The impact of grass and legume cover crops on agronomic optimum nitrogen rates for corn and cotton across 15 states

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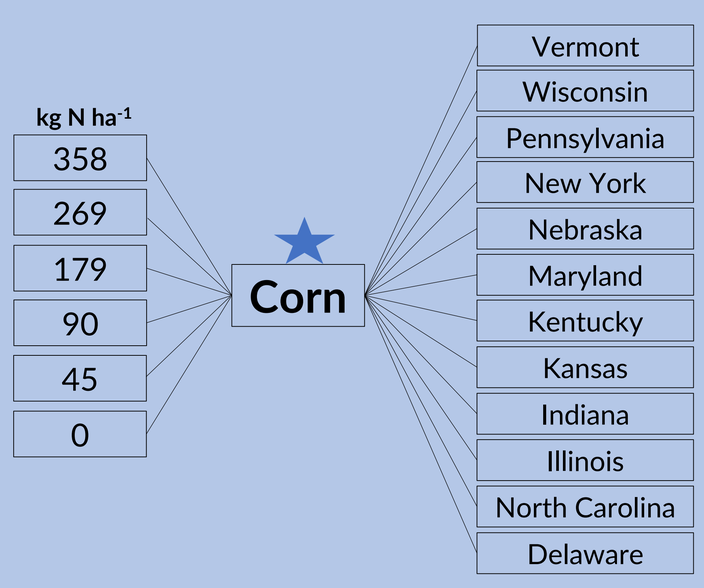
Background

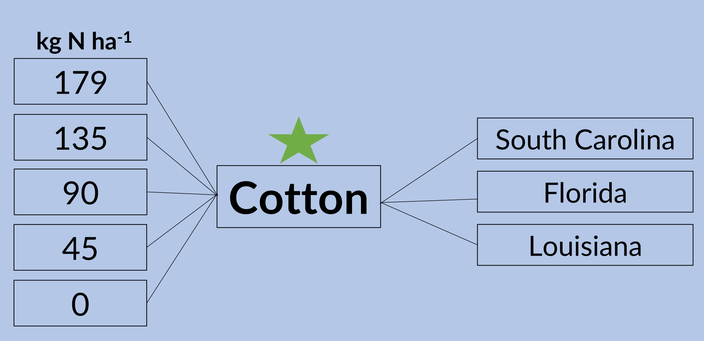
- Decades of study on cover crops have demonstrated their ability to effectively contribute to N cycling and potentially improve both NUE and soil quality.
- Cereal rye can scavenge N from deep soil layers, which not only makes N available after its decomposition but also avoids losses by leaching.
- Legume species, biologically fix atmospheric N and make it available to the subsequent cash crop.
- Many prior experiments find that corn yield is not significantly reduced following cereal rye, and most often increases after a legume cover crop.
- Establishing optimal N rates following cover crops can ensure high yields while minimizing N losses associated with fertilization.

Objective

- Evaluate how grass and legume cover crop species impact the agronomic optimum nitrogen rate (AONR) of corn and cotton to understand their potential contributions to cash crop nitrogen (N) availability and ultimately nitrogen use efficiency (NUE).

