



Managing N pollution with interseeded legume-grass cover crops grown after spelt

- Over 30% of nitrogen (N) loading to the Chesapeake Bay comes from agriculture and 75% of US anthropogenic nitrous oxide (N₂O) emissions arise from soil management.
- Cover crop interseeding combines the benefits of cover cropping and reduced tillage to decrease soil inorganic N, which may decrease nitrate (NO₃⁻) leaching and N₂O emissions.

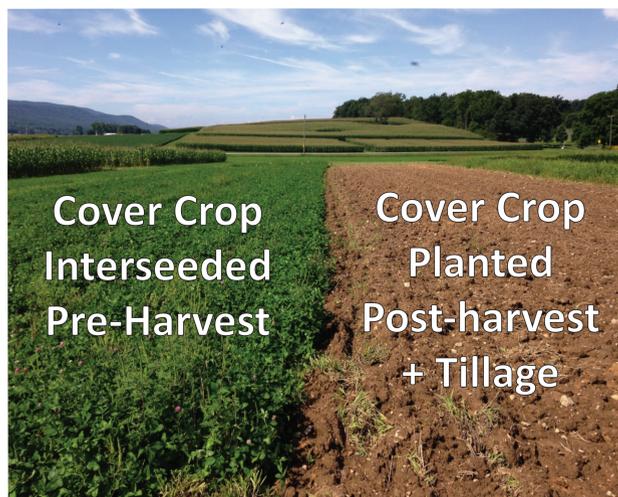


Figure 1. Comparison of interseeded (left) and non-interseeded (right) fields in August following spelt harvest

Study Site and Experimental Design

- Research conducted at the Penn State Agricultural Research Station in central Pennsylvania.
- Randomized complete block, full-entry design in a three-year corn-soy-spelt crop rotation with four cropping systems.
- The data presented here represent the spelt entry of the rotation and its subsequent cover crop.

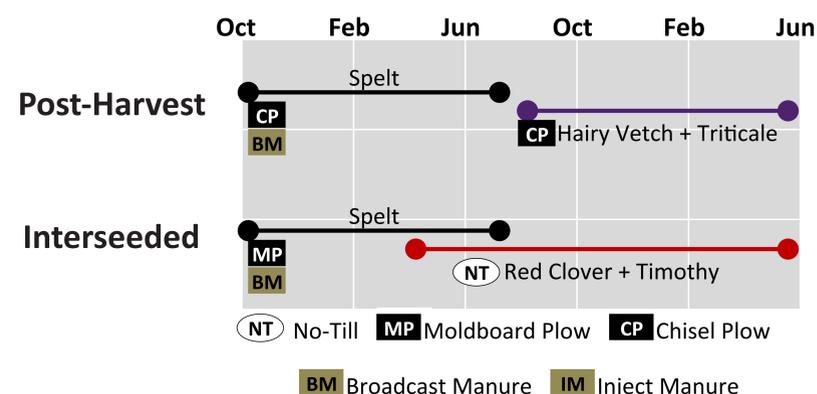


Figure 2. Cover crop management after spelt

Research Questions

- Do interseeded cover crops maintain a smaller pool of soil inorganic N than cover crops planted post-harvest?
- Does more N uptake by interseeded cover crops result in decreased soil NO₃⁻ leaching and N₂O emissions?

Interseeded cover crops maintain a smaller pool of soil inorganic N

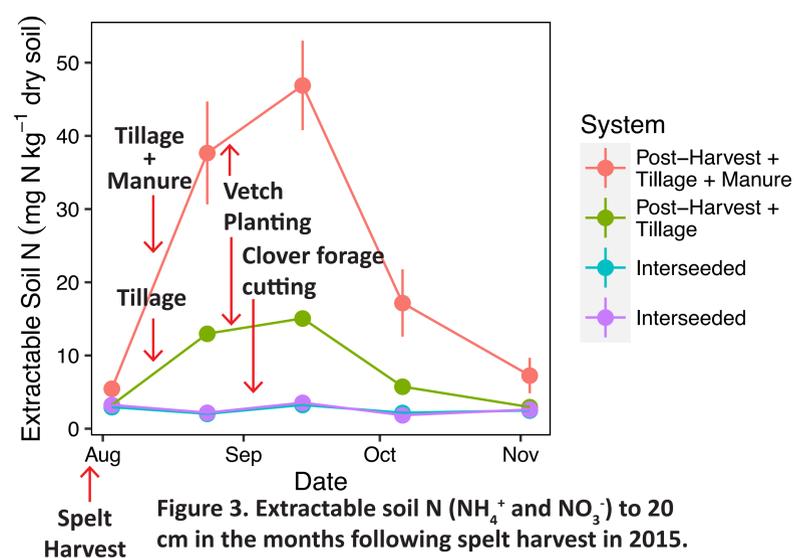


Figure 3. Extractable soil N (NH₄⁺ and NO₃⁻) to 20 cm in the months following spelt harvest in 2015. Error bars represent one standard error.

