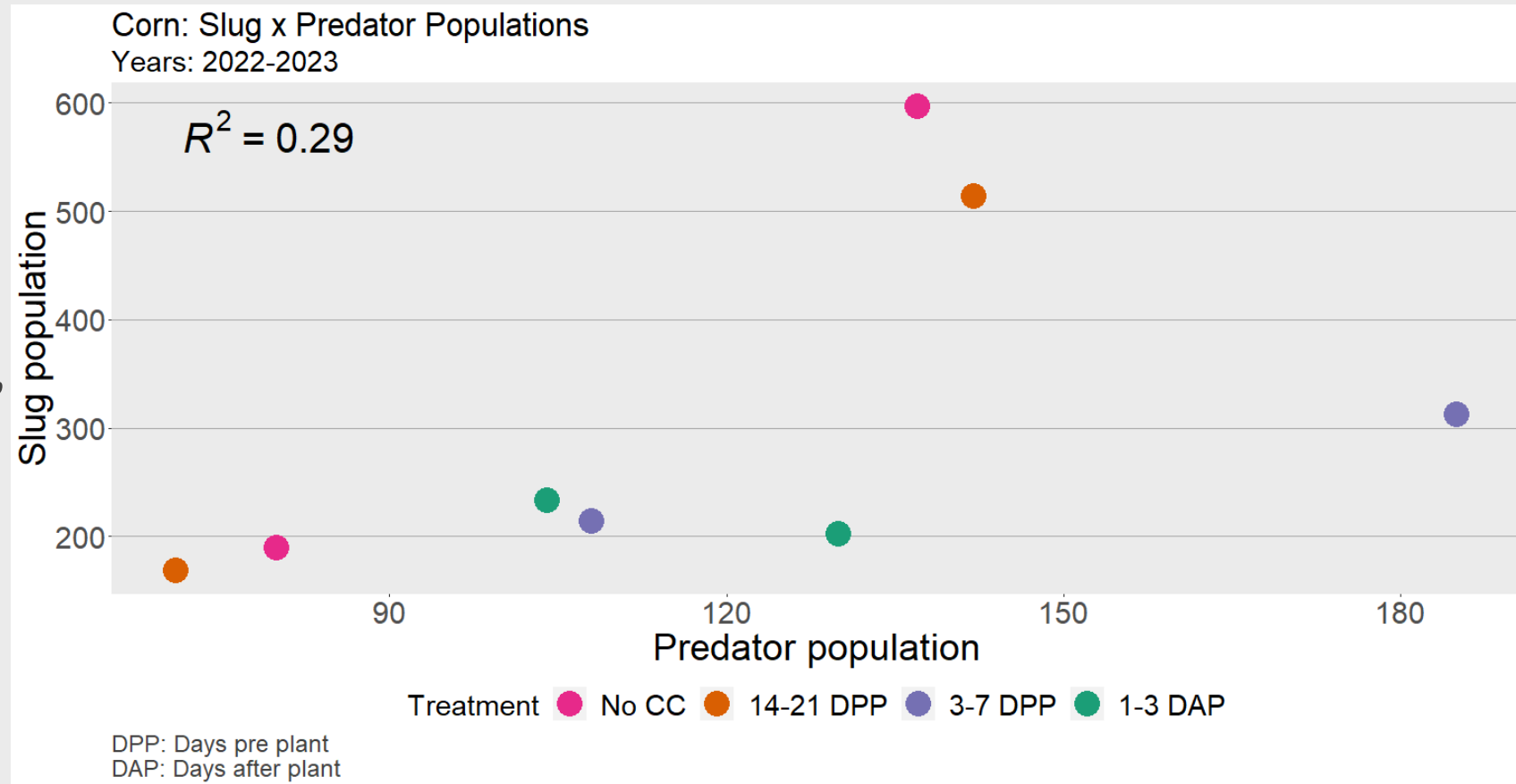


Inverse relationship of predators x slugs

Corn

Predators:

Spiders, Carabids,
Staphylinids,
Formicids, Ensifera,
etc.



