Managing spider mites in watermelon production

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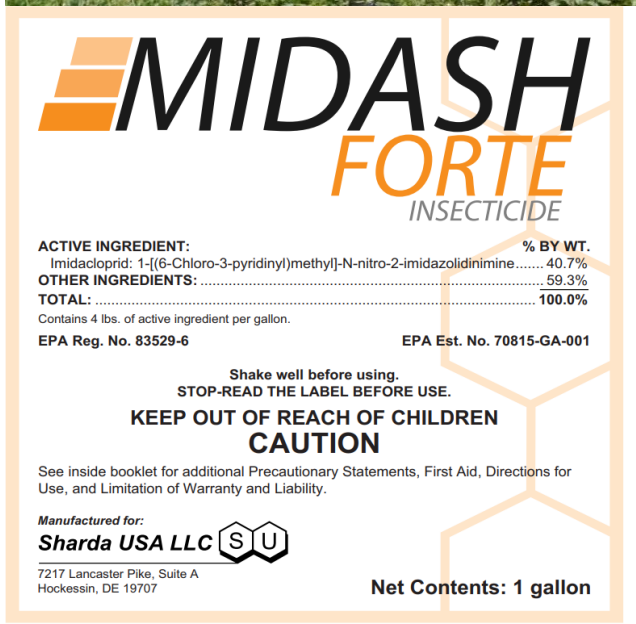
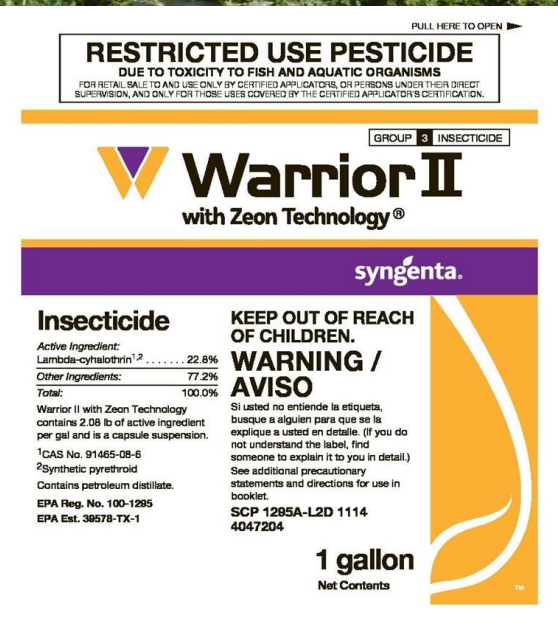
Insecticides

- Reliable and fast-acting to control insect pests
- Secure marketability and yields
- Broad-spectrum insecticides
  - Neonicotinoids
    - (e.g., imidacloprid)
  - Pyrethroids
    - (e.g., permethrin)



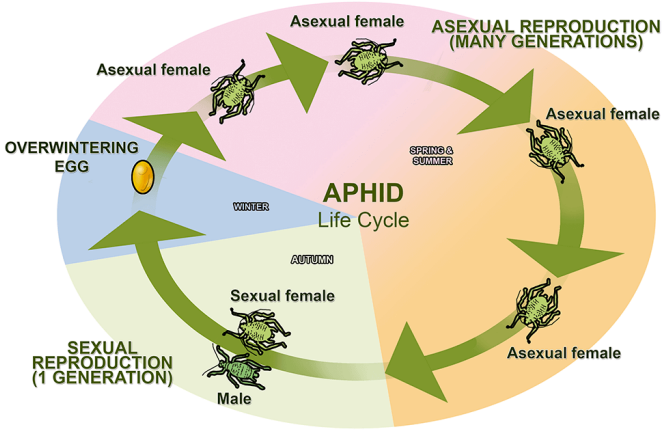


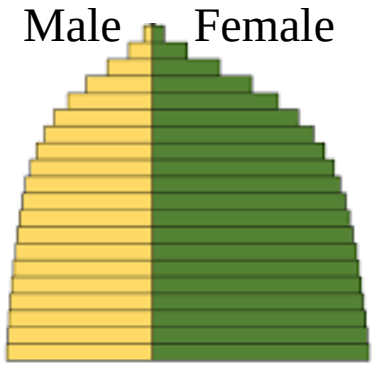
Broad-spectrum insecticides

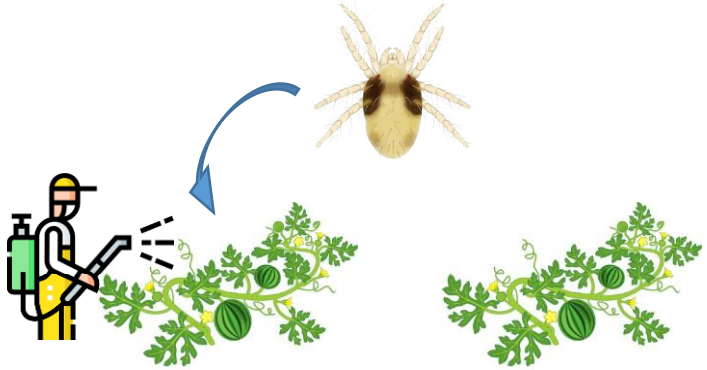
- Non-target specific
- Detrimental effects on beneficial insects
  - **Lethal** and **sub-lethal**
- Impaired biological control

Broad-spectrum insecticides

- Unexpected **effects on secondary pests**
  - Enhanced reproductive rate
  - Reduced generation time
  - Female-biased sex ratios
- **Suppressed plant defenses** that enhance crop susceptibility



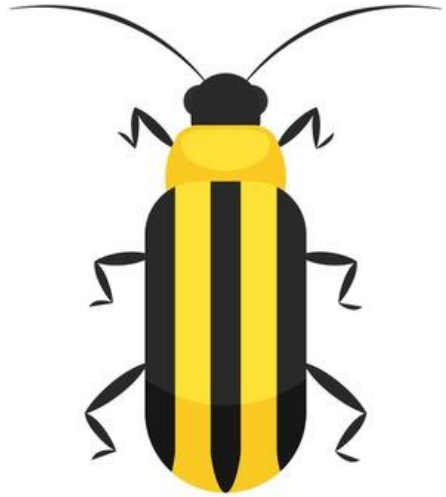


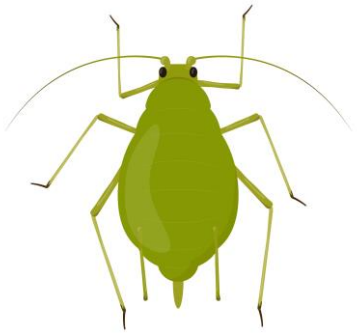


Broad-spectrum insecticides

- Targeting primary pests
  - Striped cucumber beetles

- **Secondary pest outbreaks**
  - Small arthropods
    - (e.g., spider mites, aphids)



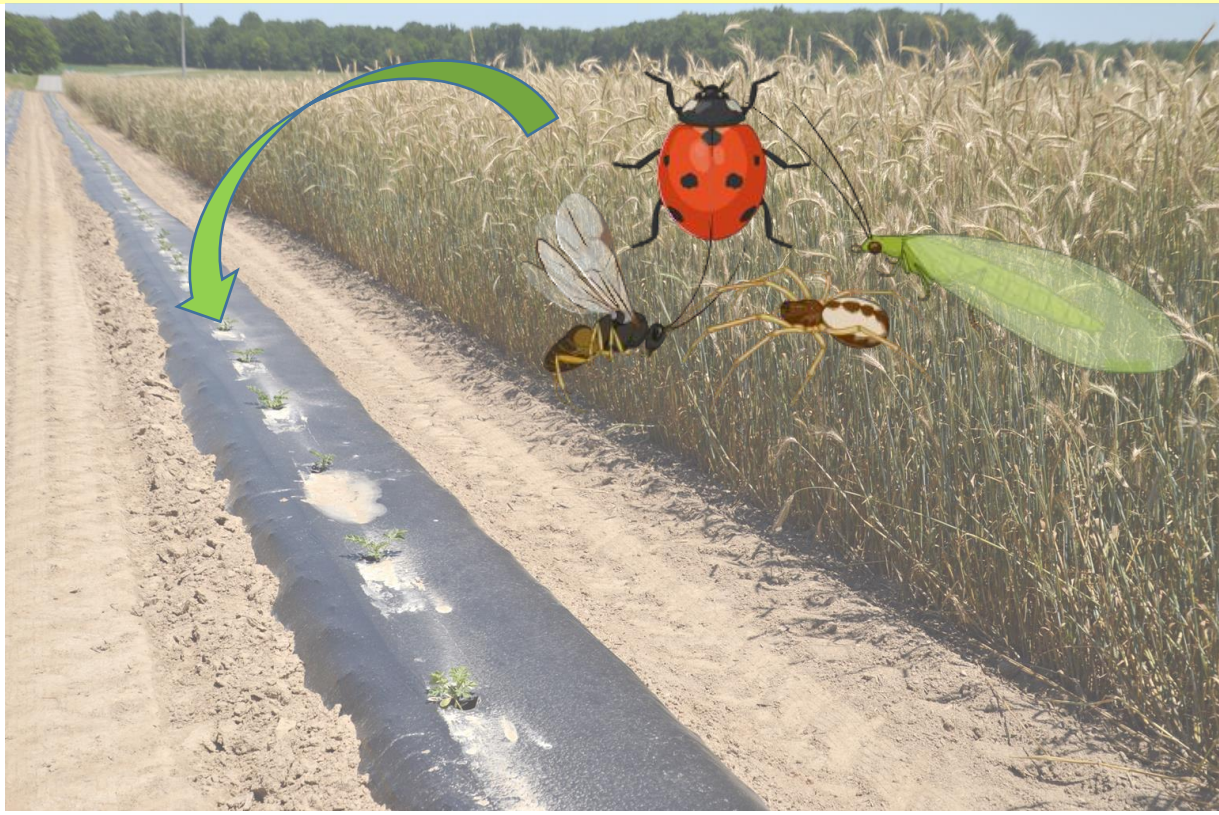


Rye cover crop

- **Wind-break** function
  - Sand-blasting damage
- **Indirect and direct effects** on pests

Rye cover crop

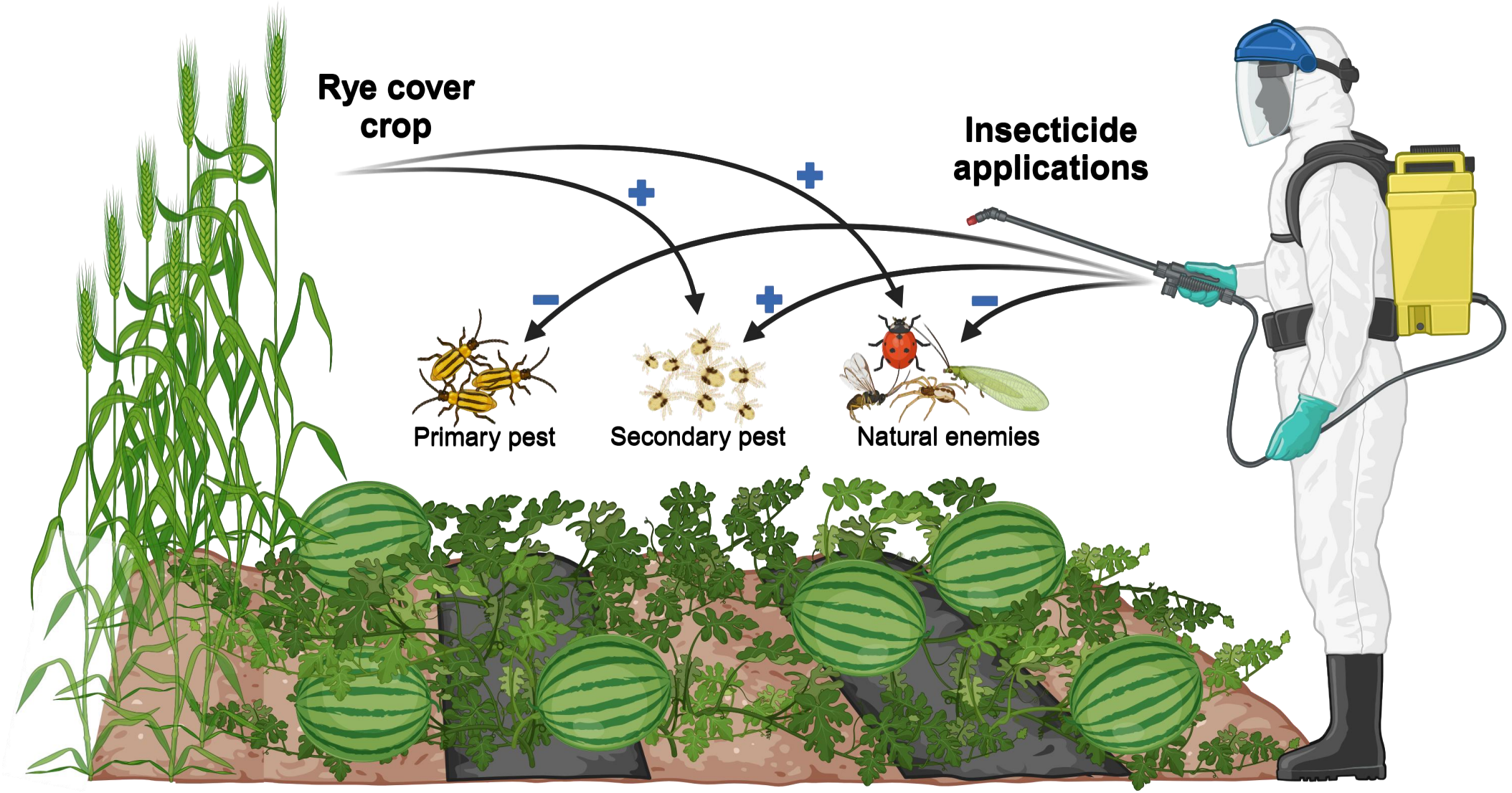
- Habitat for natural enemies
  - Biological control
- **Indirect negative effects on pests**



