

Slugs as pests and prey: growing practices that impact slugs in soybeans



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Outline

- Slug species and biology: who are we dealing with?
- Slug feeding and damage
- Management challenges and opportunities
- Questions/discussion



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Two main slug species in soybeans



Slug Lifecycle



20-80 eggs in clusters



Juveniles



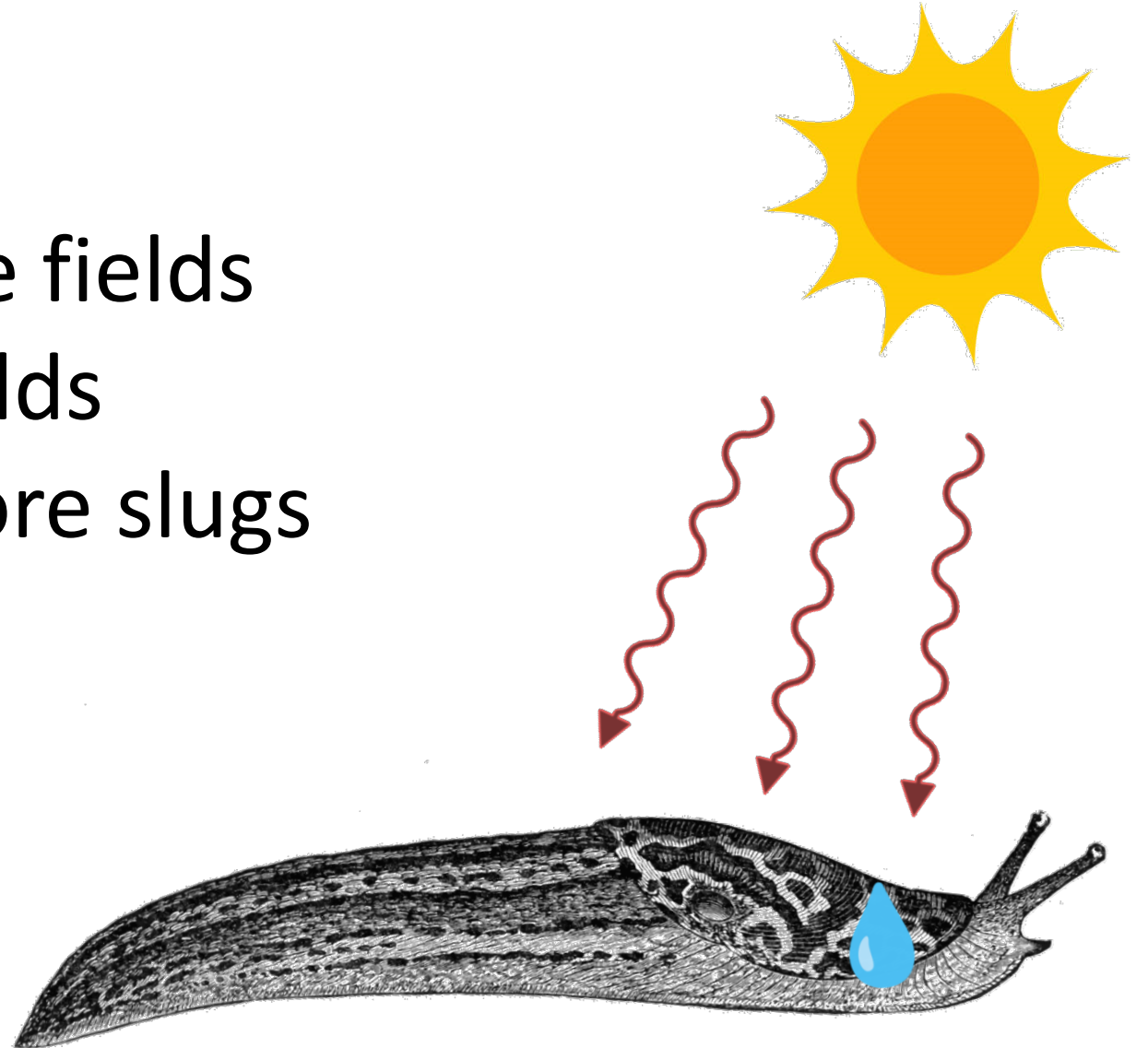
Adults



Mating

Slugs prefer cool wet conditions

- Slugs dehydrate easily
- Do well in high-residue fields
- Wetter, lower-lying fields
- Cool, wet springs = more slugs and damage