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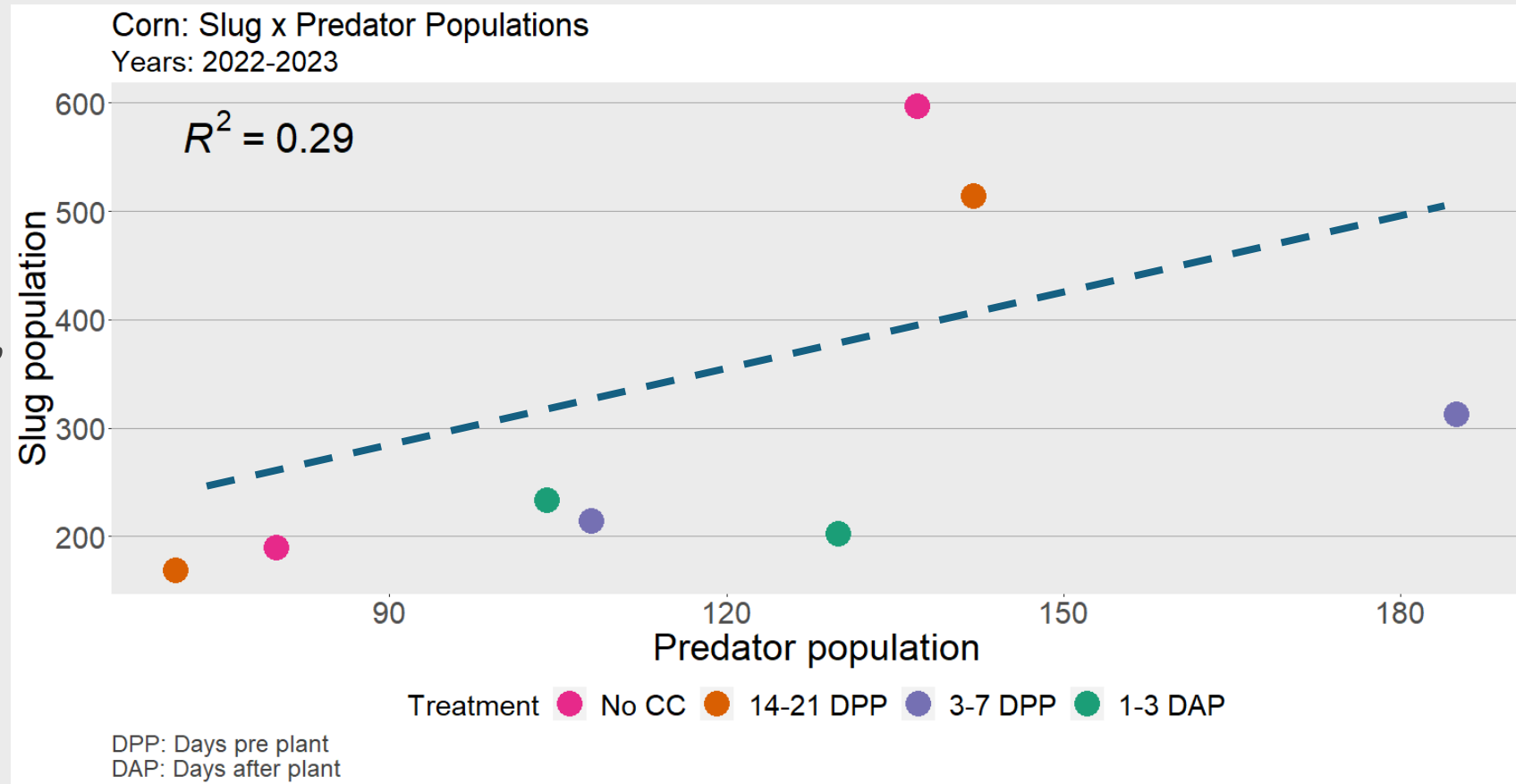
Inverse relationship of predators x slugs

Corn

Predators:

Spiders, Carabids,
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etc.