Rye cover crop

- Rye can act as a “green bridge”
  - Exacerbating pest damage
- **Direct positive effects on pests**

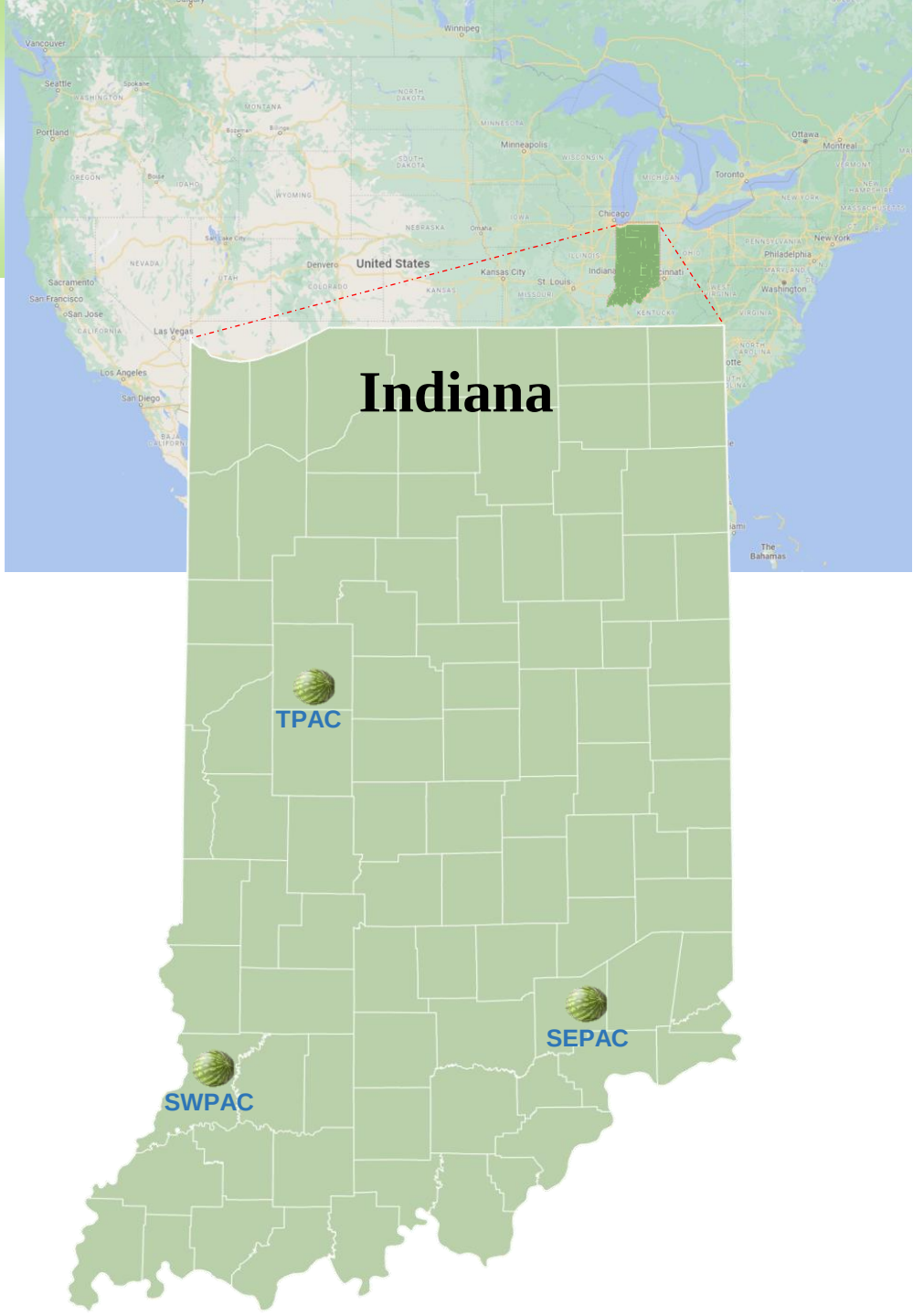
Broad-spectrum insecticides and rye cover crop in watermelon systems



Study location

3 locations across **Indiana**

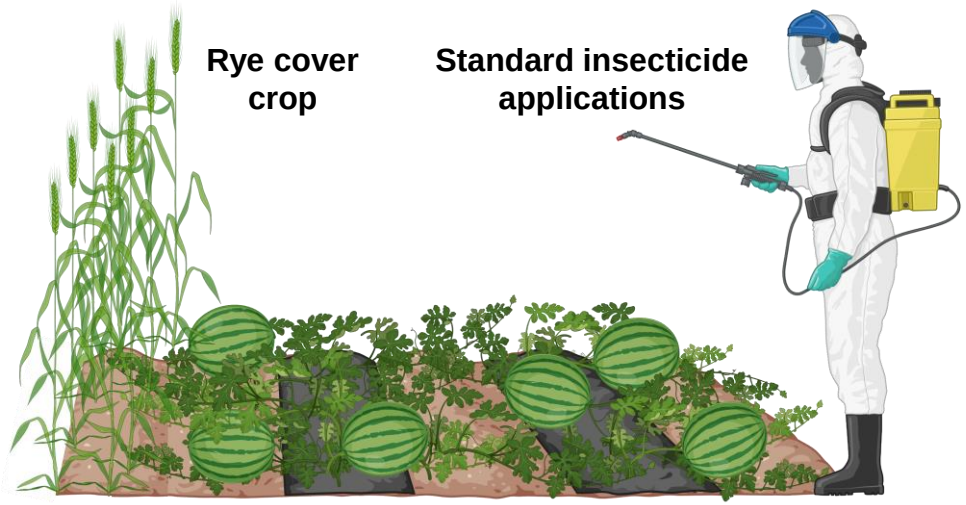
- TPAC (Throckmorton Purdue Agricultural Center) 2023 & 2024
- SWPAC (Southwest Purdue Agricultural Center) 2024
- SEPAC (Southeast Purdue Agricultural Center) 2024