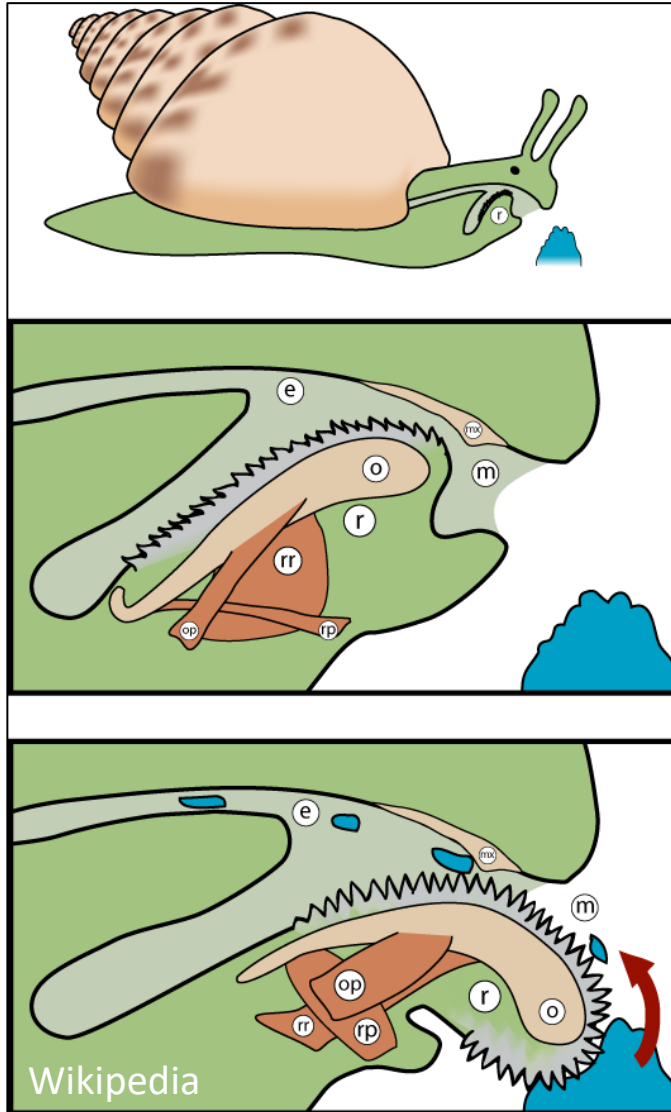


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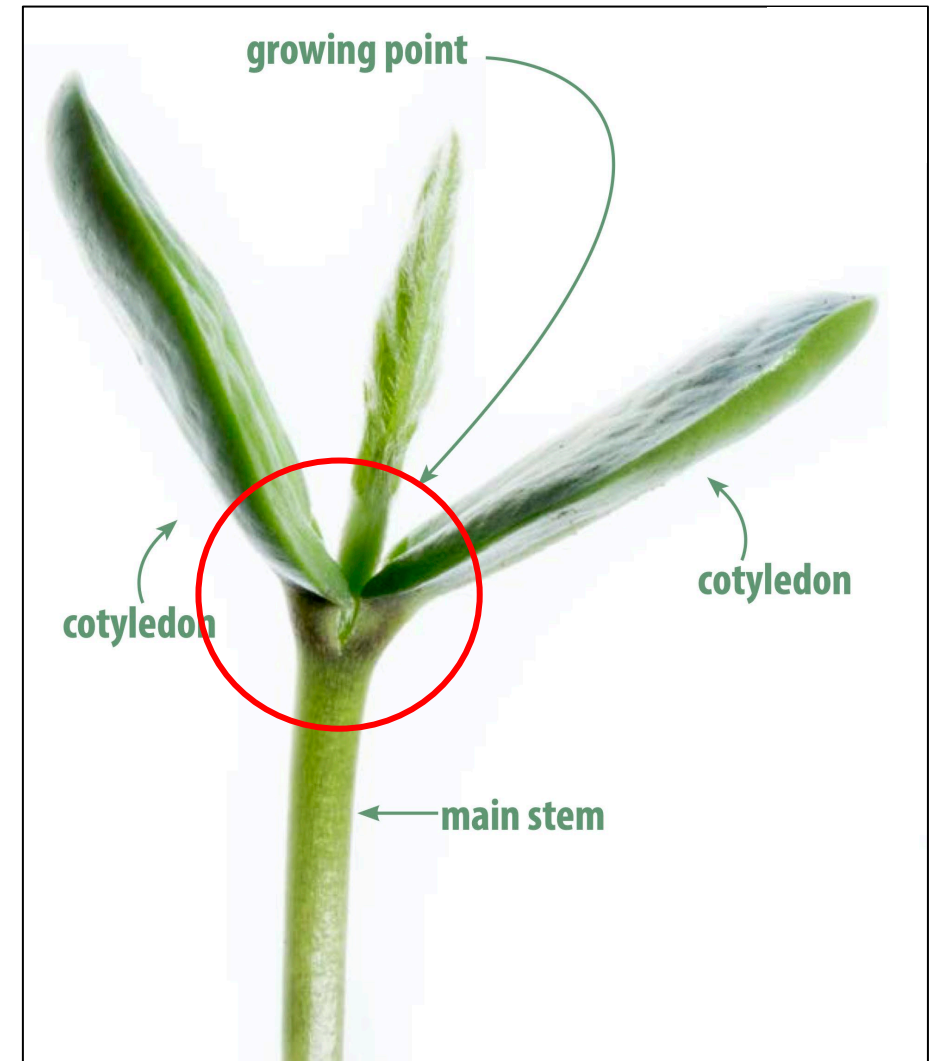
Slugs feed by scraping



Surface of the radula



Slug damage to soybeans



Pitted cotyledons, window-paning of adult leaves

Slug damage to soybeans



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Main management challenges:



- No-till favors slugs¹
 - Abundant organic matter
 - Higher soil moisture retention
 - Staying cooler into the spring time

¹Douglas and Tooker, 2012

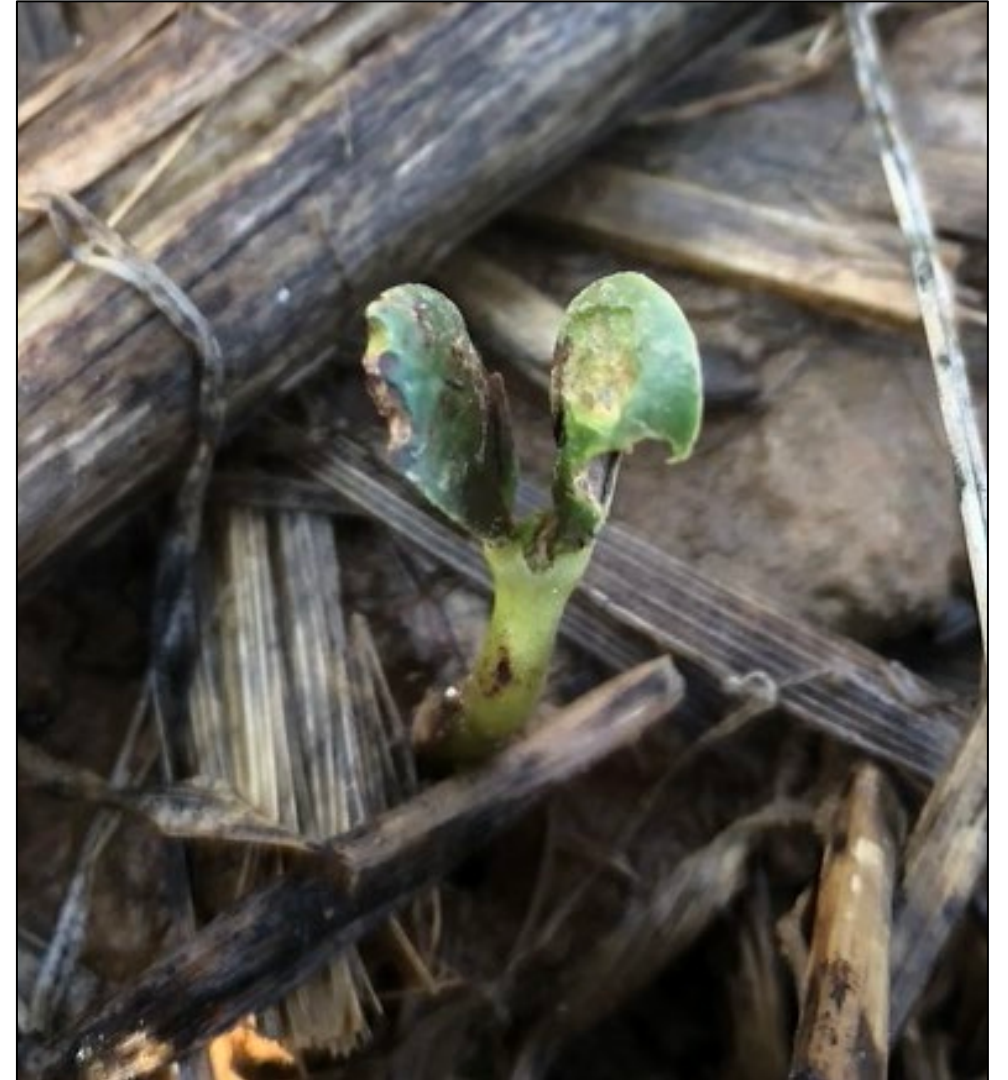
Chemical treatment challenges

- There are no broadly-usable treatment thresholds
- Chemical treatments (molluscicides) all share several issues:
 - Short shelf life
 - Expensive
 - Precise application requirements