Trending **increase**
in slugs with an
increase in
predators



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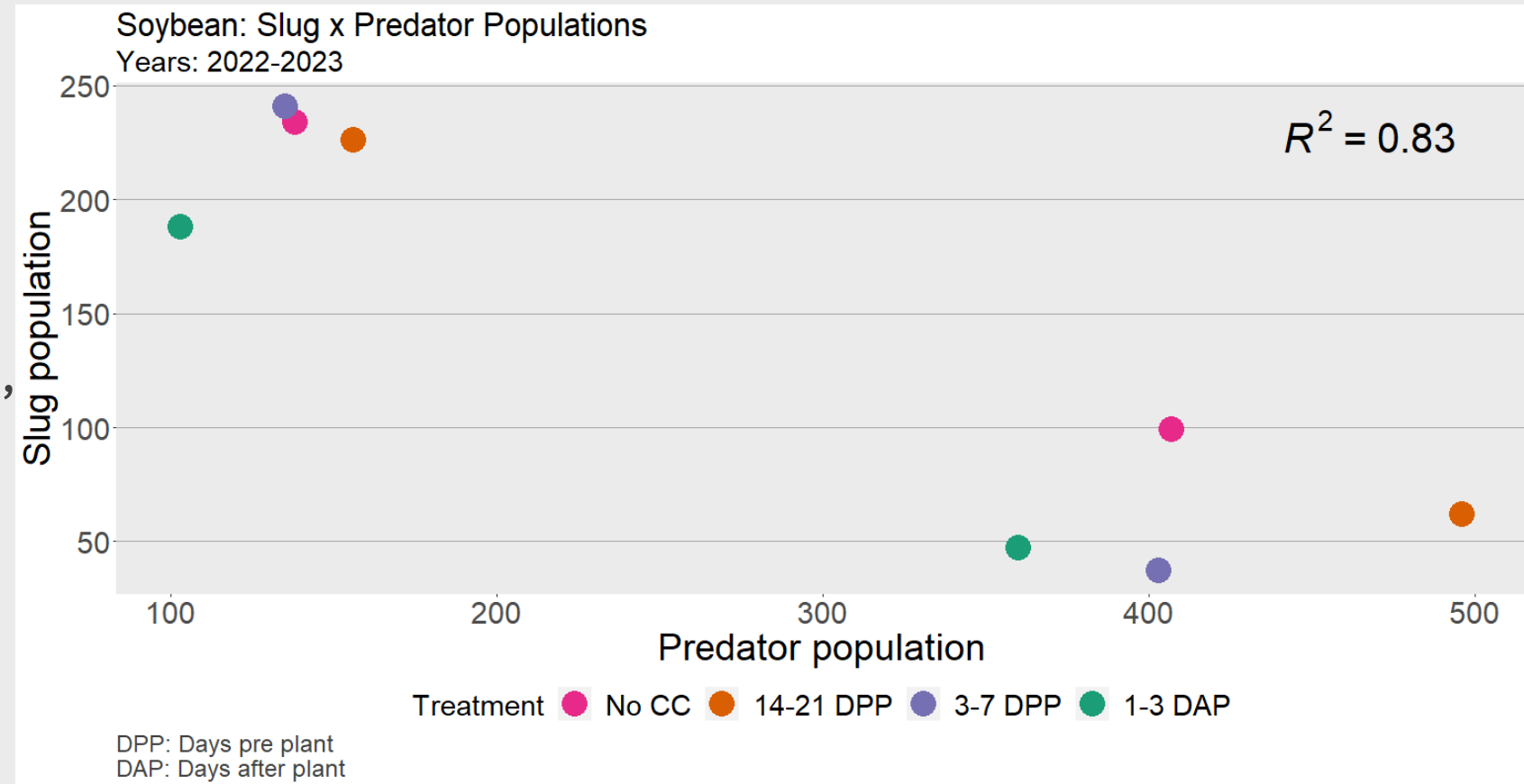
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Predicted relationship of predators x slugs

Soybean

Predators:

Spiders, Carabids,
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etc.