Treatments

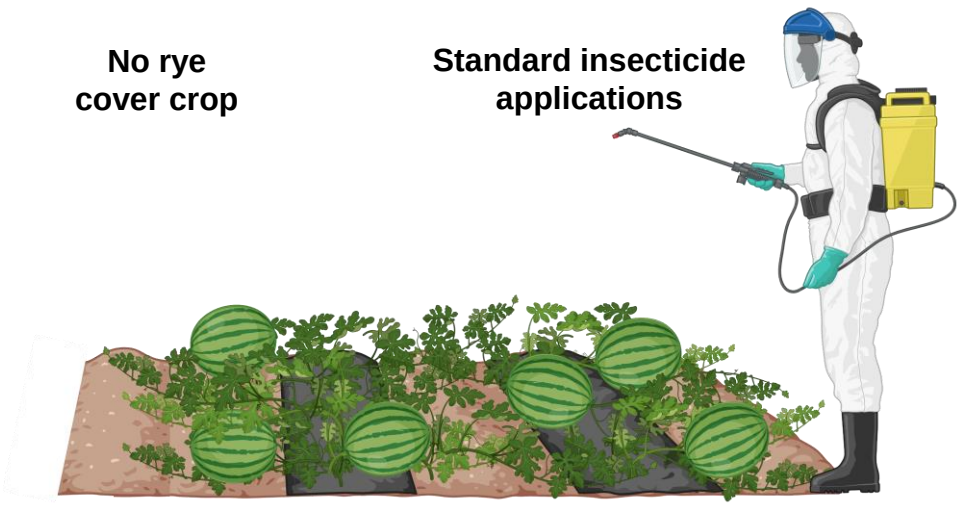
Rye cover crop

Standard insecticide applications



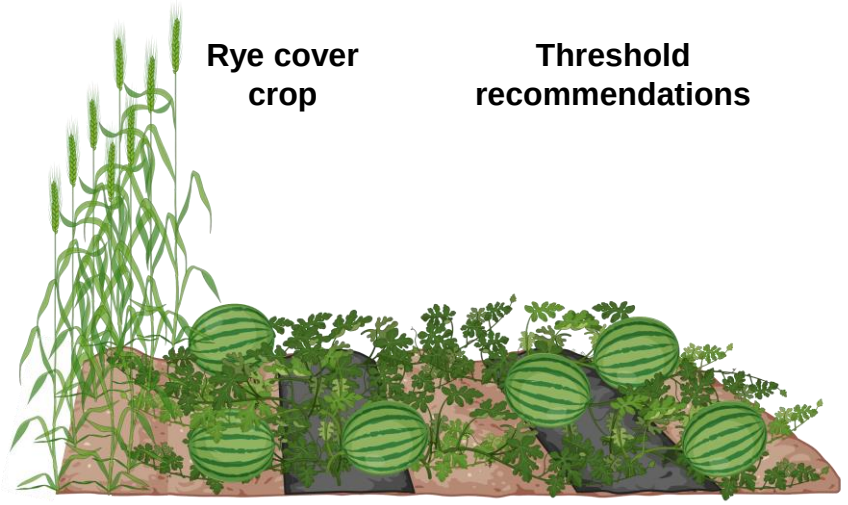
No rye cover crop

Standard insecticide applications



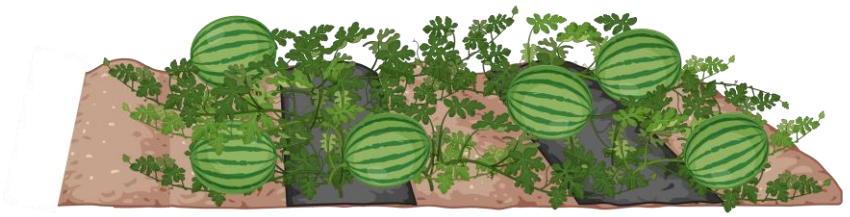
Rye cover crop

Threshold recommendations



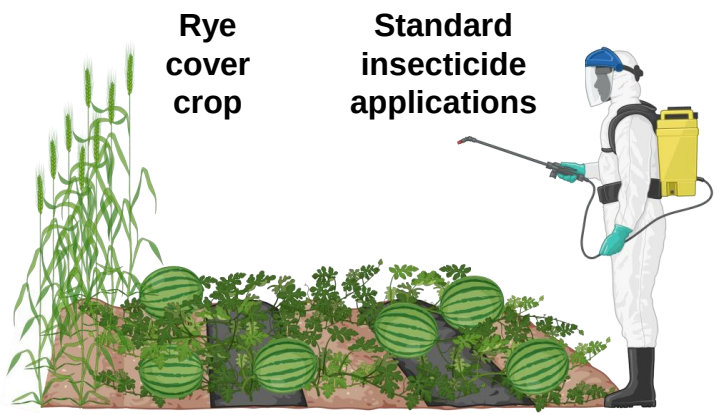
No rye cover crop

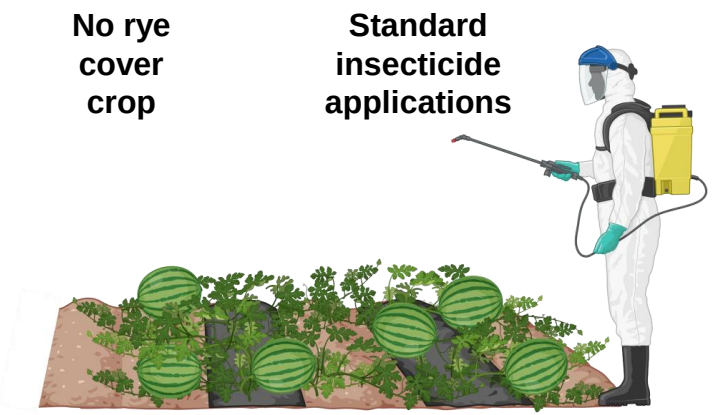
Threshold recommendations

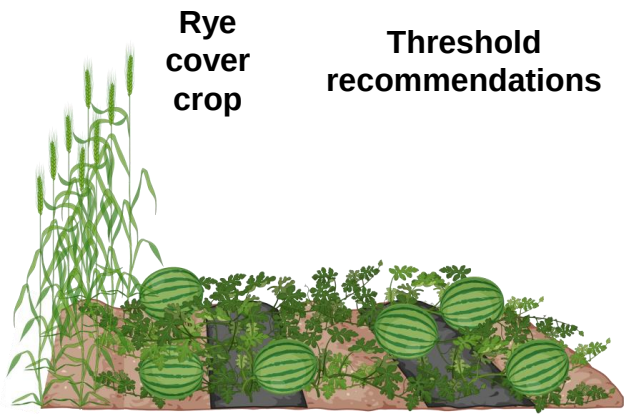


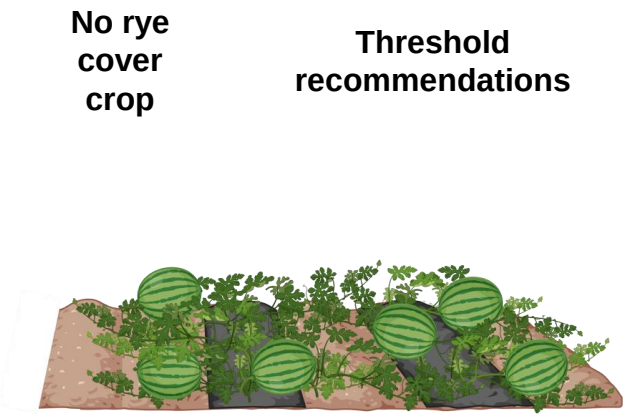
Treatments

- Treatments were replicated **5 times** per location
- **20 replicates** in total!





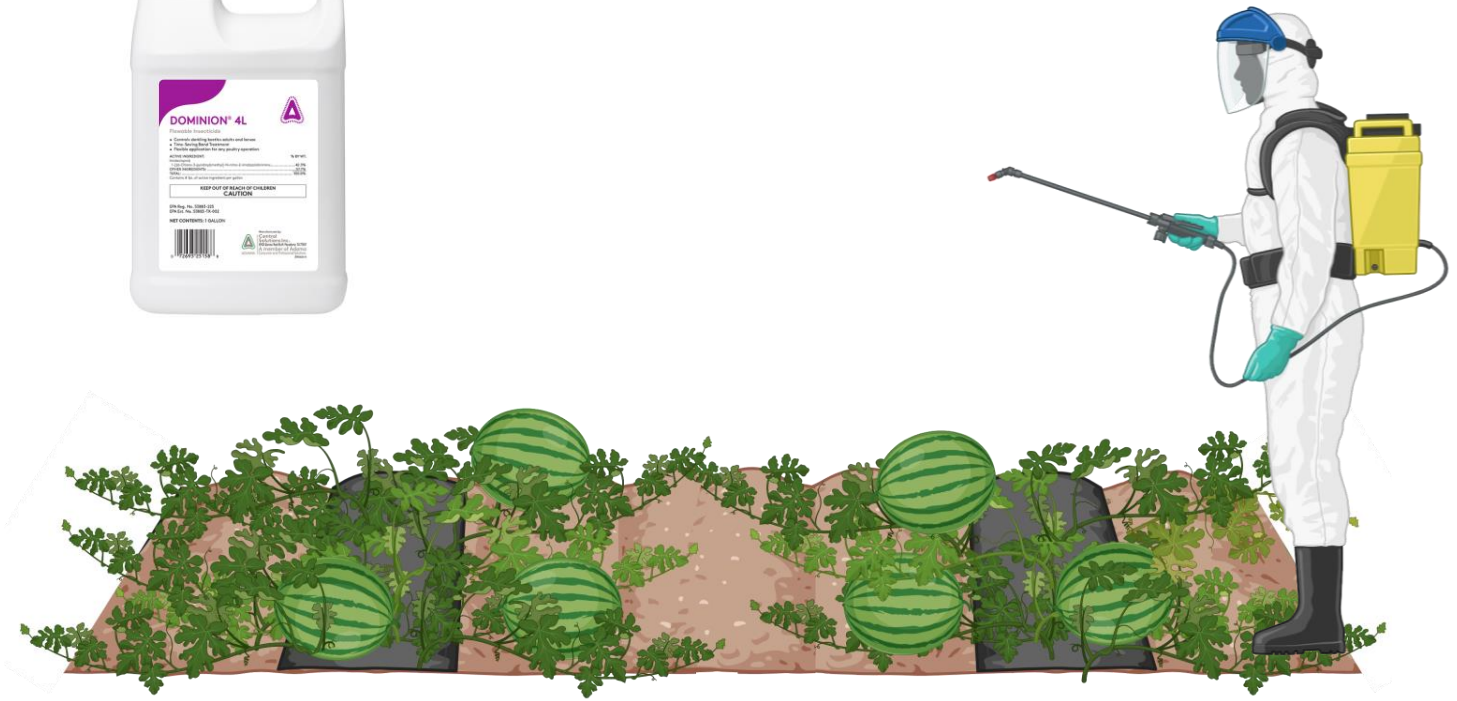




Treatments

Standard insecticide applications

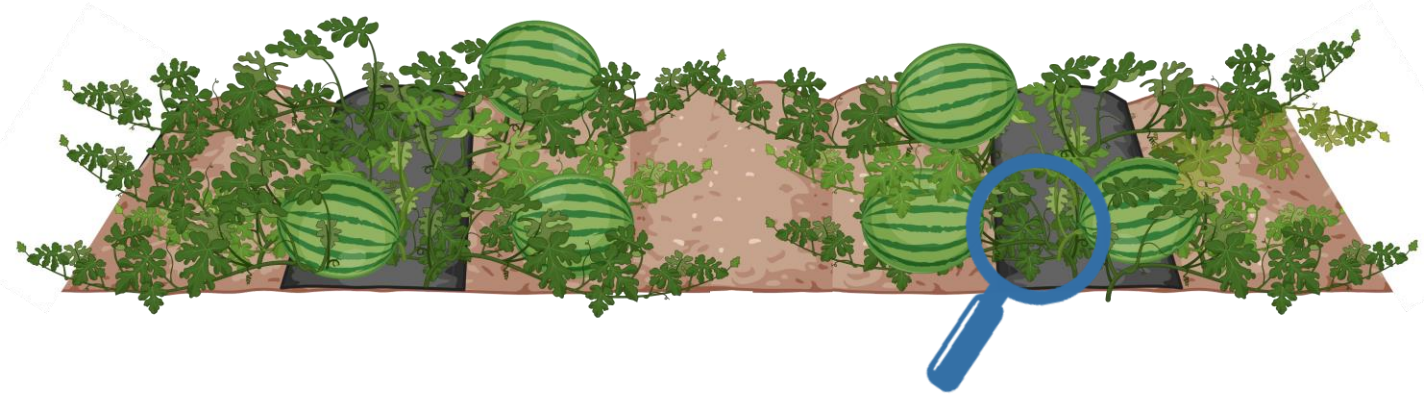
- 1 **imidacloprid** application at transplant
- 4 **pyrethroid** applications every 2 weeks



Treatments

- 1 **acetamiprid** application in 2023 TPAC
  - Cucumber beetle and aphid outbreak

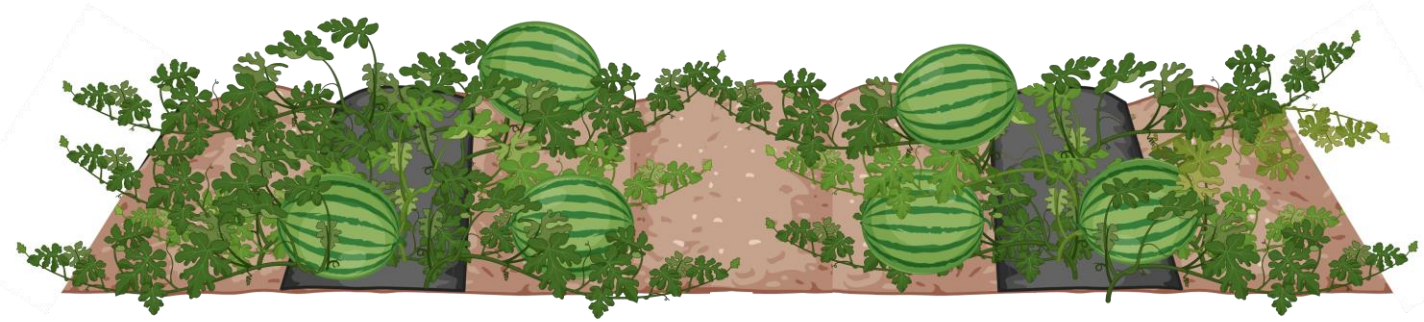
Threshold recommendations



Treatments

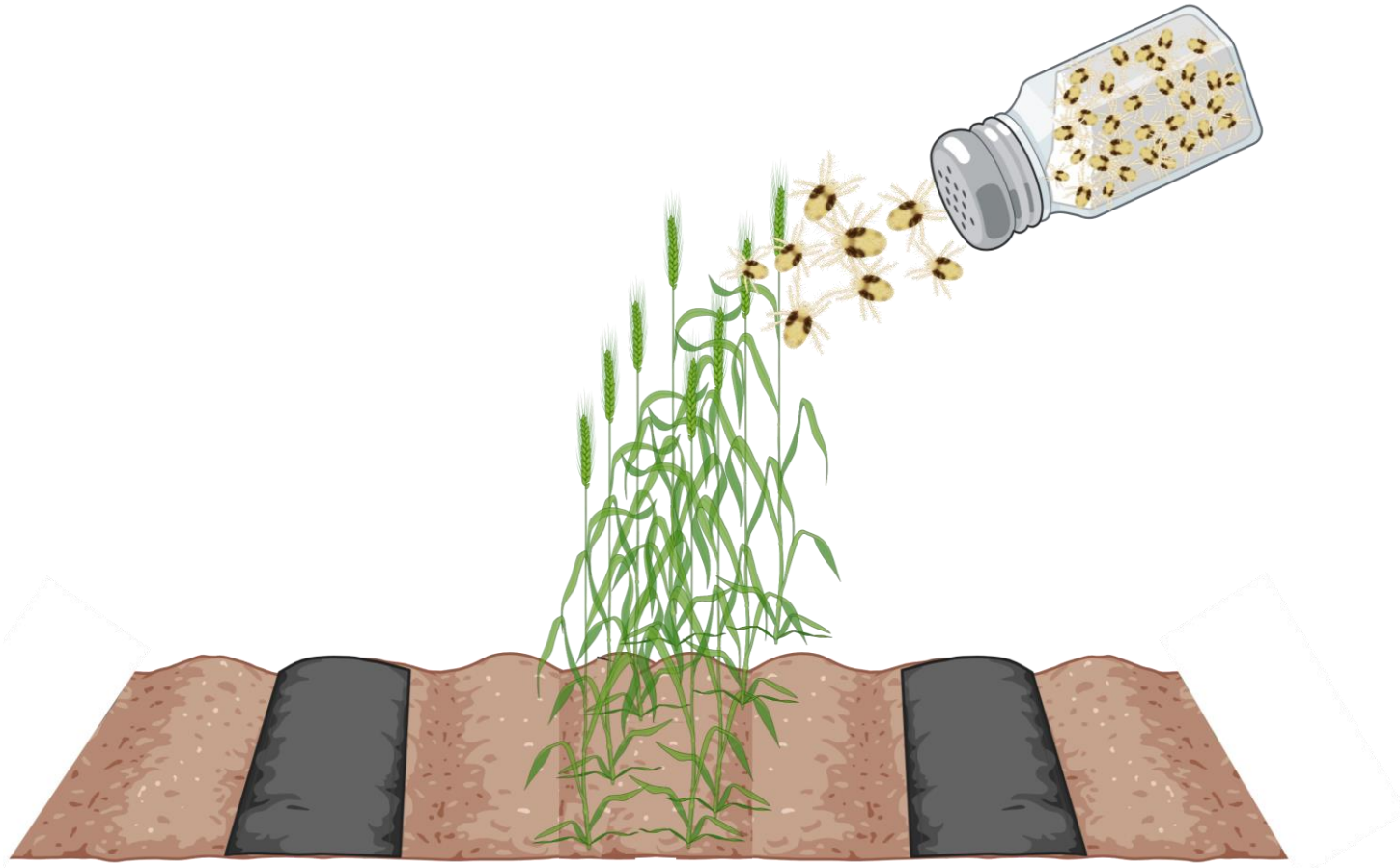
Rye cover crop absence

- Presence vs. absence of rye cover crop



Spider mite infestation

- 1 **rye** infestation prior to planting



Spider mite infestation

- 1 **rye** infestation prior to planting
- 3 **watermelon** infestations over the summer
- **~1,600 spider mites** released per plot