Early planting may prolong vulnerability

- Slow germination and growth = longer vulnerable period
- Prolonged cool/wet period also keeps slugs active and feeding



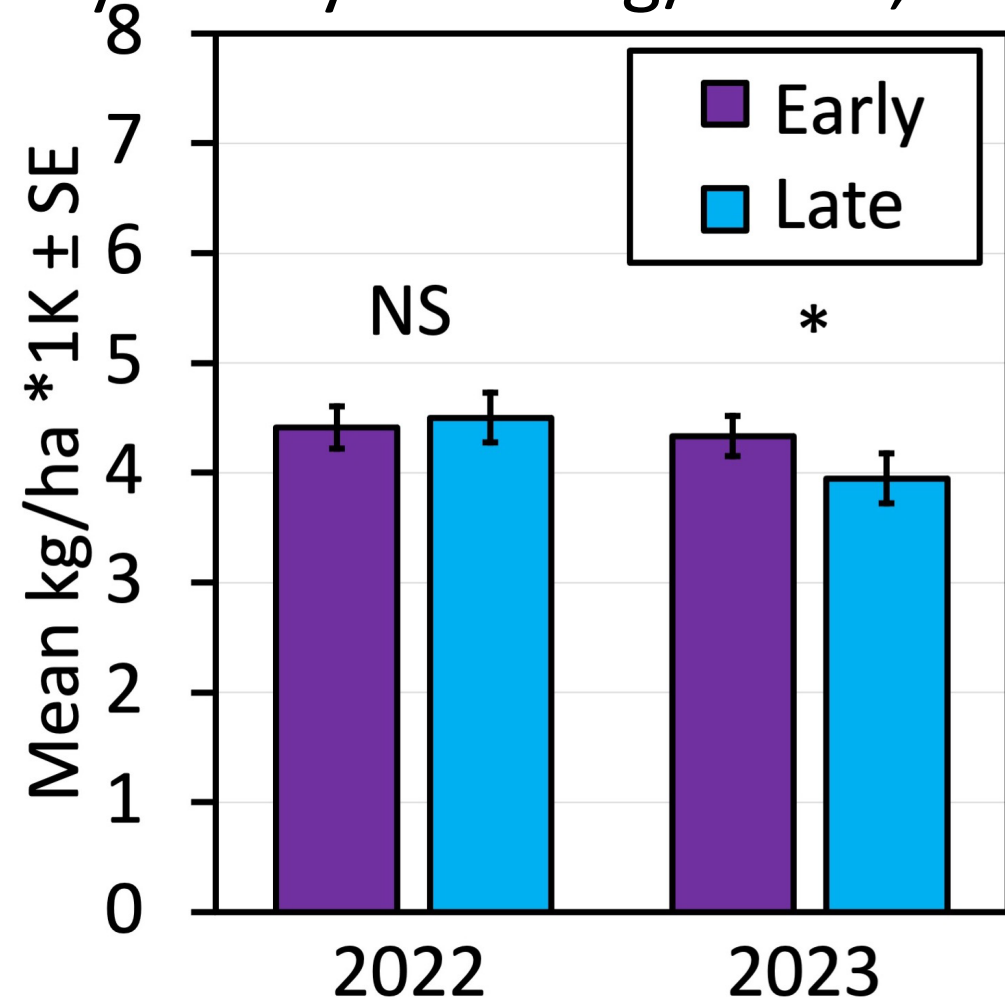


Is planting later a good option?

- Comparing planting dates for full-season soybeans: Early vs late

Year	Research farm	Early planting	Late planting
2022	Location 1	May 2	June 7
	Location 2	April 29	June 1
2023	Location 1	May 12	June 12
	Location 2	April 27	May 31

Soybean yield in kg/ha *1,000



2022: $F_{1,42} = 0.14; p = 0.71$ 2023: $F_{1,42} = 5.09; p = 0.03$

Cover cropping is a mixed bag



Dave Robison

- Traditional cover cropping, planting green, and even weedy fields all posited to influence slug populations and damage
- However, no consistent pattern has emerged¹⁻⁴

¹Mugala et al., 2023; ²Cook et al., 1997

³Le Gall et al., 2022; ⁴Reed et al., 2019

Conservation practices = slug biocontrol

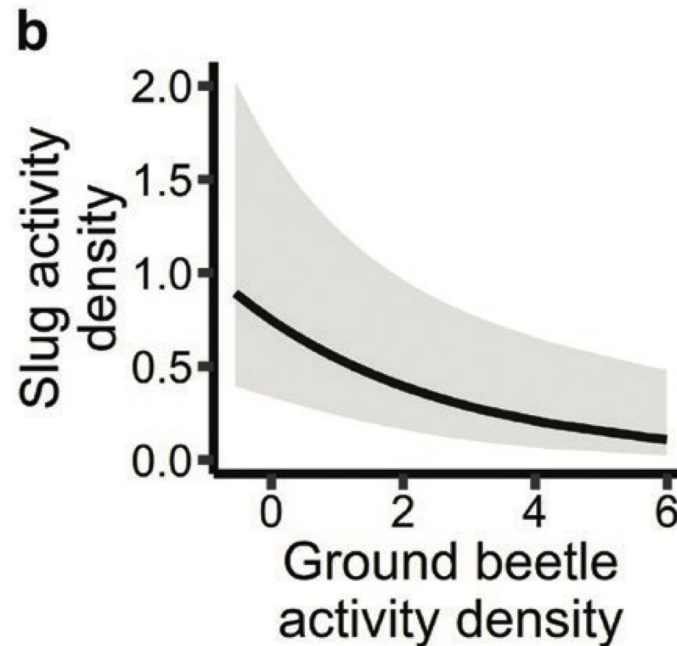
- There are many invertebrate slug predators
- Conservation practices (e.g. no-till, unmanaged habitat) can preserve populations¹

¹Busch et al., 2020



Carabid beetles are key predators

- Diverse family of beetles often abundant in crops
- In native and introduced range eat slugs, slug eggs¹⁻³



Mugala et al., 2023 “Ground beetles suppress slugs in corn and soybean under conservation agriculture”