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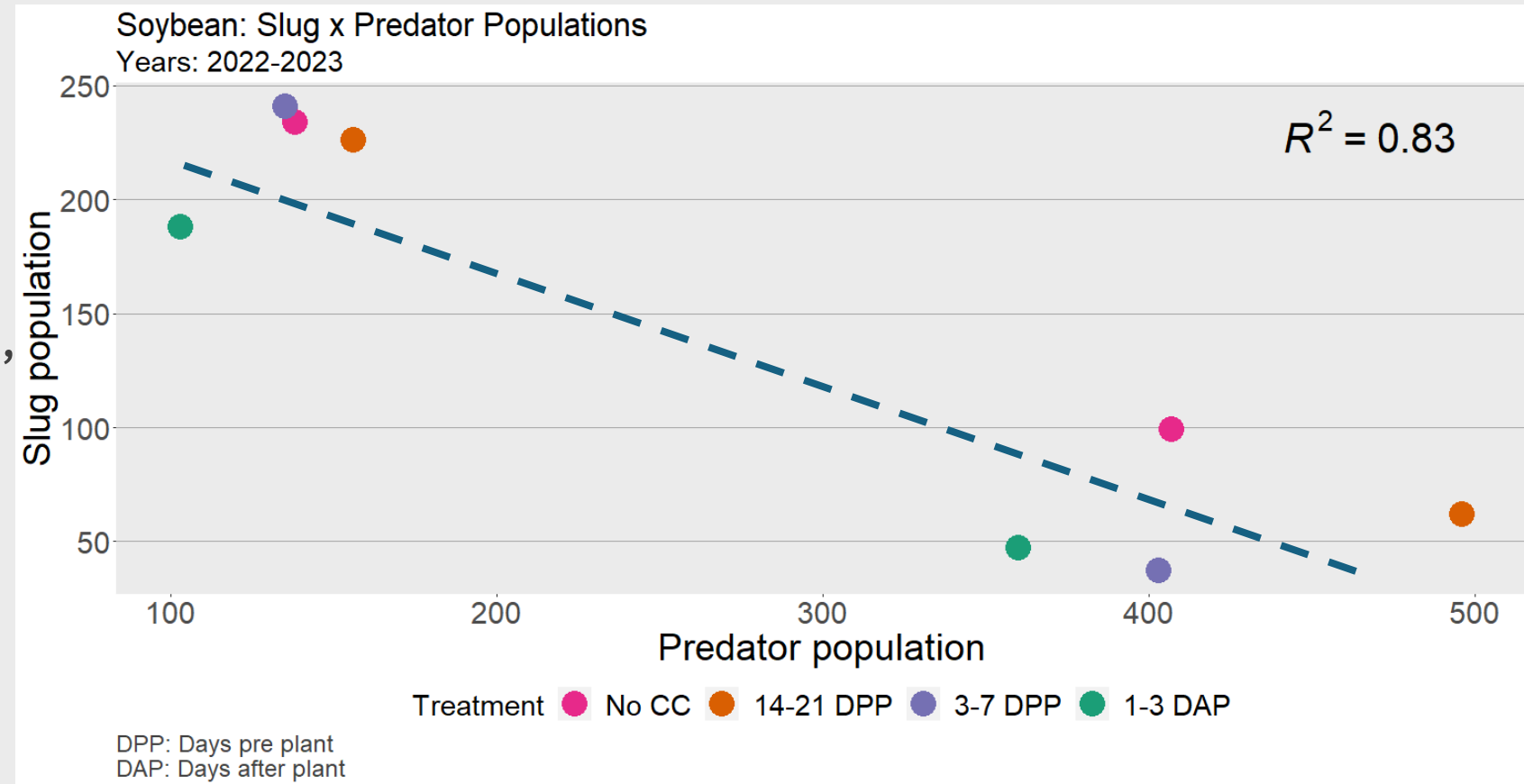
Predicted relationship of predators x slugs

Soybean

Predators:

Spiders, Carabids,
Staphylinids,
Formicids, Ensifera,
etc.