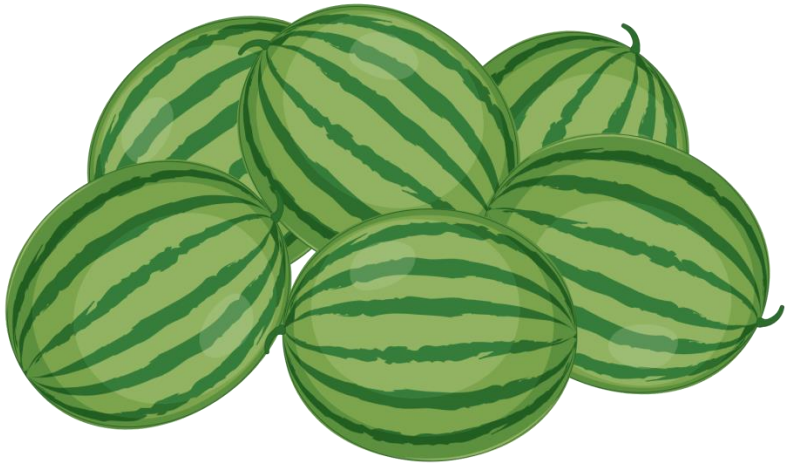
Weekly scouting

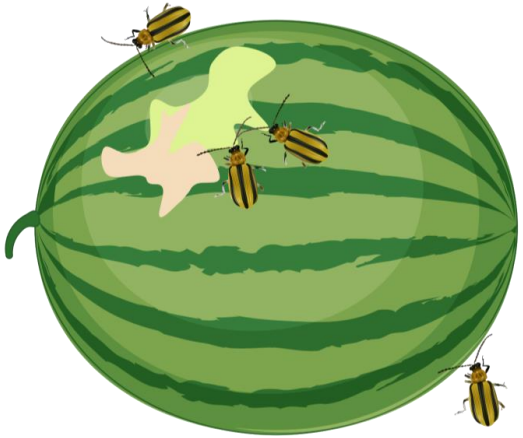
- **Pests**
  - Striped and spotted cucumber beetles
  - Spider mites
  - Aphids
- **Natural enemies**

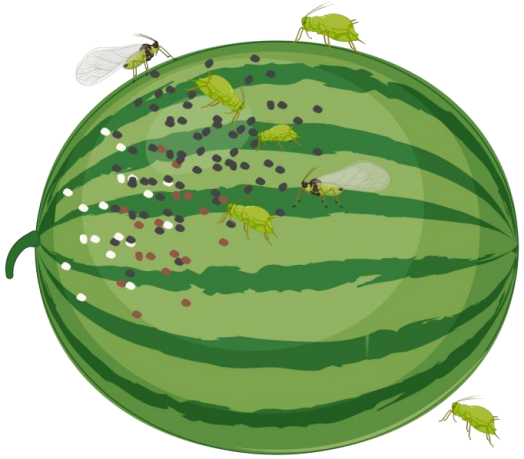
- From transplant to harvest
  - May - August

Harvest

- Fruit set
- Weight
- Rind damage
- Honeydew

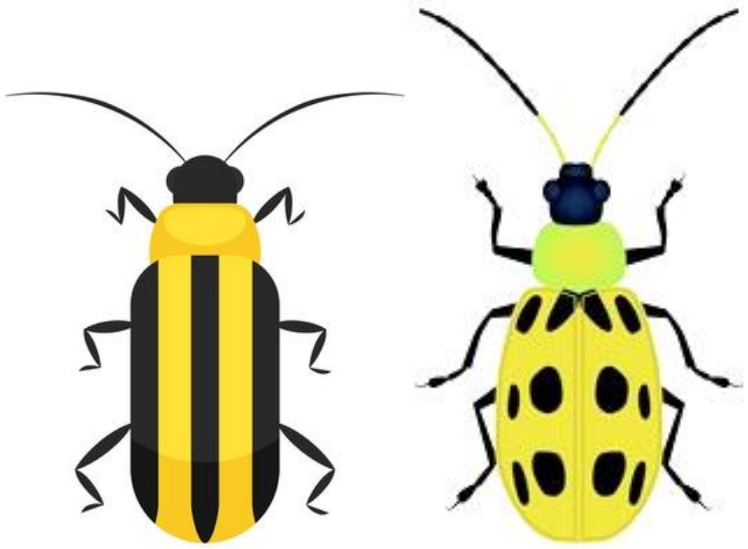


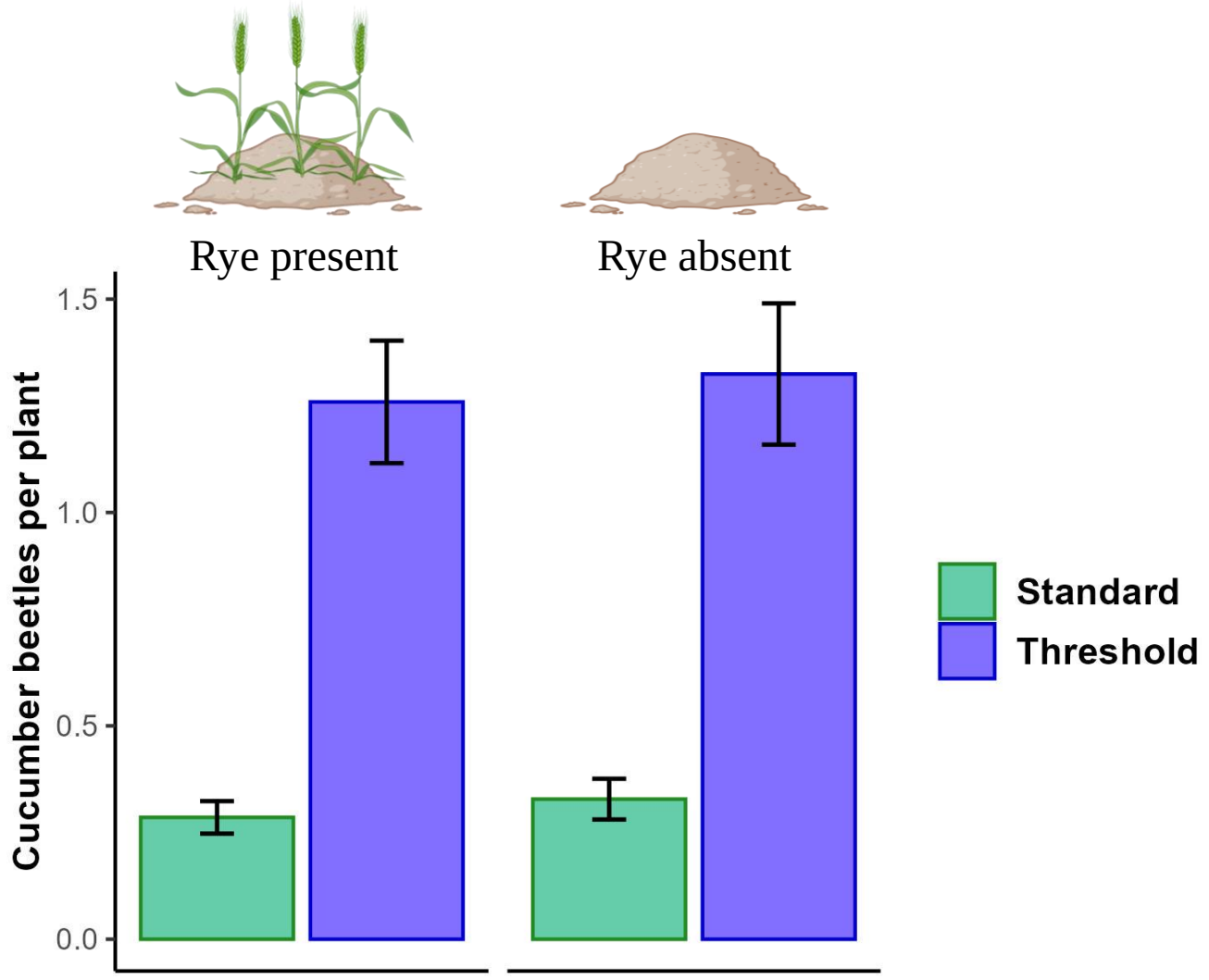




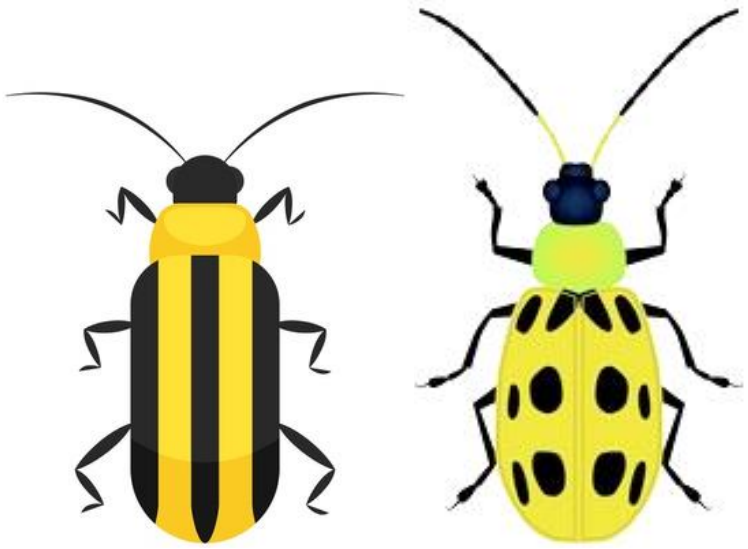
Greater number of cucumber beetles in the threshold