¹Reich et al., 2020; ²Bohan et al., 2000

³El-Danasoury and Piñero, 2018

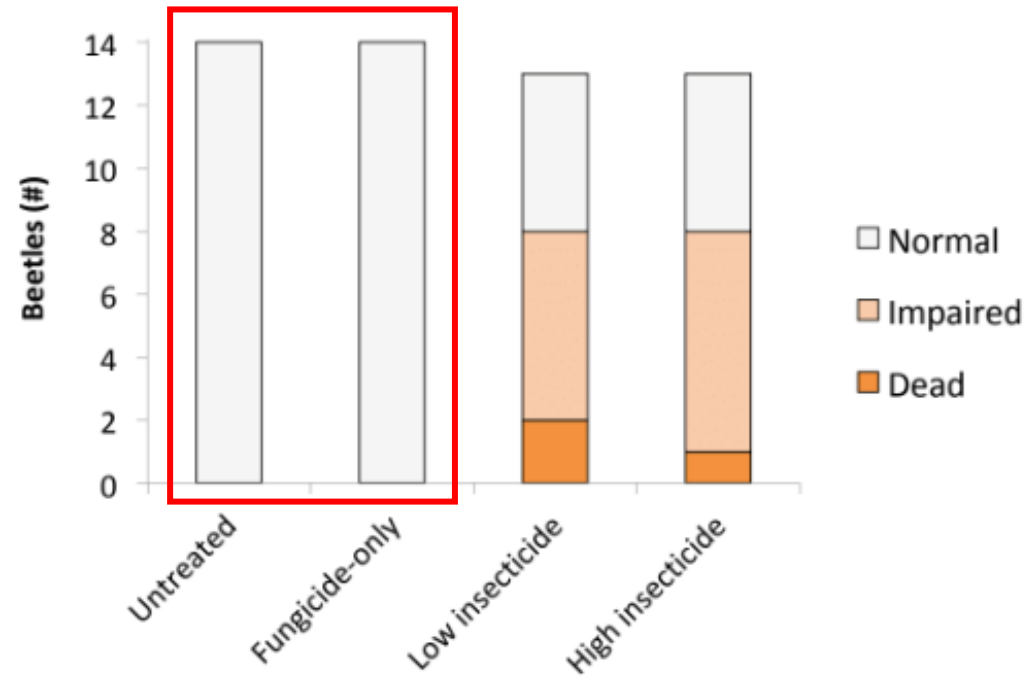
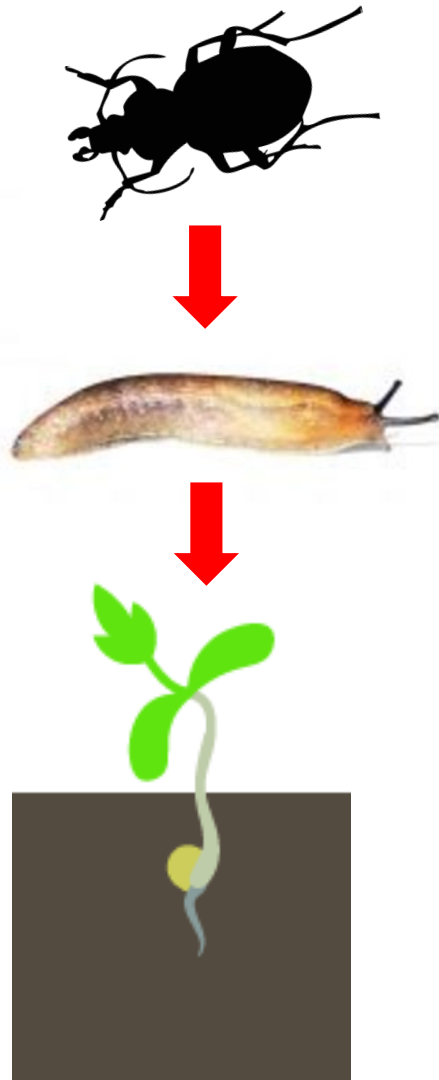
Insecticides may favor slugs

- Slugs are not susceptible to insecticides (not insects!)
- Some preventative insecticides may exacerbate slug problems by affecting predators^{1,2}



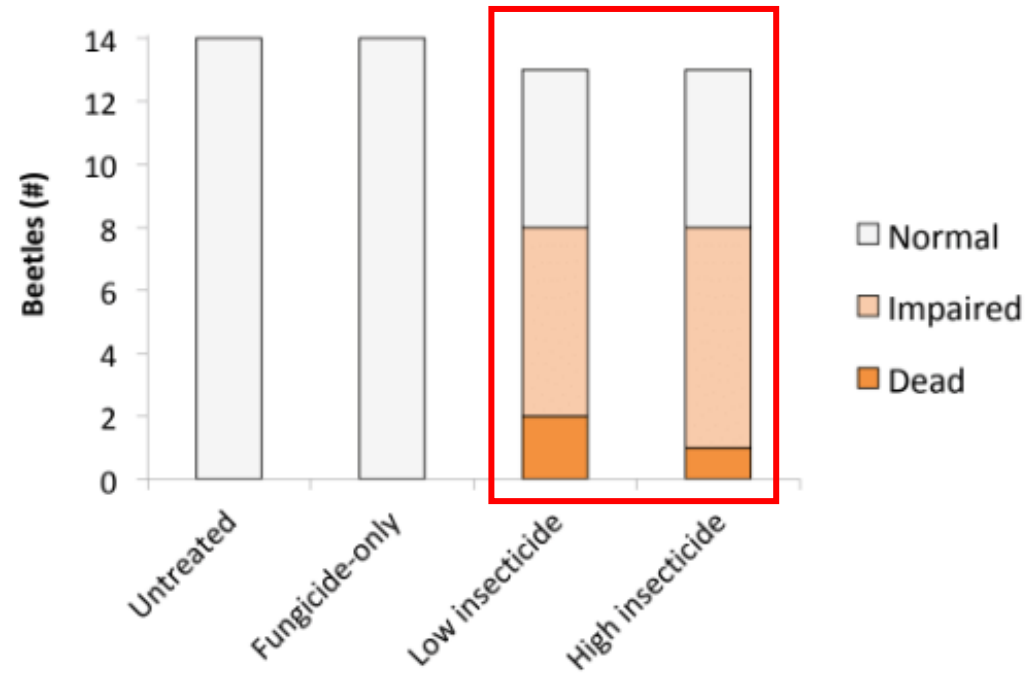
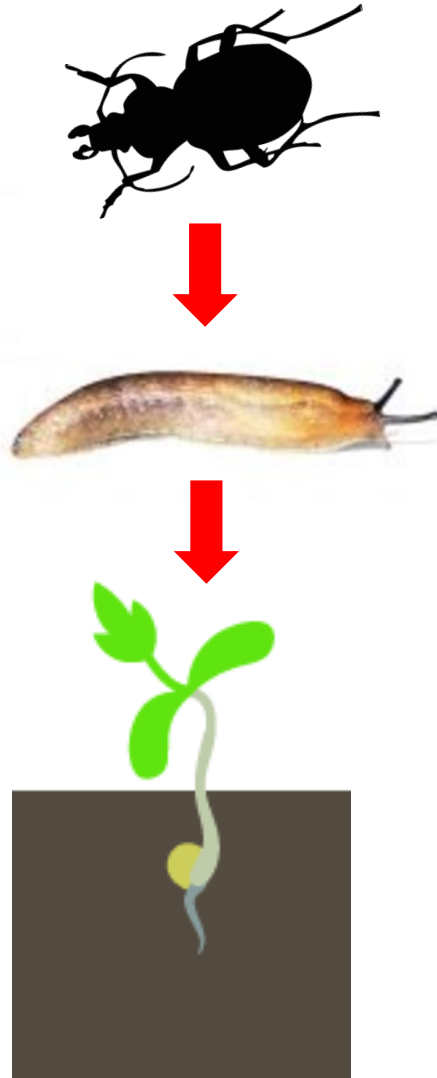
¹Douglas et al., 2015; ²Hill et al., 2017