Interseeded cover crops take up more soil N, fix more atmospheric N, and provide the economic benefit of a forage cutting

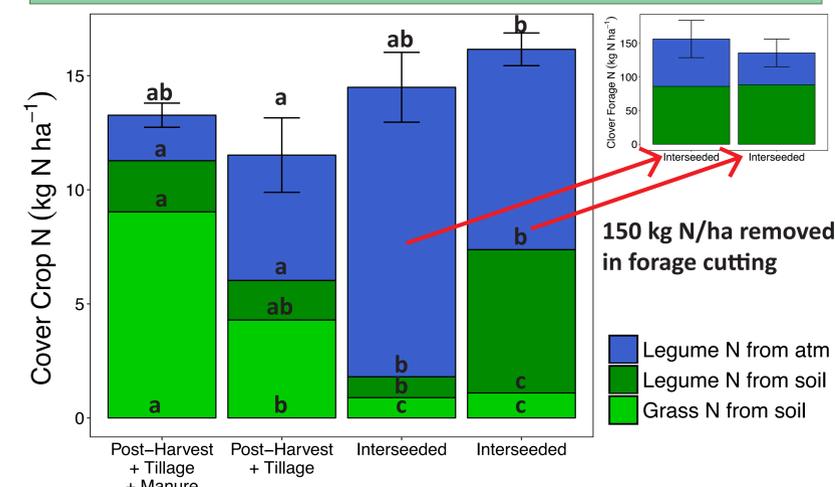


Figure 4. Cover crop biomass N in Fall 2015. Error bars represent one standard error. Fractions with different letters are significantly different ($p < 0.05$).

Interseeded cover crops may not decrease nitrate leaching

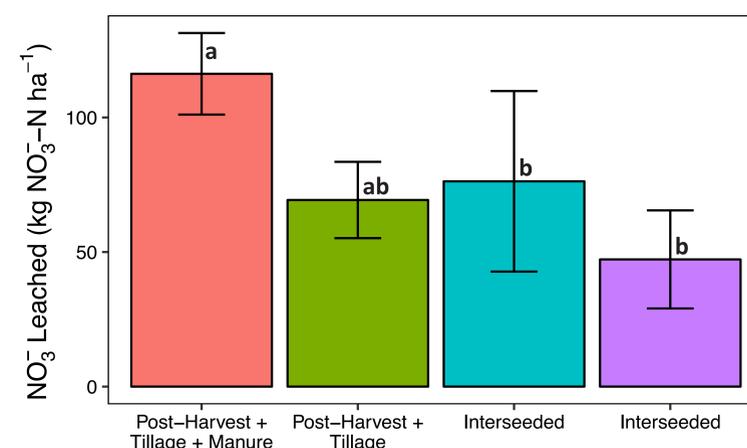


Figure 5. Potentially leached NO₃⁻ adsorbed to anion resin beads at 25 cm. Installed August 2015 and removed May 2016. Error bars represent one standard error. Systems with different letters are significantly different ($p < 0.05$).

Interseeded cover crops can decrease hot moments in nitrous oxide emissions

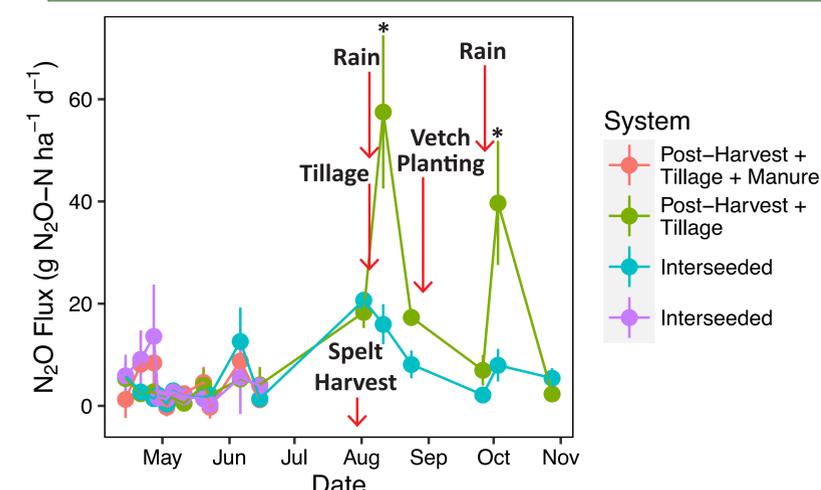


Figure 6. Soil N₂O emissions in 2016 using static chamber method. Error bars represent one standard error. Time points with asterisks are significantly different ($p < 0.05$).

References and Acknowledgements

U.S. EPA. 2016. Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014
Reckhow et al. 2011. Achieving Nutrient and Sediment Reduction Goals in the Chesapeake Bay
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Conclusion: Interseeded cover crops can mitigate nitrogen pollution

- Interseeded cover crops can maintain a smaller pool of soil N than a cover crop planted post-harvest with an associated decrease in N₂O emissions. Decreased N₂O fluxes could result from lower substrate availability for denitrification.
- Interseeded cover crops did not decrease nitrate leaching compared to the post-harvest cover crop, which suggests additional mineralization over the winter season or that high-N legumes are not suitable for decreasing leaching.
- Interseeded cover crops provide greater N from fixation and greater income from a forage cutting.