No effect of rye



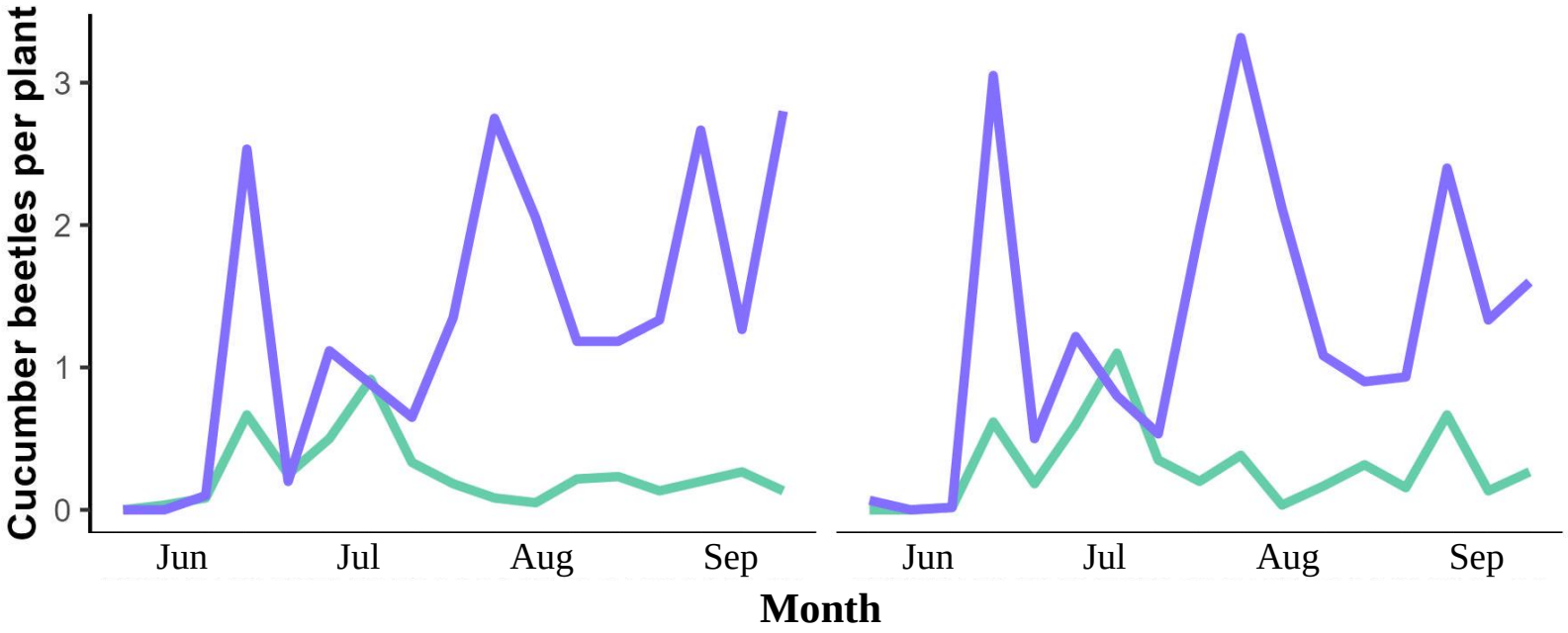


Cucumber beetles under 5 beetles per plant threshold



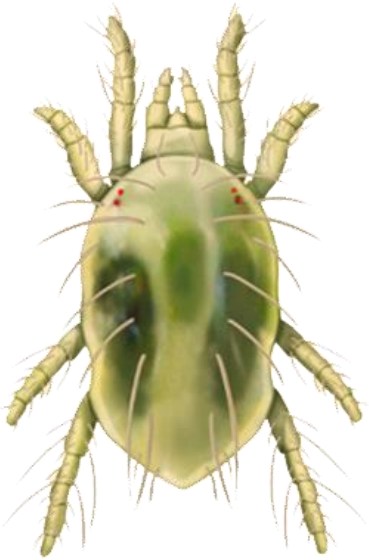
Rye present

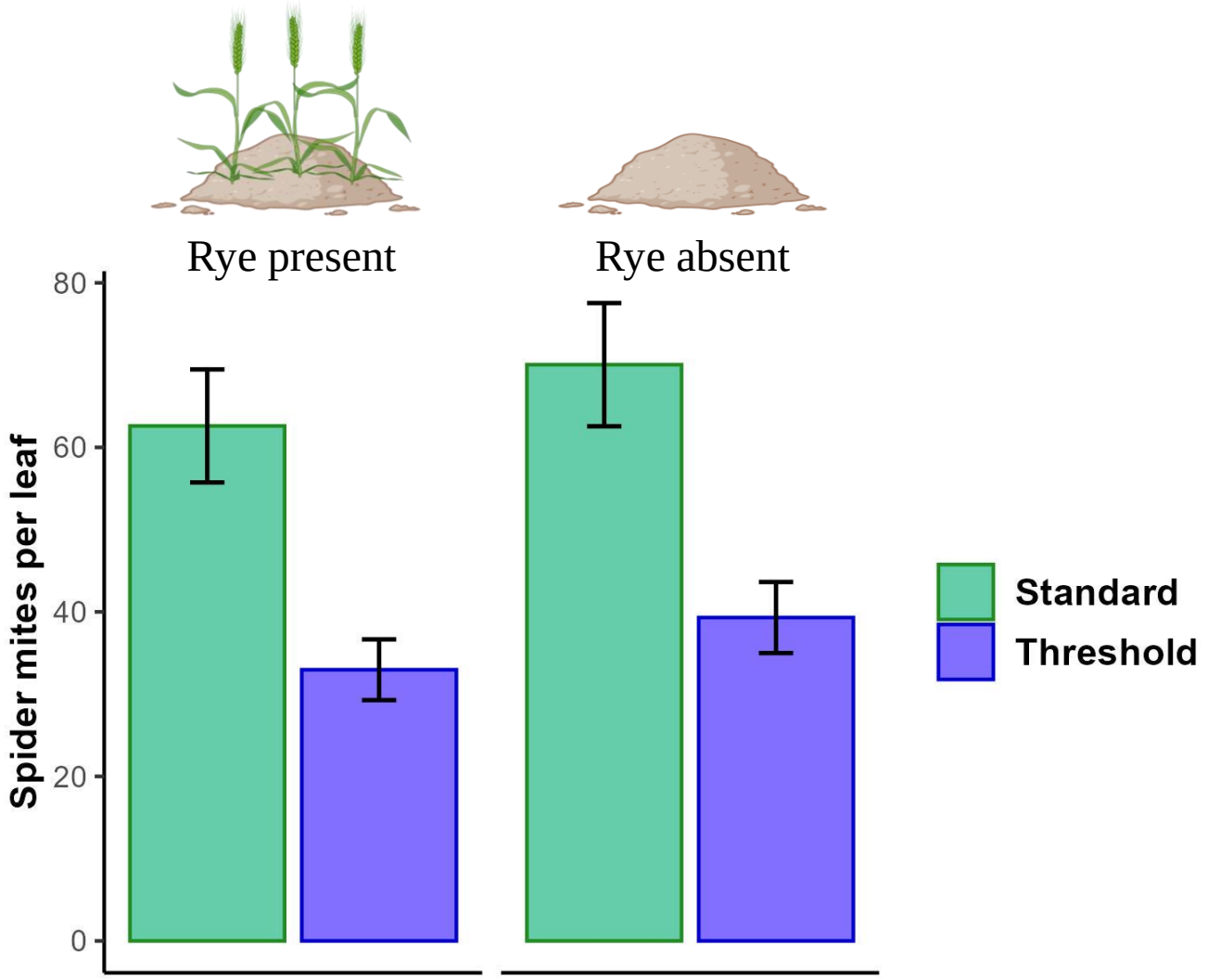
Rye absent



More spider mites in the standard insecticide treatment

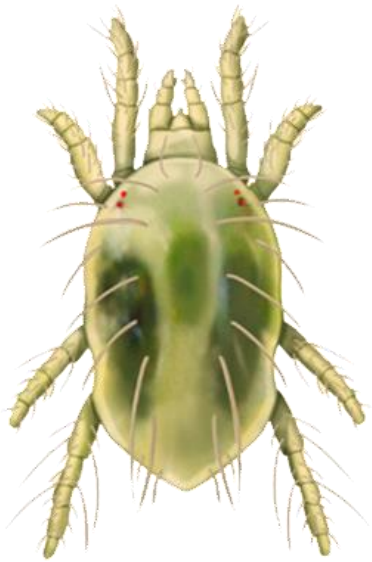
No effect of rye





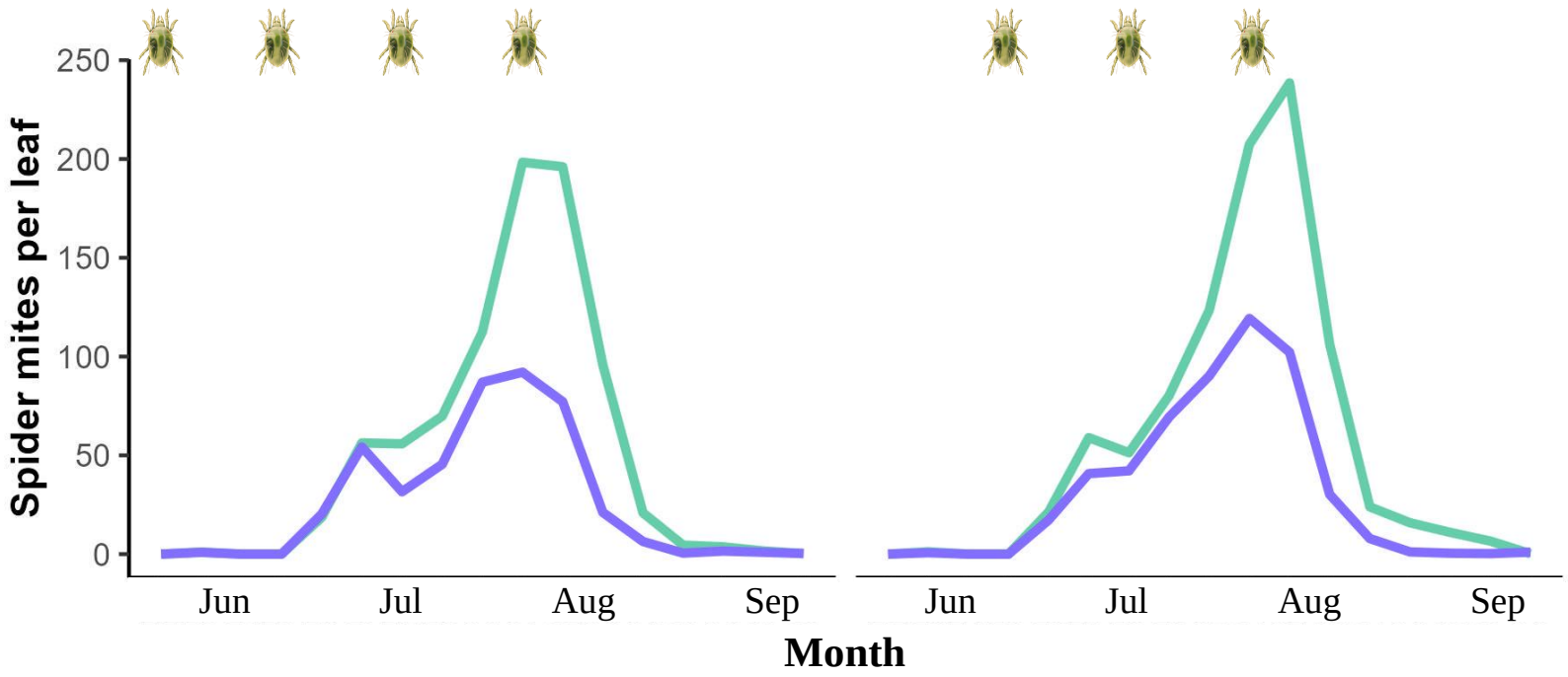
Spider mites were controlled over time in the threshold

No green bridge effect!