Seed treatments and ground beetles



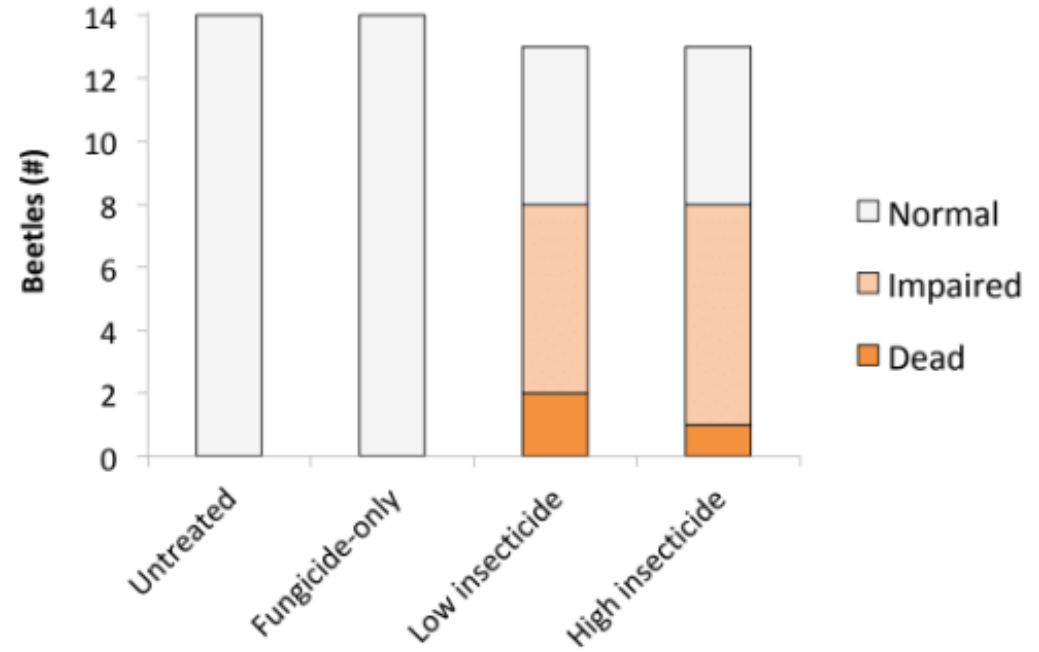
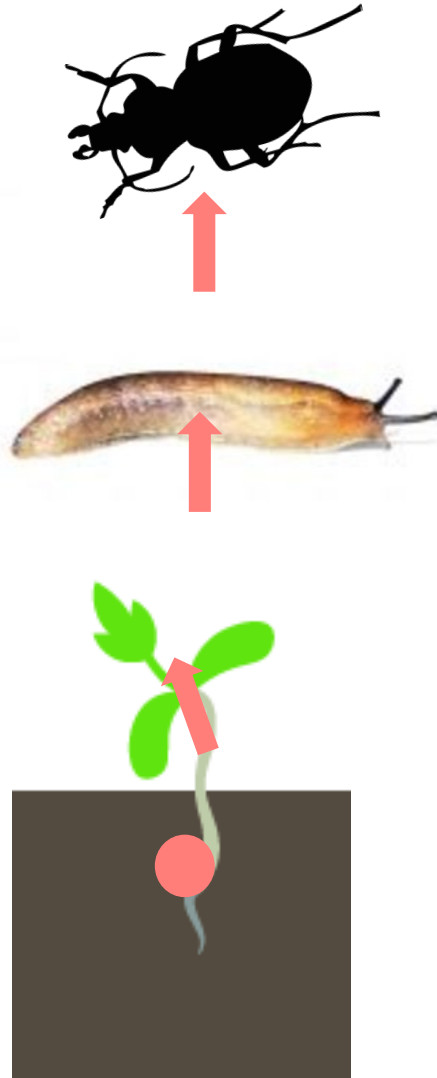
Douglas, 2019

Seed treatments and ground beetles



Douglas, 2019

NST traveled up the food chain



Douglas, 2019



Hamby lab slug research

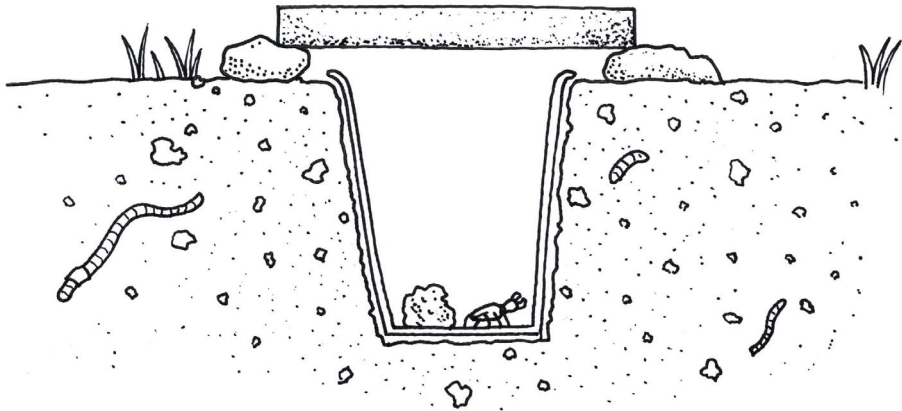


- At-planting insecticides routinely used in a range of field crops
- In the mid-Atlantic slugs are most often the pest of concern
- How do commonly-used insecticides impact slug biocontrol?