Trending **decrease**
in slugs with an
increase in
predators



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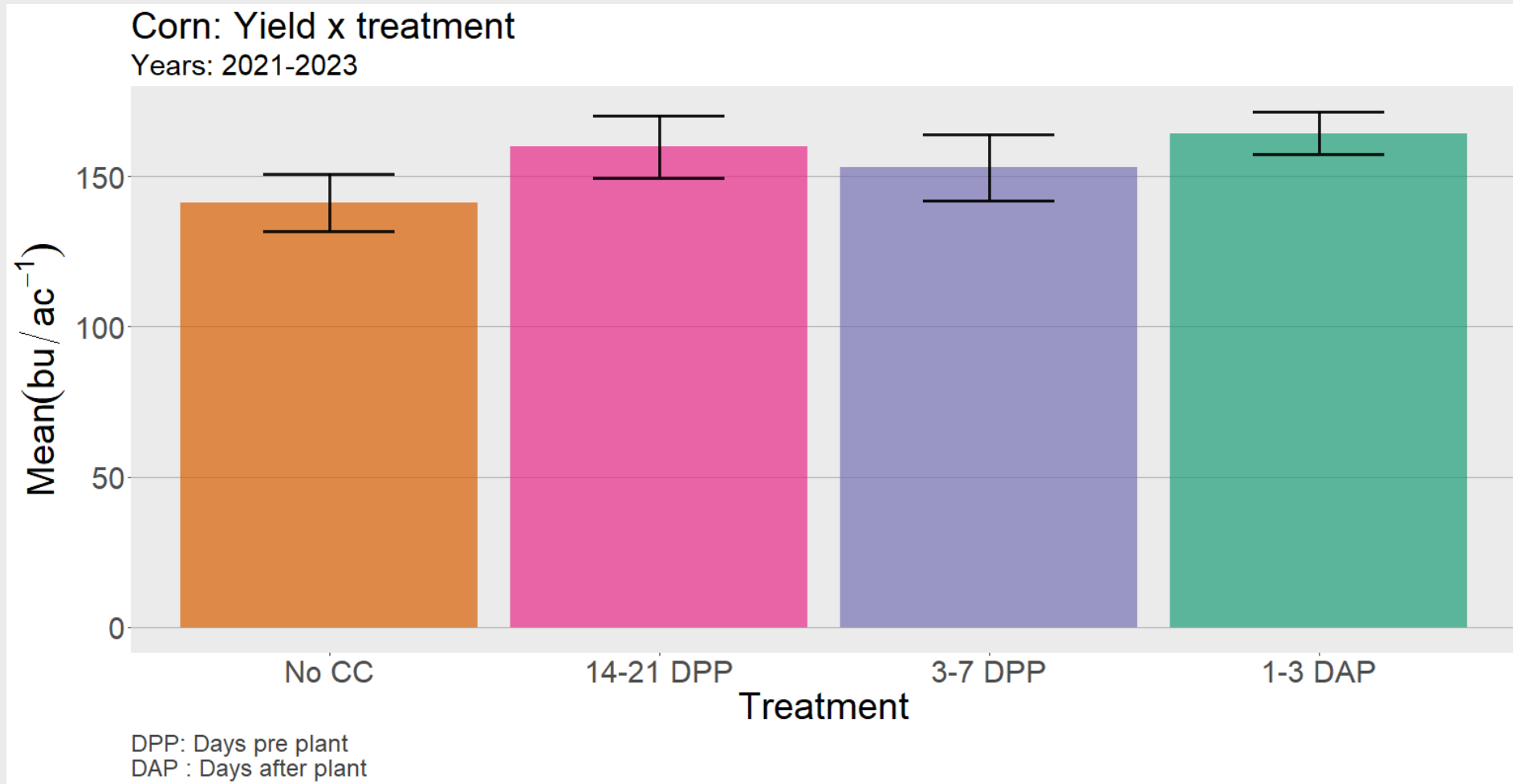
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No differences in yield x treatment