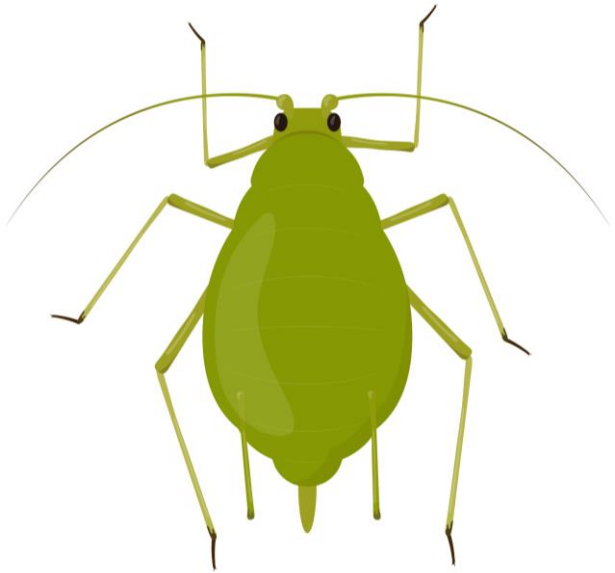
Rye present

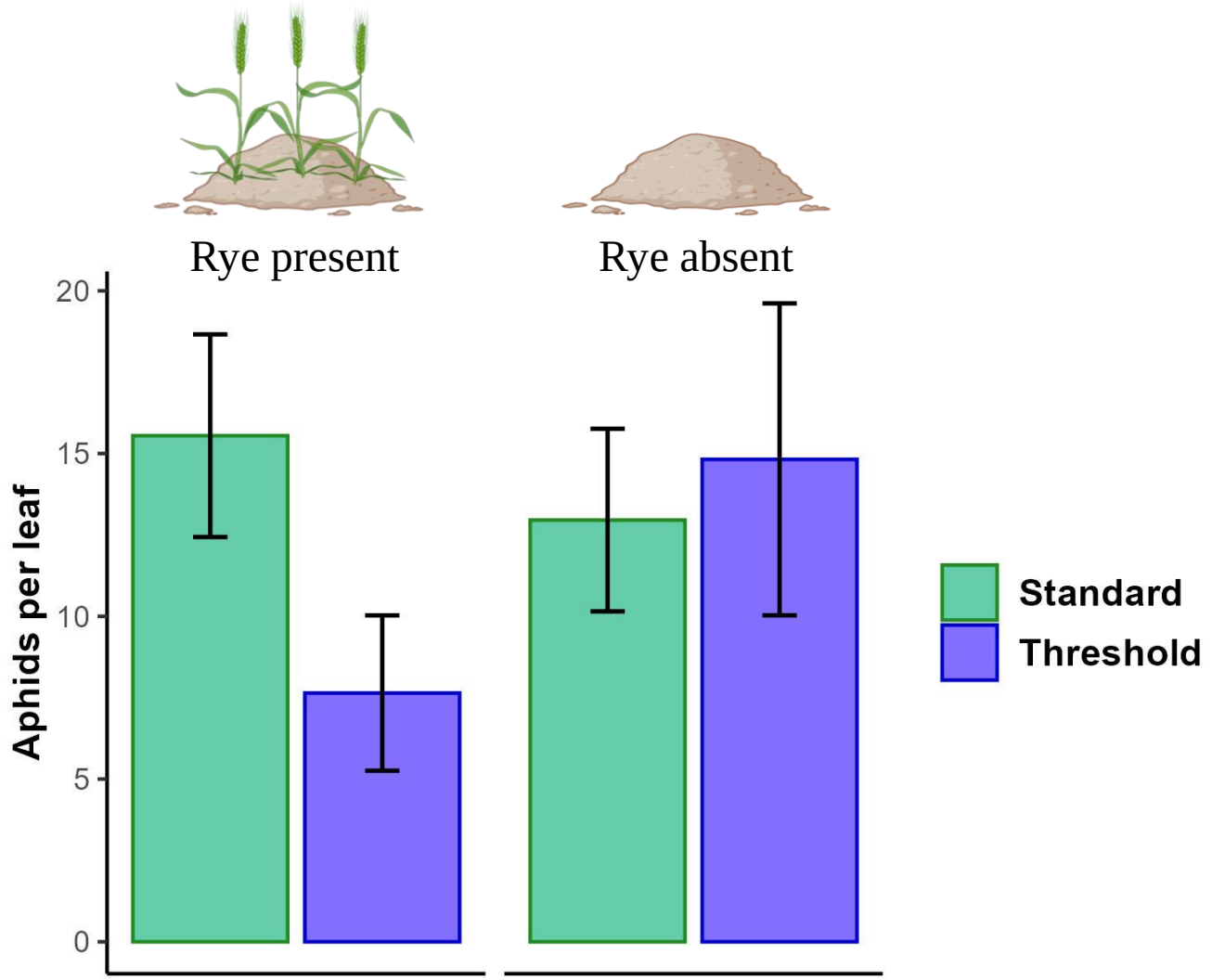
Rye absent



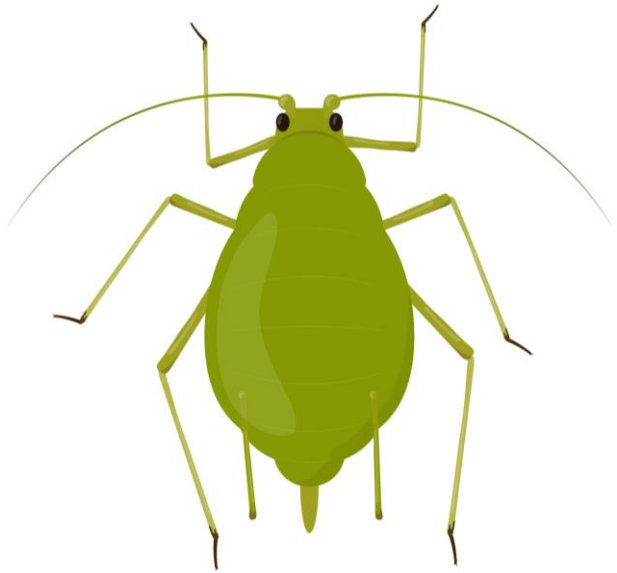
More aphids in the standard insecticide treatment