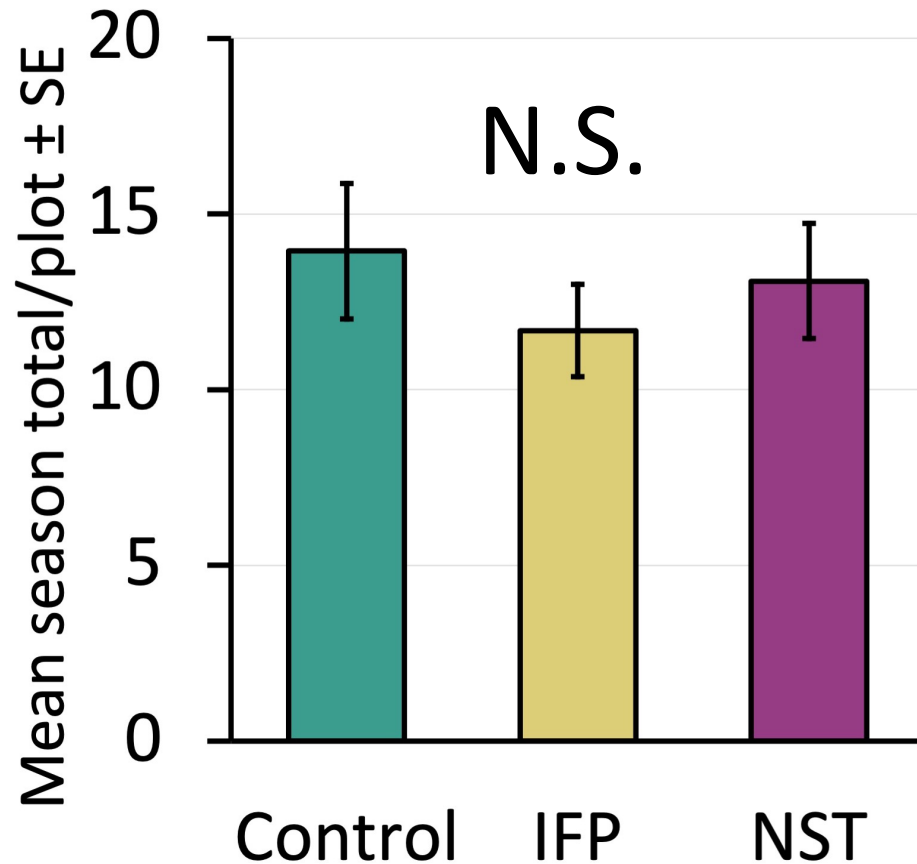
Measuring predator populations

- Slug predators (especially ground beetles)



