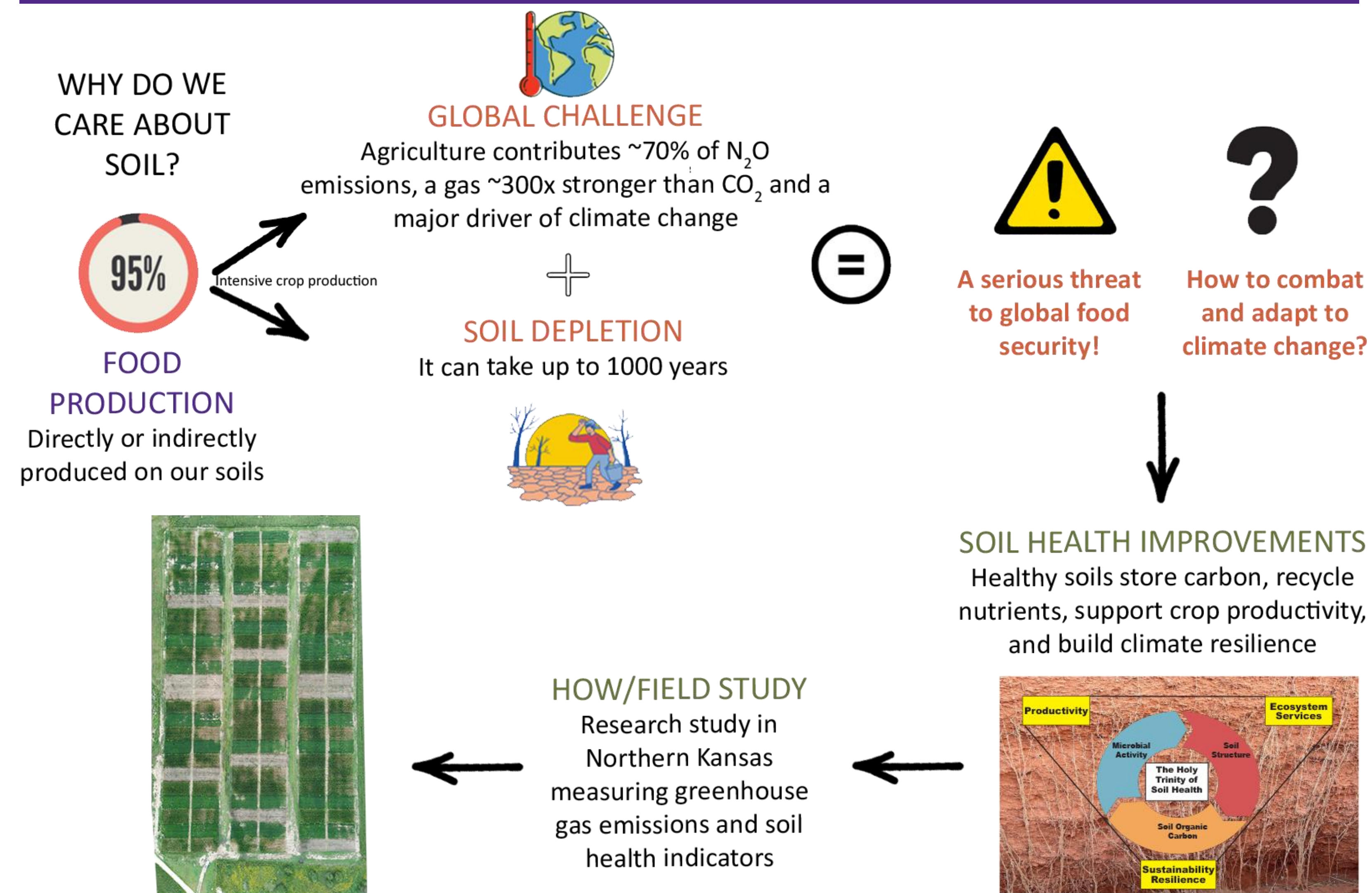


BACKGROUND



OBJECTIVE

Assess the effects of cover crops, tillage, rotation intensity, and N rates on soil microbial diversity and N₂O flux dynamics.

HYPOTHESIS

Management practices that build soil health are expected to reduce nitrous oxide emissions.