Slight rye effect



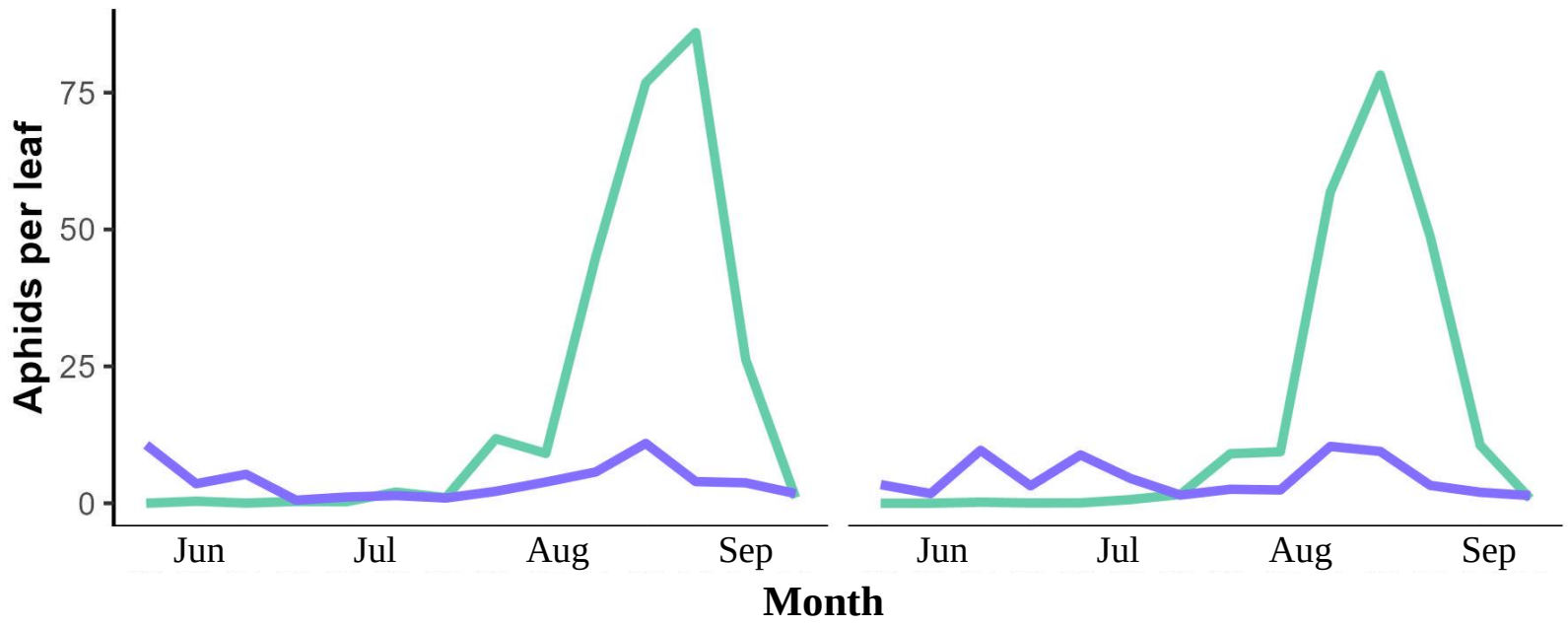


Aphid outbreaks later in the season in the standard insecticide treatment



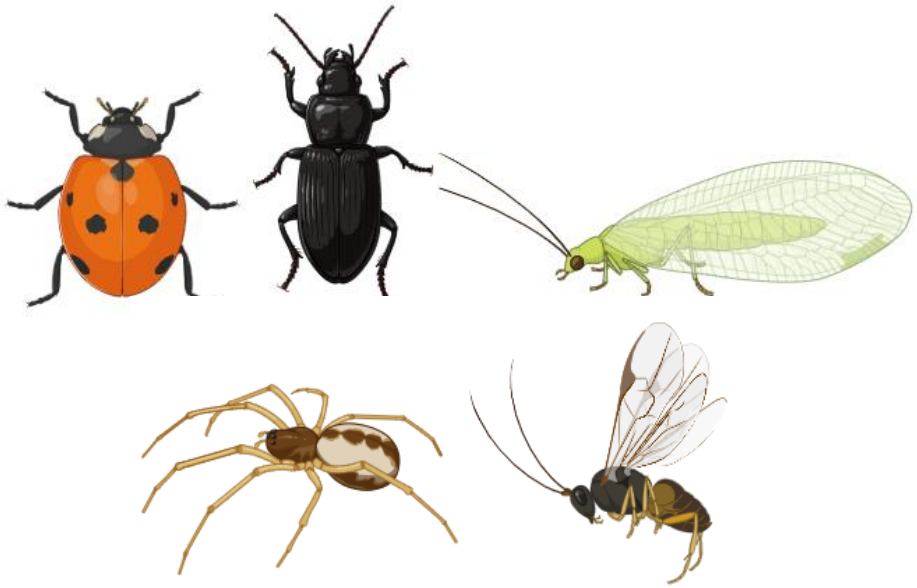
Rye present

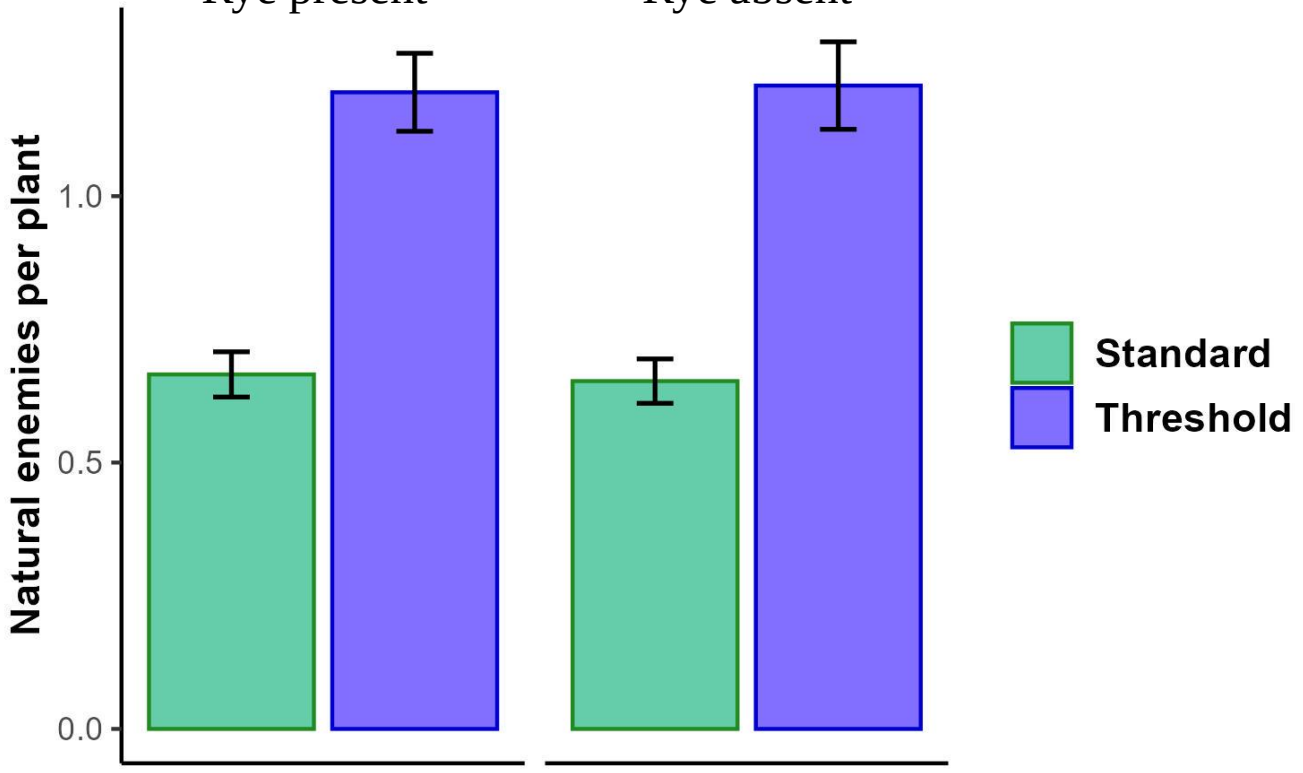
Rye absent



Greater number of natural enemies in the threshold

No effect of rye

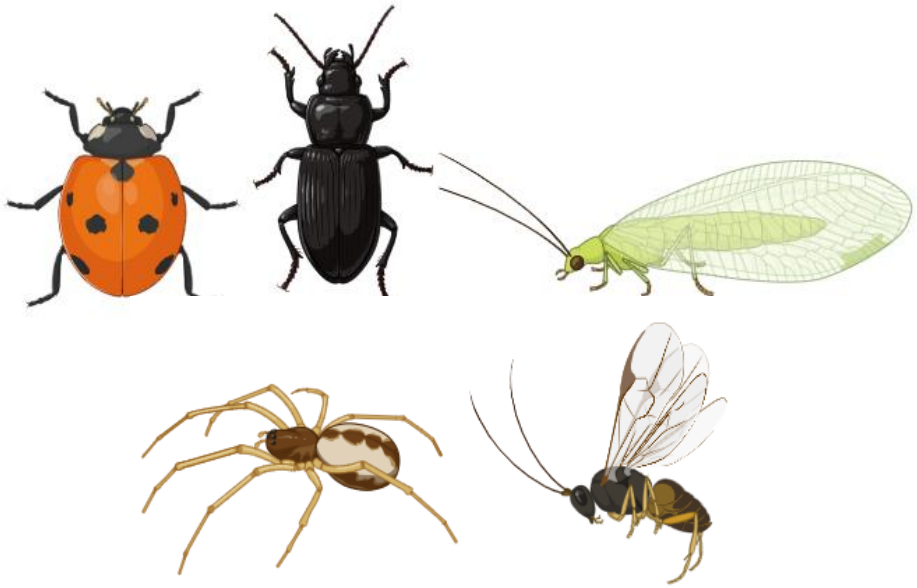


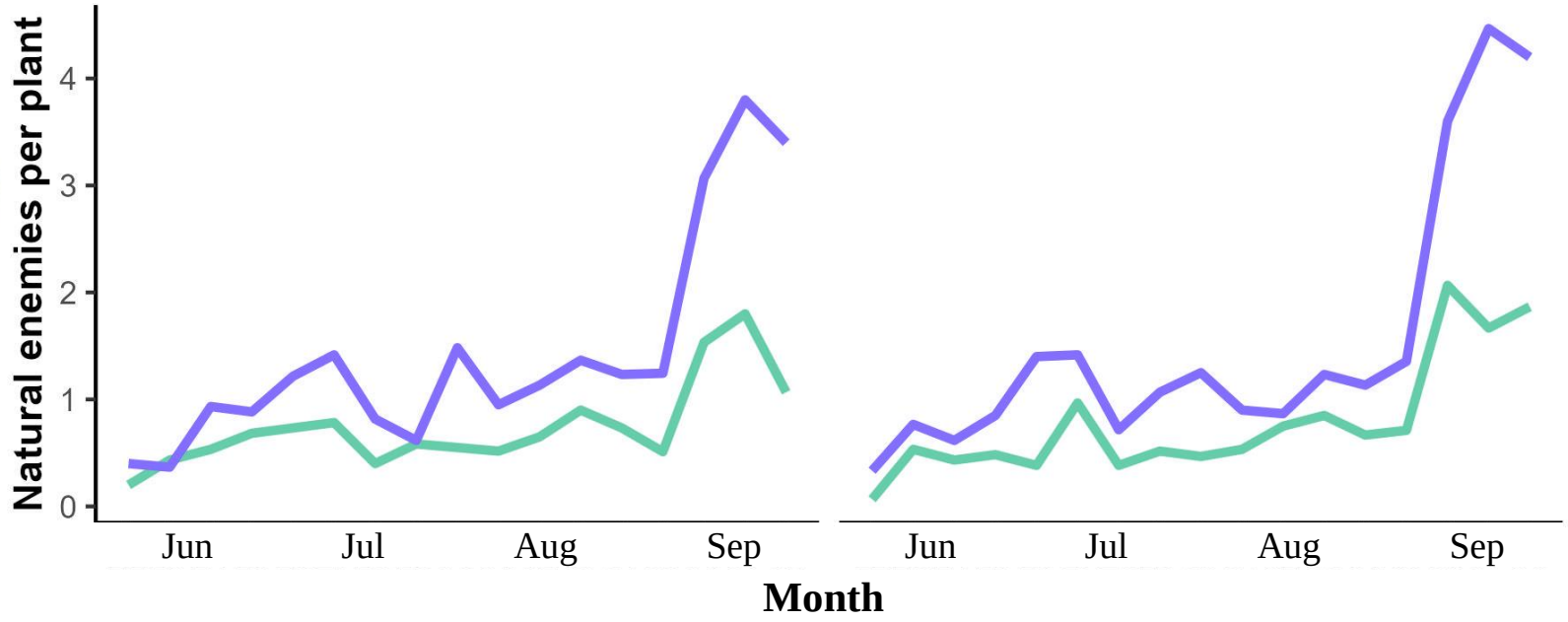


Natural enemies consistently more abundant in the threshold

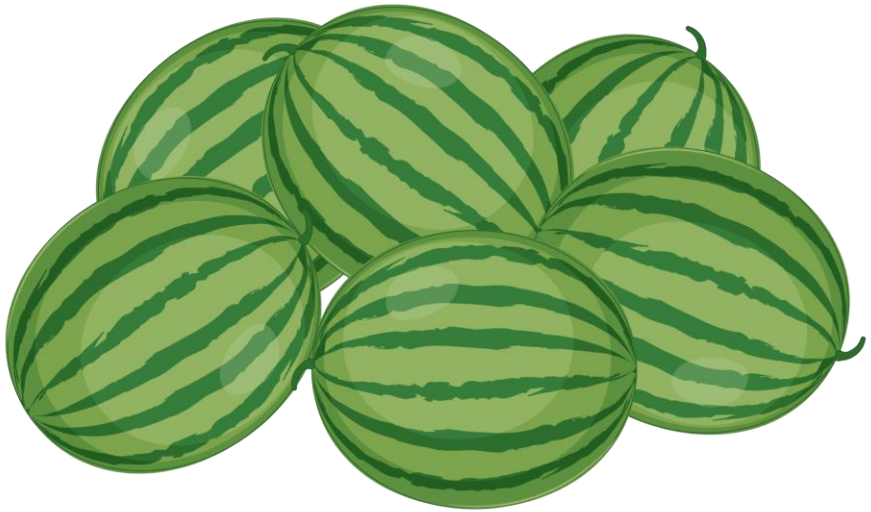
Rye present

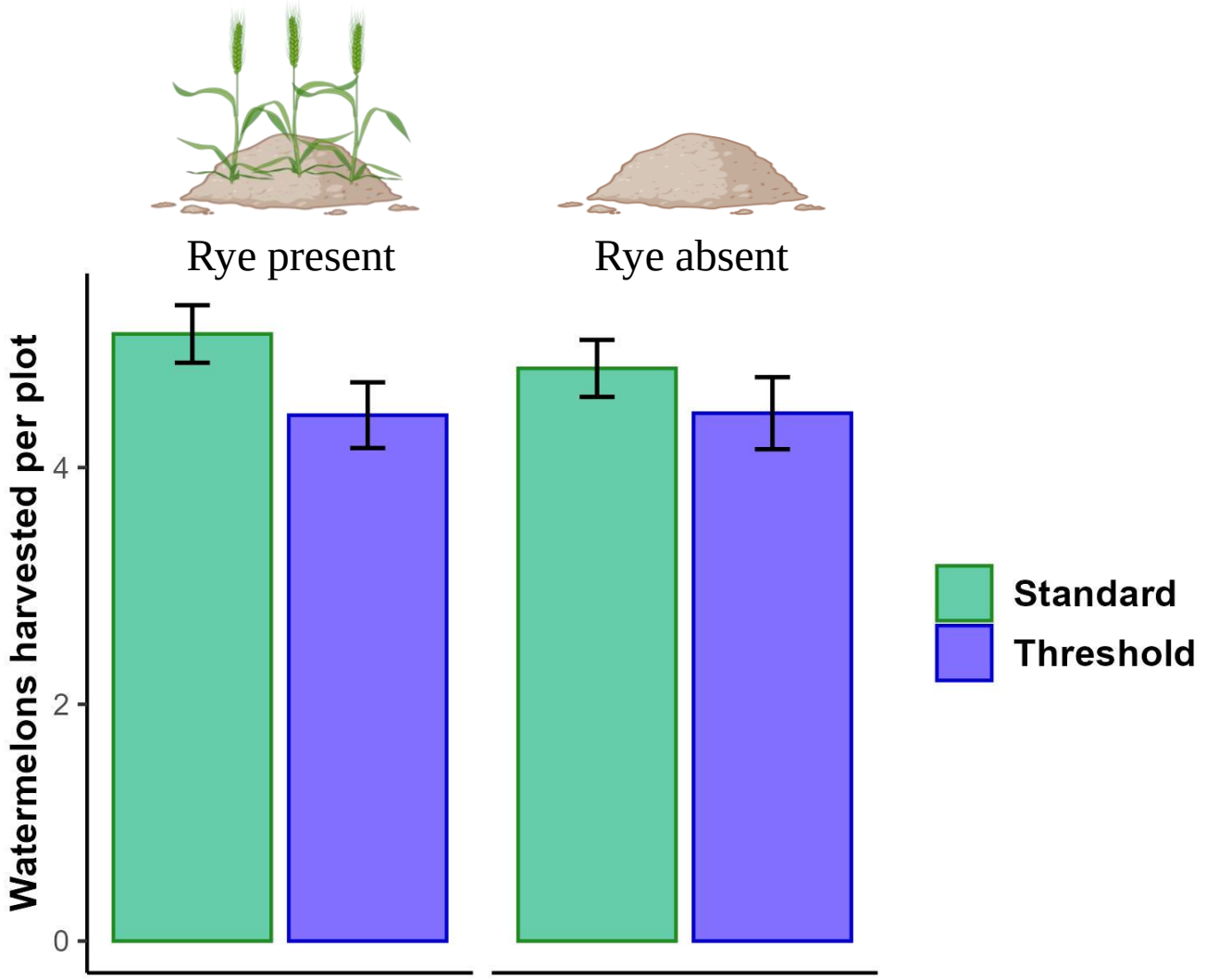
Rye absent



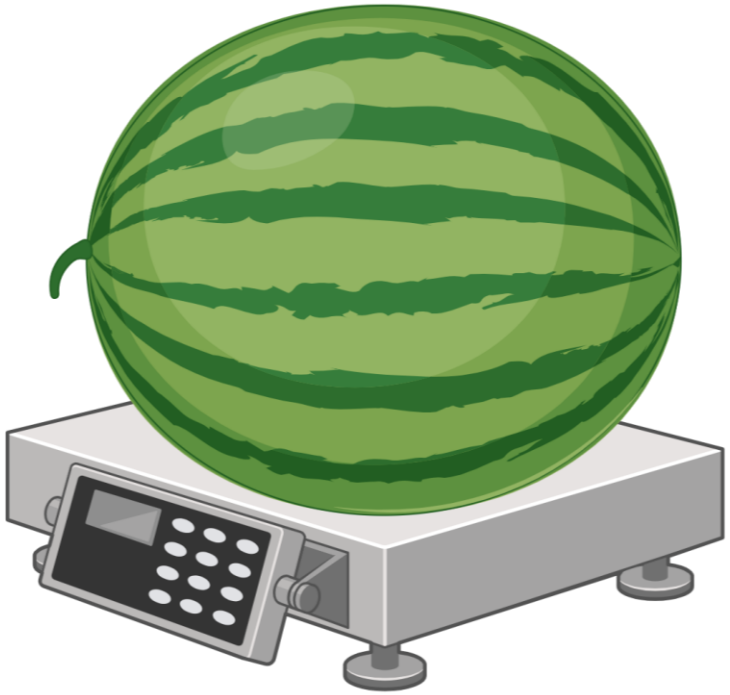


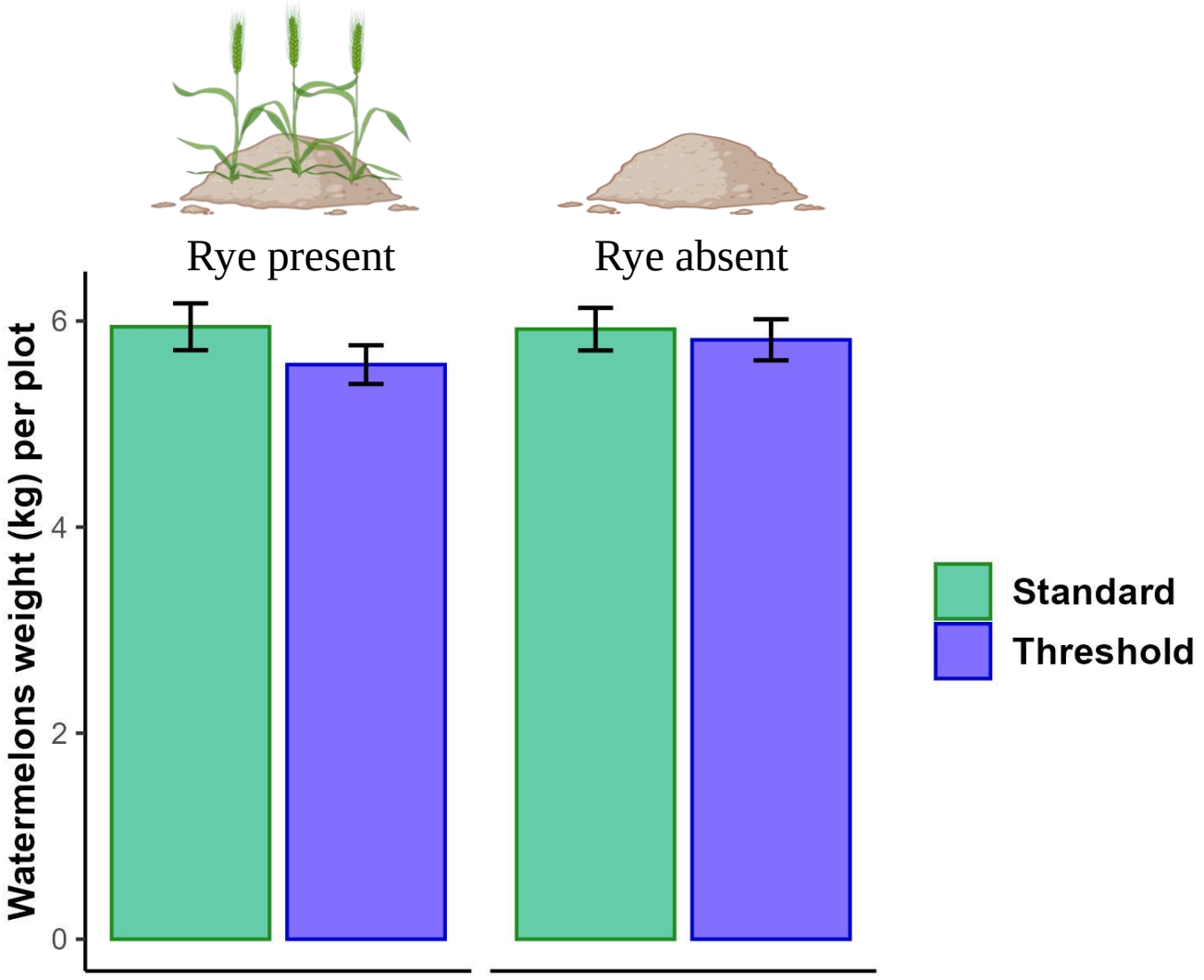
No differences in the number of watermelons harvested