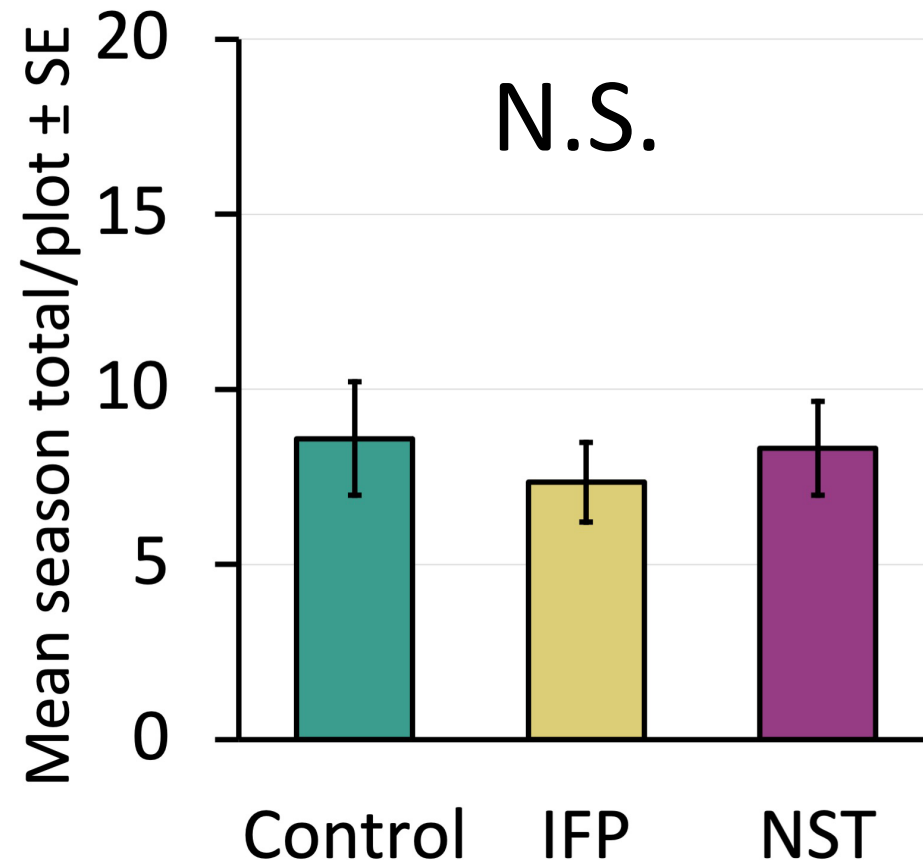
No treatment effect

All ground beetles



$$F_{2,154}=0.54 ; p = 0.585$$

Predatory ground beetles

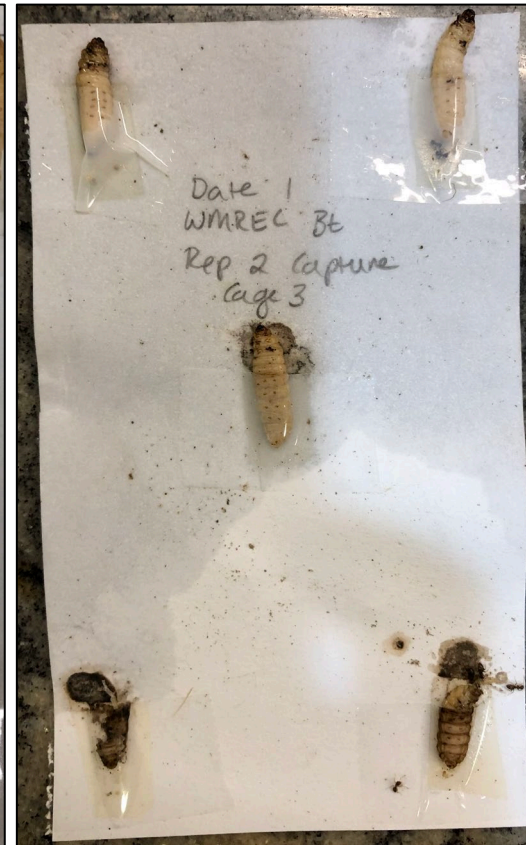


$$F_{2,152}=0.28 ; p = 0.757$$

Measuring predation



0%

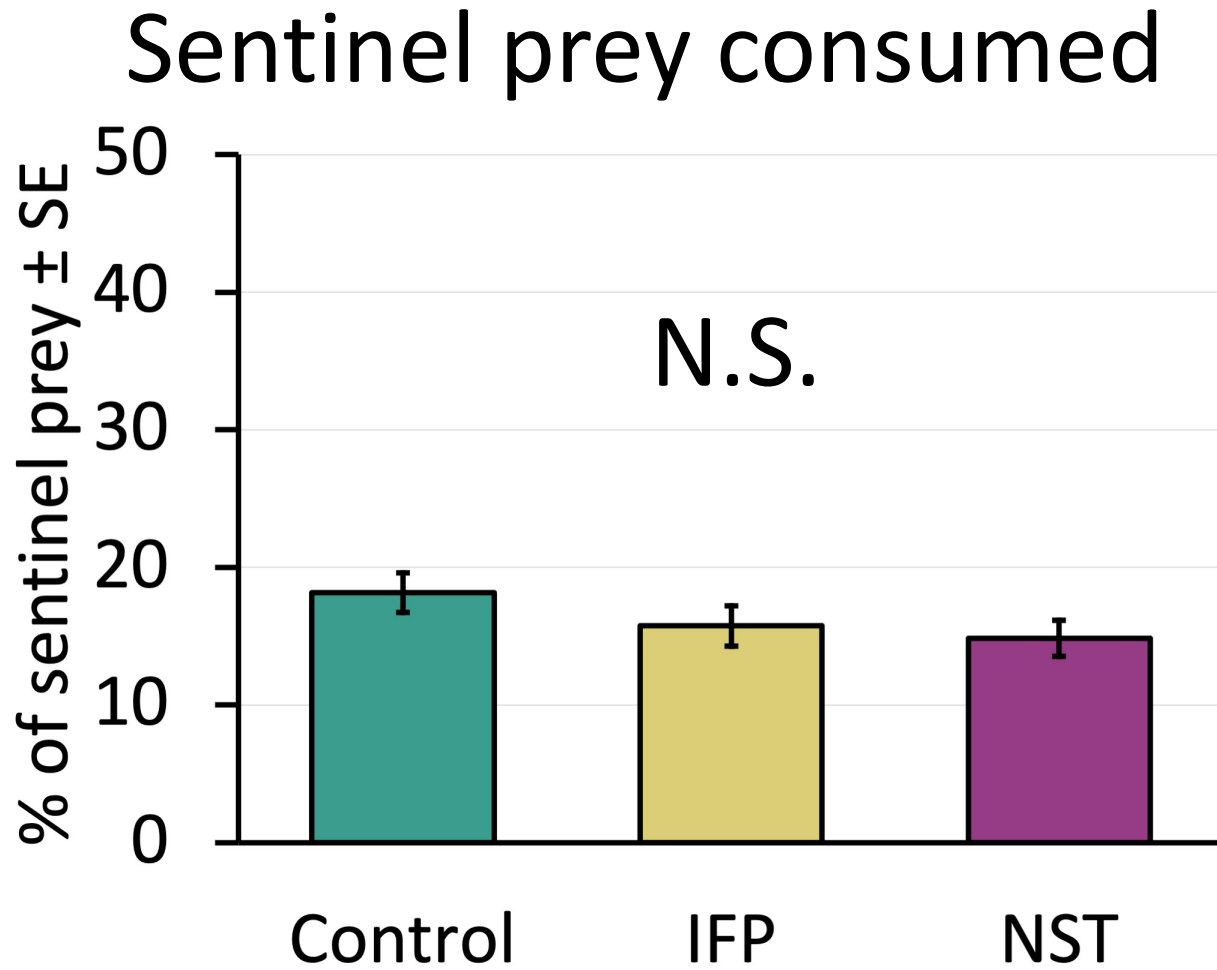


60%



100%

Measuring predation



$$F_{2, 418.6} = 1.80, p = 0.172$$

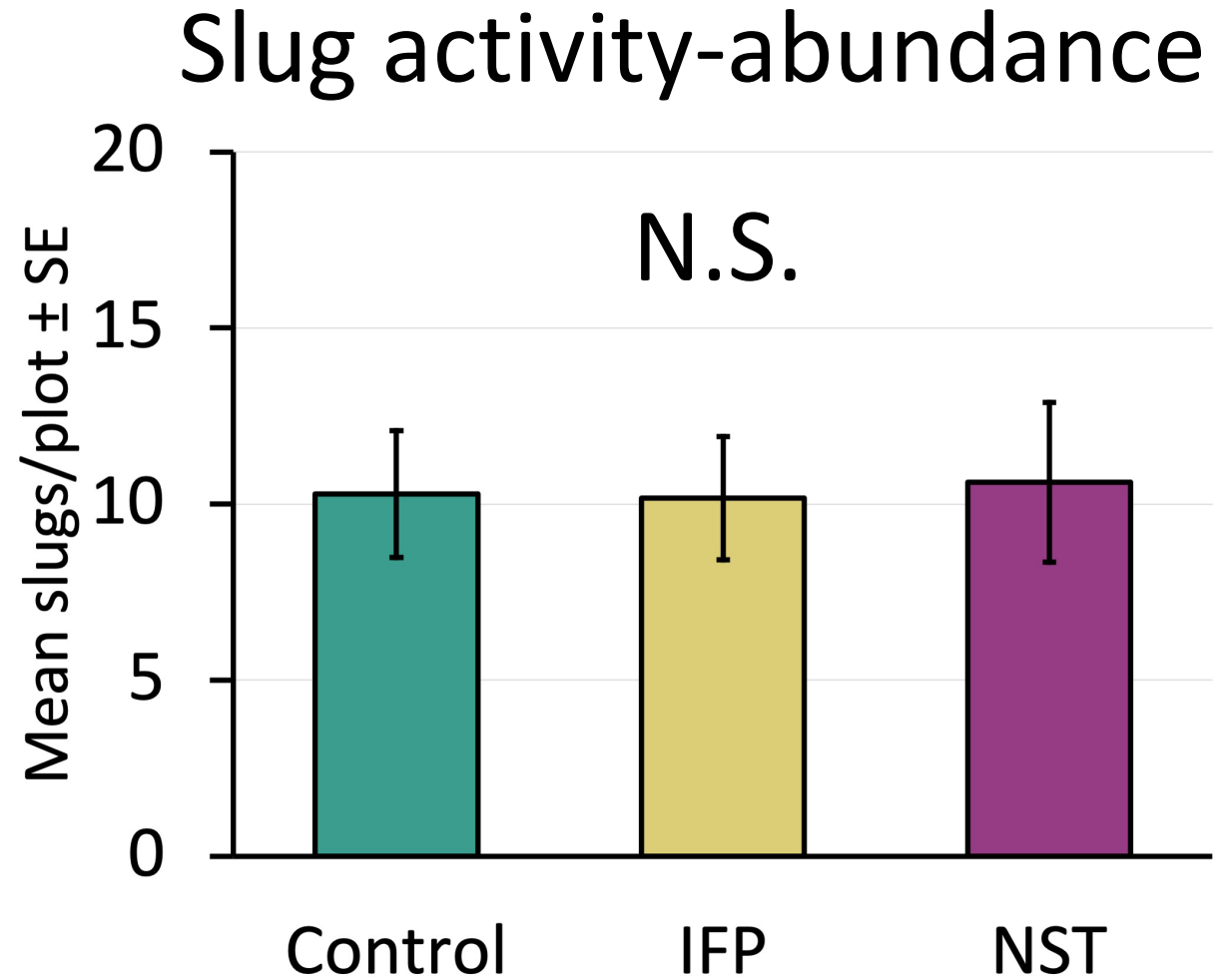
Sampling slug activity-abundance



- Sampled with soapy-water shelter traps¹

¹Raudenbush, et al., 2021

Treatment did not change slug counts



$$F_{2, 118.9} = 0.03, p = 0.975$$

Research takeaways



- Treatments may not impact slug pressure
- Historic use of NSTs may have changed predator community
- Other non-target risks known¹⁻³