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Conclusions

No differences in slug counts by treatment or year

Driven by precipitation

Sentinel prey

More prey consumption later in the season

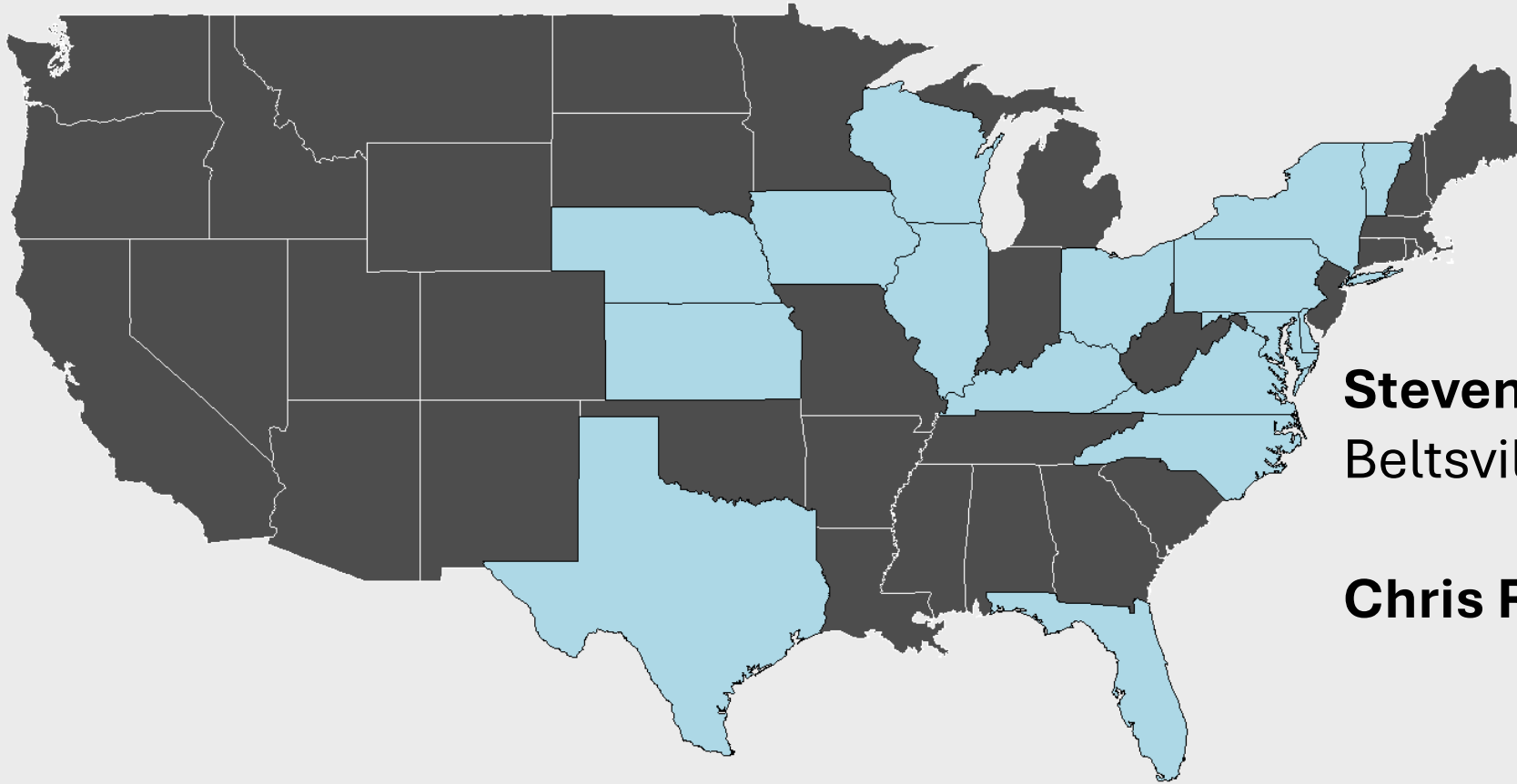
Predators

Corn *trending* an **increase** in slugs with an increase in predators

Soybeans *trending* a **decrease** in slugs with an increase in predators

No treatment differences in yield

Project replicates



**Steven Mirsky: USDA –
Beltsville, MD**

Chris Reberg-Horton: NCSU

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Future Directions



Synthesize across 16 state replicates

Not all with slugs

Analyze regional affects of cover crop termination timing

Conduct one/several more seasons to tease out trends in regressions

Add a leguminous cover crop to the mix

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Acknowledgments

Precision Sustainable Ag

Tooker lab

Wallace Lab

Sara Hermann

Tosh Mazzone



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Questions?