No differences in individual watermelon weight

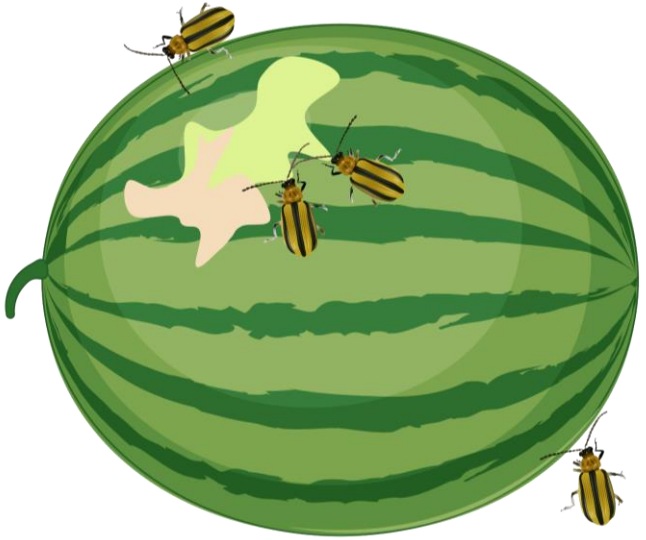


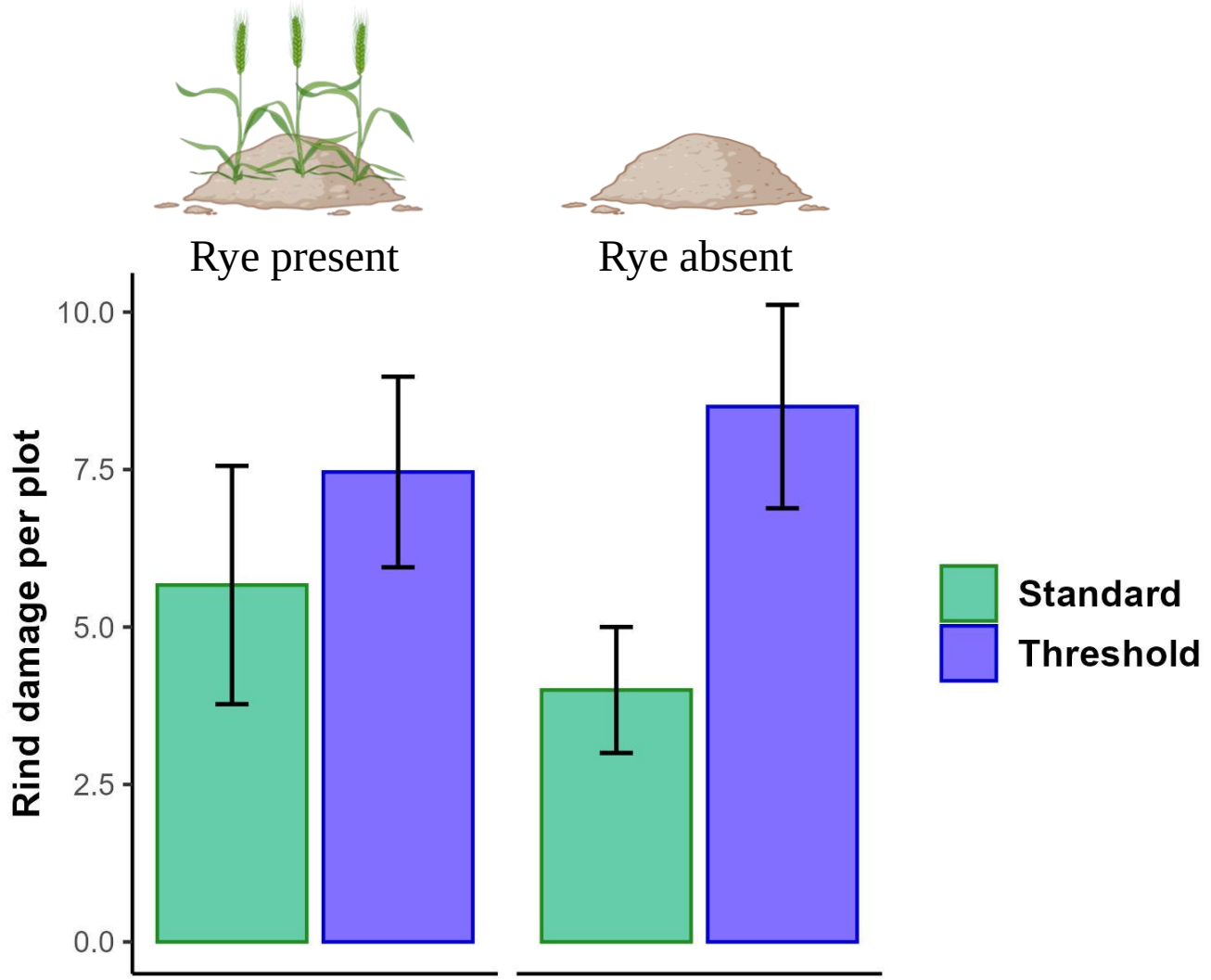


Slightly greater rind damage in the threshold

USDA marketability standards: 7 in^2

- 822 watermelons assessed
  - 1 in the standard insecticide (**0.1%**)
  - 6 in the threshold (**0.7%**)

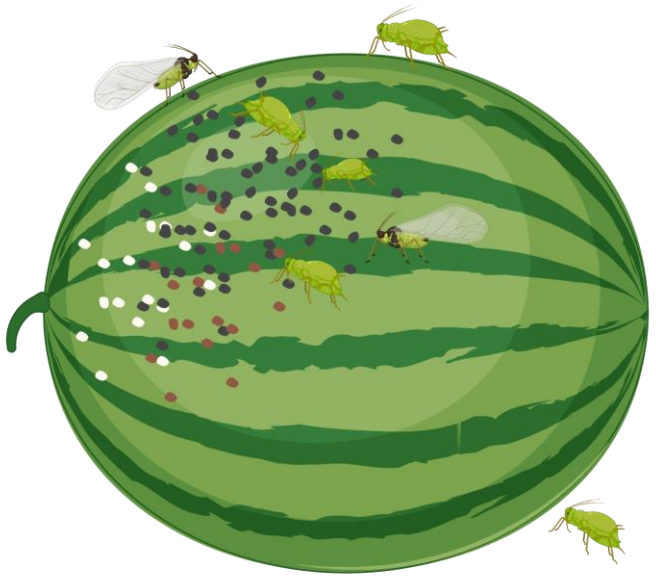


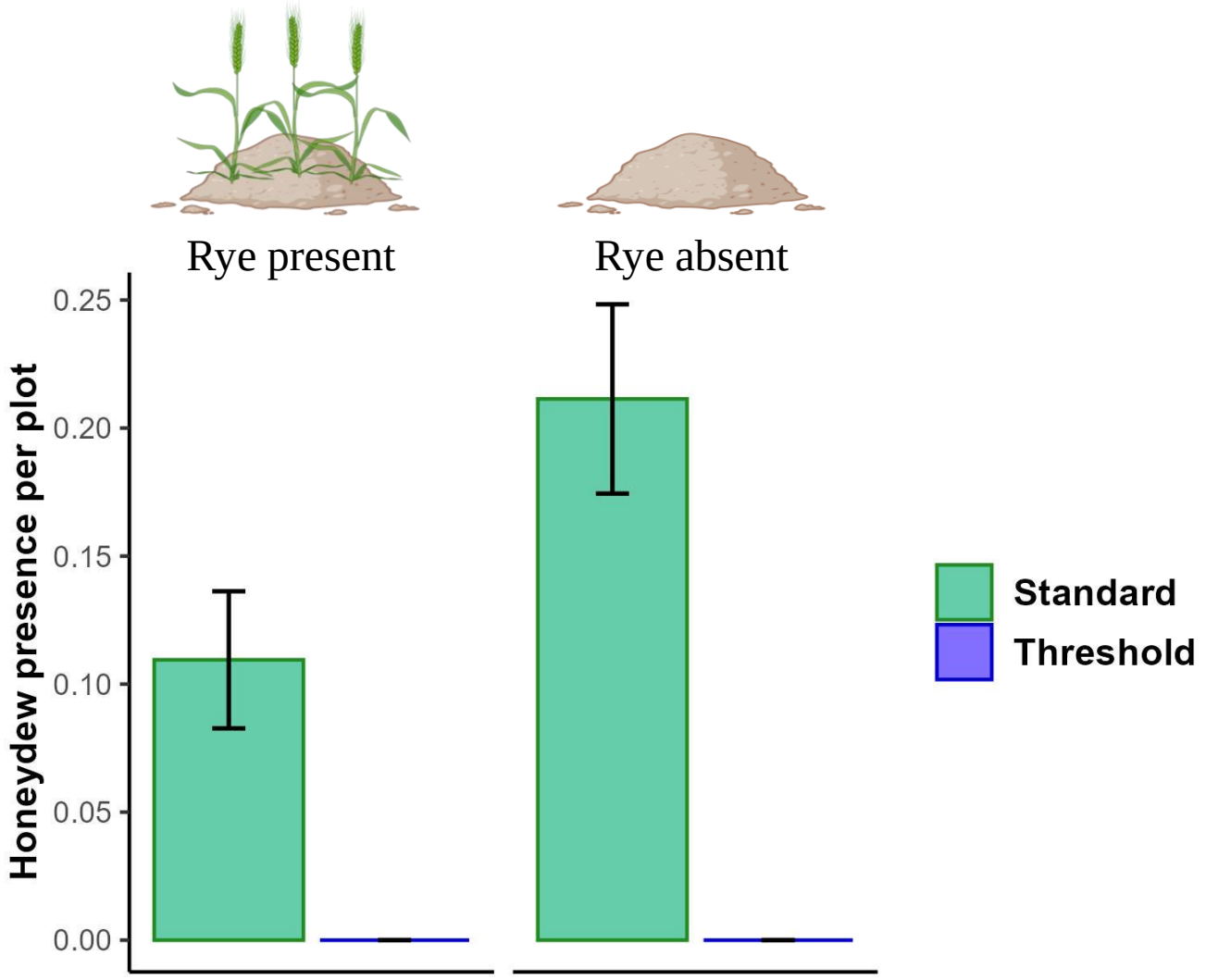


No honeydew observed in the threshold

USDA marketability standards

- 518 watermelons assessed
  - 41 in the standard insecticide (**10.8%**)
  - None in the threshold





Conclusions and recommendations

- Broad-spectrum insecticides can trigger spider mite and aphid outbreaks probably because of the reduction in natural enemies
- We recommend adopt integrated pest management (IPM) programs and apply insecticides when pests exceed economic thresholds
- IPM can protect beneficial insects and minimize secondary pest outbreaks
- Spray programs based on threshold recommendations can save costs on insecticides and miticides
- Spider mites do not seem to use rye as a green bridge to move into the crop nor do natural enemies
- Rye might have a negative effect on aphids and can help control them

Acknowledgements

Thank you!

- **USDA**
  - Grant number 2022-67019-36365
- **PAC managers**
  - Chloe Henscheid - TPAC
  - Dennis Nowaskie - SWPAC
  - Joel Wahlman - SEPAC
- **Technicians, students and staff**

Interested in collaborating with us?

Flowering cover crop trial in **2025** in commercial fields!

We'll provide **free scouting** and **weekly reports** for threshold-based recommendations!

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