✘ No yield benefits in this study

¹Dubey et al., 2020; ³Disque et al., 2019

²Douglas et al., 2016

Take-home messages

- Slugs flourish in no-till high residue systems and do best in cool and rainy spring weather
- Chemical management is hard and expensive to implement
- Natural enemies can influence populations, so conservation practices may be key to management



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UMD research farm staff

Past and present Hamby lab
members



Questions/Discussion



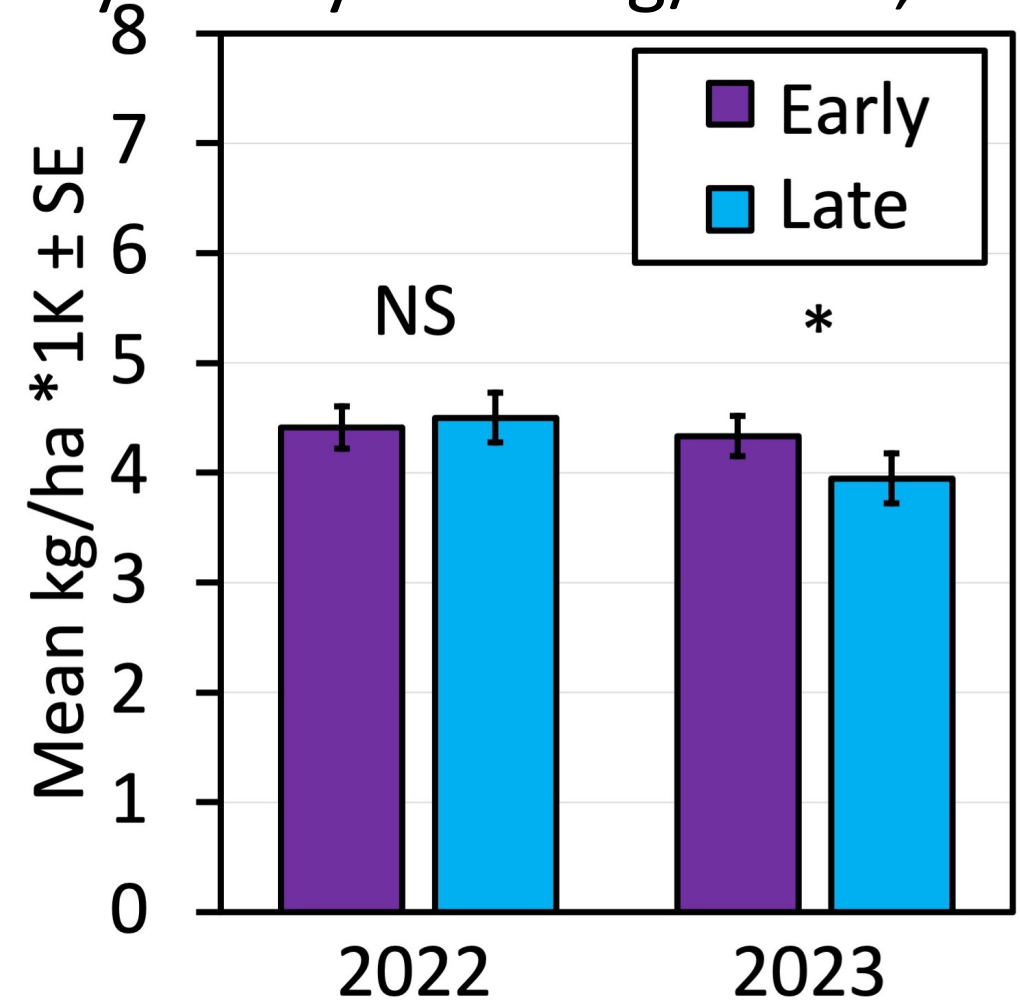
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Earlier planted = sometimes higher yield

- Comparing planting dates for full-season soybeans: Early vs late

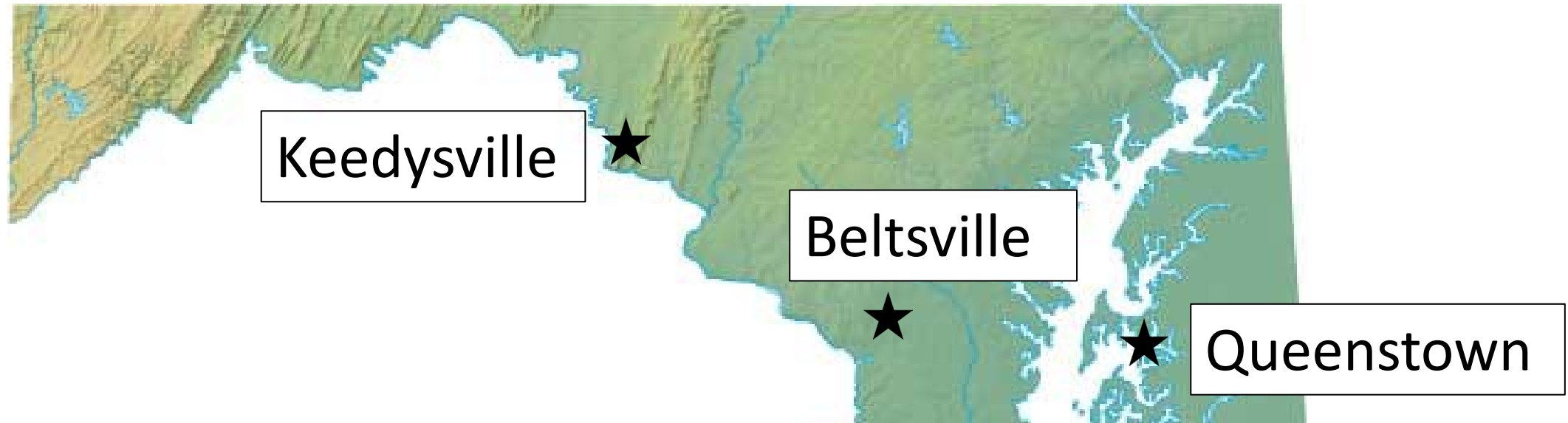
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Study locations and treatments



Control: Bare seed
and no insecticide
applied in-furrow

NST: Poncho[®]
(**Clothianidin**)
(0.25 mg/seed)

In-furrow pyrethroid:
Capture[®] LFR[®]
(**Bifenthrin**)
(13.6 fl oz/acre)