MATERIALS AND METHODS

- ❖ Lonsinger – Osborne/KS
- ❖ Samples for Soil Health Assessment: 2024 (baseline)
- ❖ Start date for N₂O measurements: [June 6th, 2025]
- ❖ LI-COR (Smart Chamber): measures N₂O fluxes

Factor	Levels	Description
Rotation Intensity	1-year	Corn (continuous)
	2-years	Corn – Soybean
	3-years	Corn – Soybean – Wheat
	(All phases every year)	
Nitrogen	Base	Based on historical yields
	Increased	Additional 60 lbs/acre
Tillage	Conventional tillage	Two tillage passes in fall or spring
	No-tillage	No tillage (or strip tillage)
Cover Crop	Yes	Cereal rye cover crop
	No	No cover crop

Experimental Structure
6 Phases of crop rotation × 2 Nitrogen levels × 2 Tillage systems × 2 Cover crop treatments = 48 treatment combinations
48 treatment combinations × 3 replications = **144 total plots**

ACKNOWLEDGEMENTS

This work was supported by the Foundation for Food & Agriculture Research under award number 22-000547. The content is solely the responsibility of the authors and does not necessarily represent the official views of FFAR.

RESULTS

Fig. 1. Daily N₂O Flux Patterns

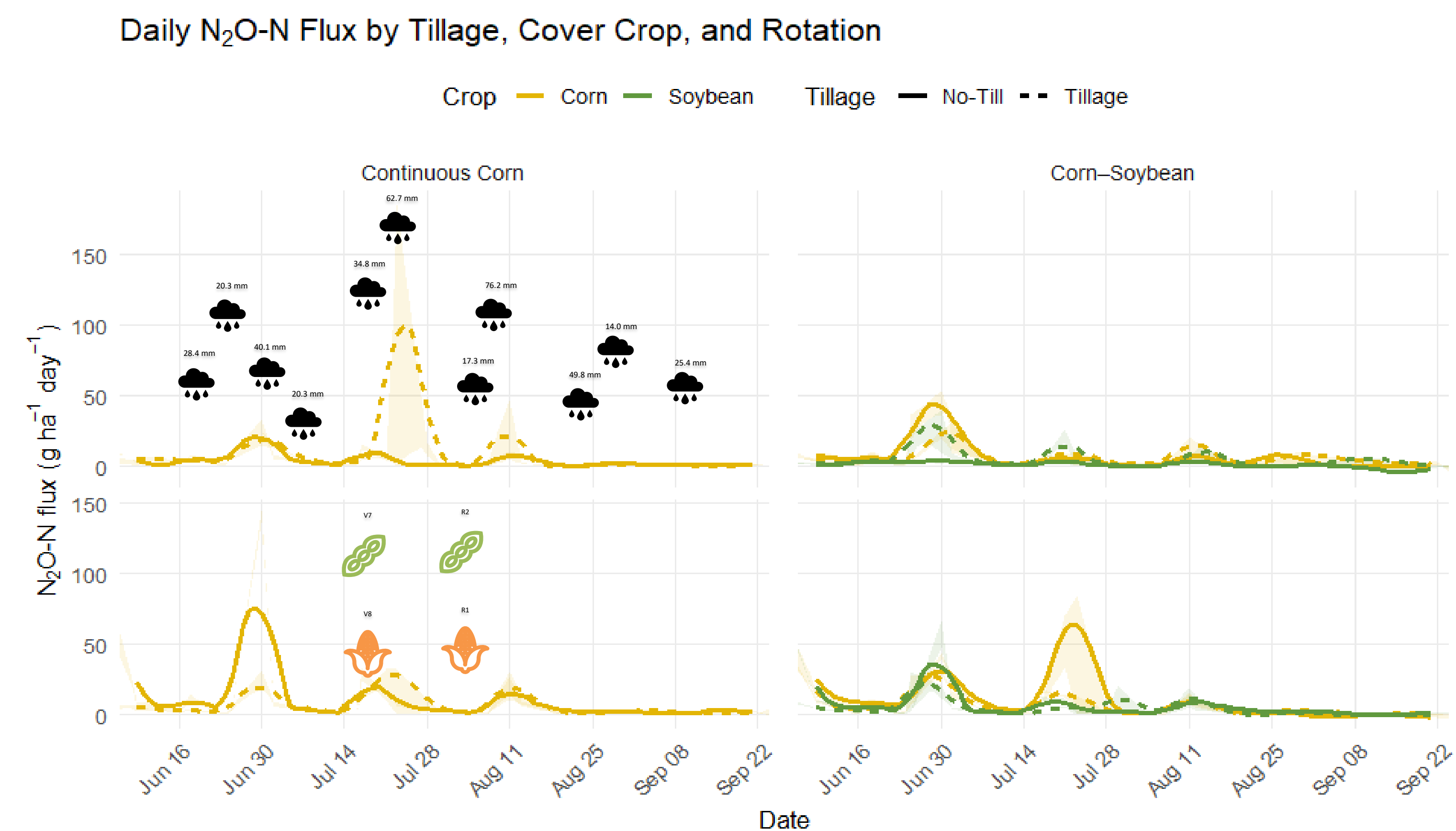


Fig. 2. Cumulative N₂O Emissions

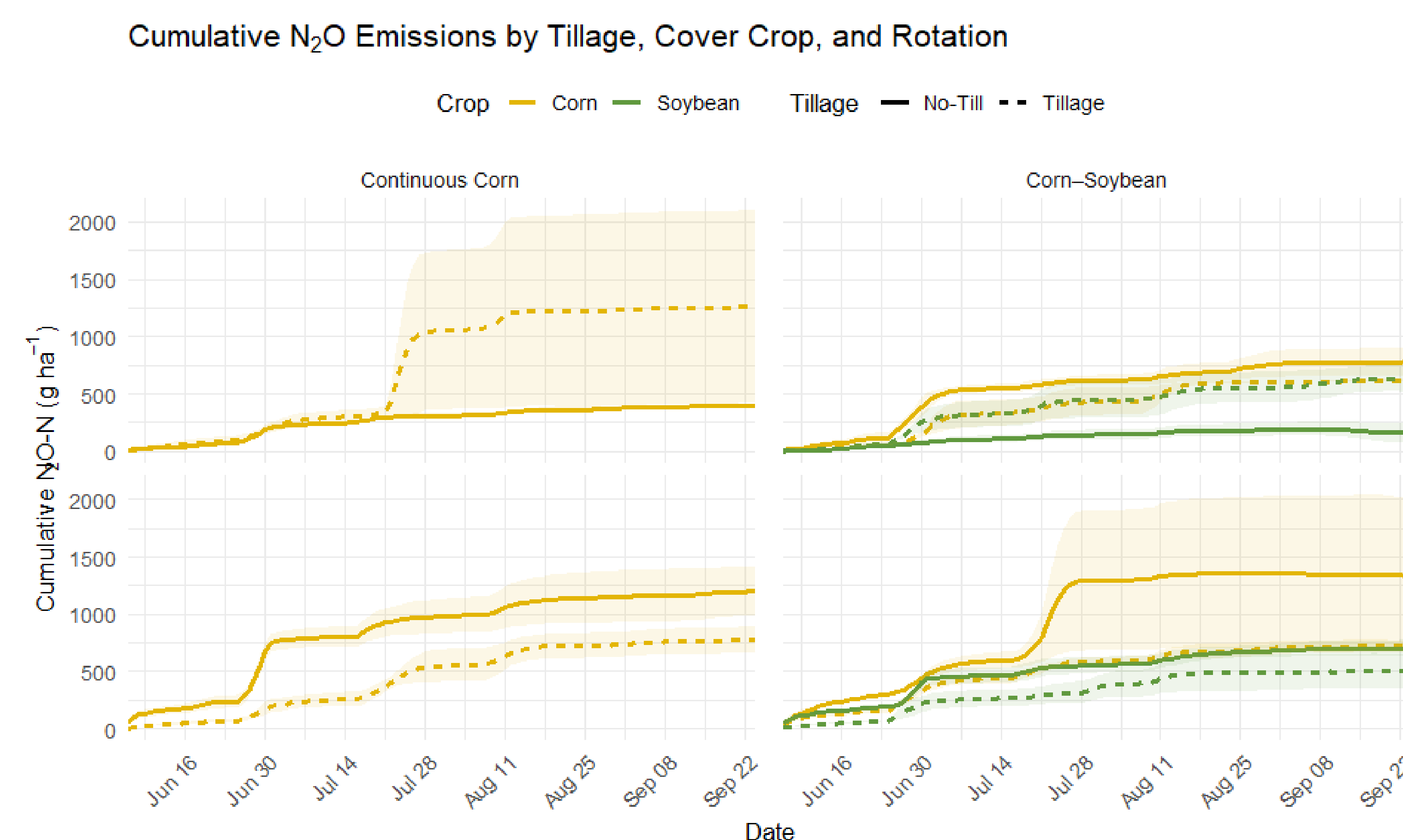


Fig. 3. Acid phosphatase activity by management system

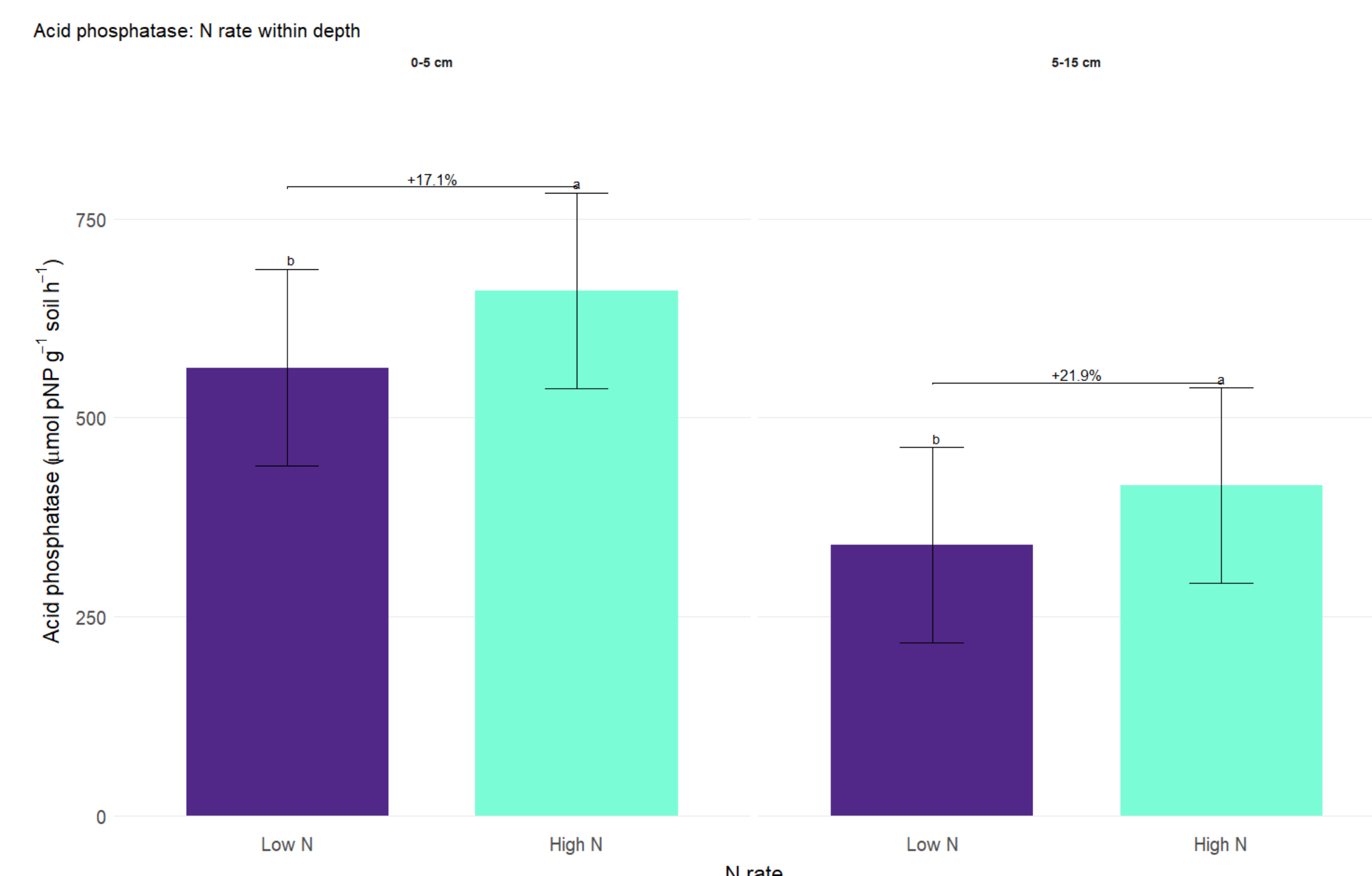


Fig. 4. Relationship between β-glucosidase and rotation intensity



CONCLUSIONS

- ❖ Rainfall drives short-term increases in N₂O fluxes, with the highest daily emission occurring under continuous corn managed with tillage and without cover crops.
- ❖ Greater cumulative N₂O emissions under cover crop × no-till systems might reflect residue decomposition and mineralization during the cash crop phase, rather than a direct effect of the cover crop itself.
- ❖ Enzyme activities increased under high N and diversified rotations, suggesting enhanced microbial function and nutrient cycling.

- Greater N₂O fluxes occurred shortly after rainfall events, lasting for ~ 2 months after planting.
- The highest daily N₂O emission was observed under continuous corn under tillage and without cover crops (upper-left).
- Incorporating soybean into the rotation reduced the N₂O emission intensity.
- Year 1 – Continuous Corn, No Cover, Tillage (upper-left): Cumulative emissions exhibited greater variability than any other treatment.
- Soybean, overall, had lower cumulative N₂O fluxes compared to corn.
- Cover crop × No-till interaction (bottom row): Increased cumulative N₂O in Year 1 and Year 3.