States



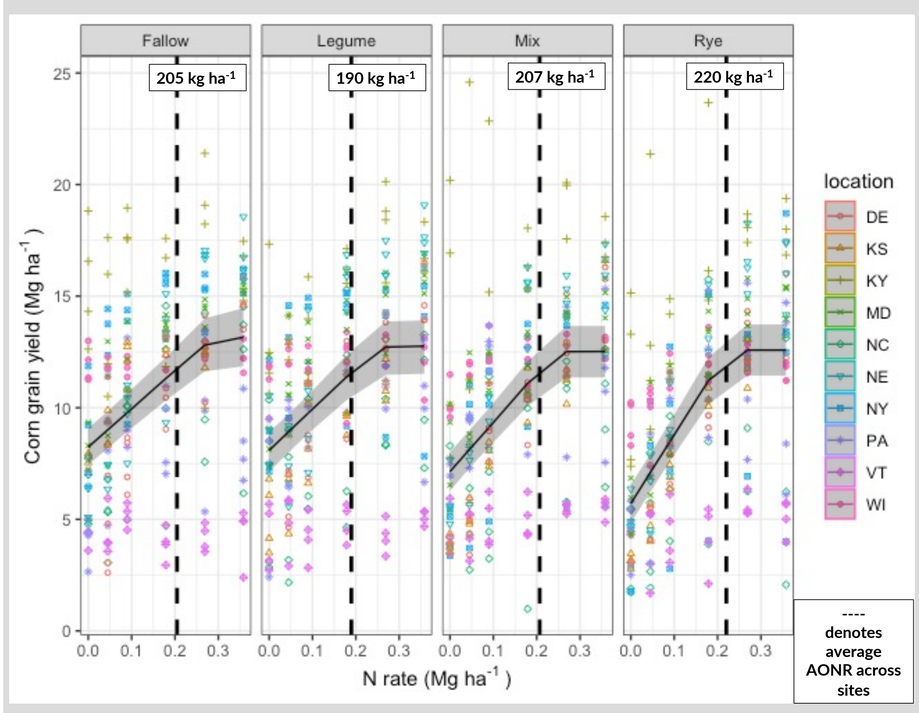


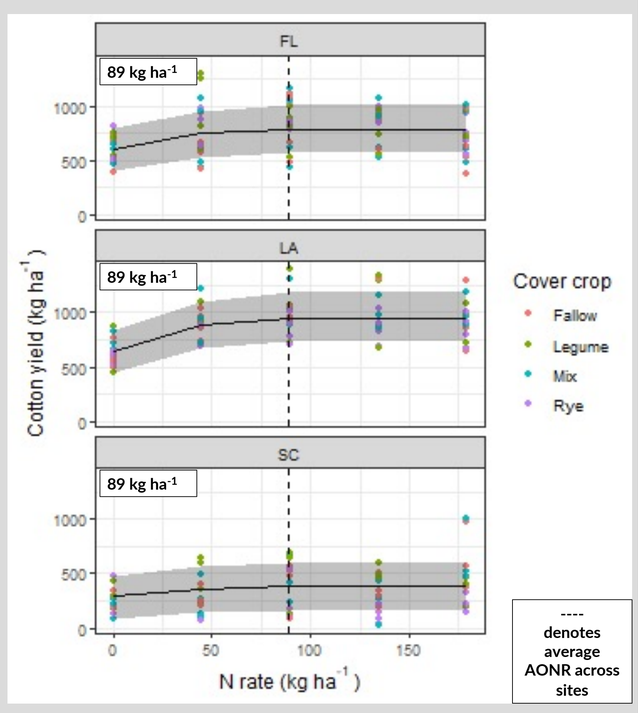
Methods

- Four winter cover crop treatments were included at all sites: fallow, cereal rye, a legume (crimson clover, *Trifolium incarnatum* L. (southern states), or hairy vetch, *Vicia villosa* Roth (north states), and a mixture of cereal rye and a legume.
- The winter cover crops were established from mid August to mid October of 2020, at a seeding rate of 67.2 and 28 kg ha^{-1} of cereal rye and legume in monoculture, and 33.6 and 22.4 kg ha^{-1} of cereal rye and legume in mixture, following small grain or corn silage harvest.
- The cover crops were chemically terminated from mid April to mid May, prior to corn (*Zea mays* L.) or cotton (*Gossypium hirsutum* L.) planting.
- The shoot biomass of each species was collected just before the cover crops termination, in the spring. The samples were dry and weighted.
- The corn was planted on May, and the cotton from end April to mid May. Nitrogen fertilizer was split applied, 44.8 kg N ha^{-1} at corn planting and 22.4 kg N ha^{-1} at cotton planting, and the remaining at V5 stage of corn and before first flowering in cotton (~60 days after planting), with no N applied for the zero N rate.

Results

- Following the legume cover crop treatment, corn had the lowest AONR, ranging from 77 to 296 kg N ha^{-1}, averaging 190 kg N ha^{-1}. When following cereal rye, corn had a higher AONR value across all states, ranging from 107 to 327 kg N ha^{-1}, and averaging 220 kg N ha^{-1}.
- Per 1 kg of N, corn following cereal rye produced 35.6 kg of corn grain, and the control (fallow) produced 28.7 kg of corn.
- The AONR for cotton was not affected by cover crop treatment, averaging of 89 kg N ha^{-1}.





Ongoing work

- We will continue investigating location variability for site specific recommendations.
- This research will continue across all sites for more two years, in order to improve the model confidence.

Tauana F. Almeida, Lucas P. Canisares, Hanna Poffenbarger, Gustavo Pesini, Resham Thapa, Steven Mirsky, Rongzhong Ye, Pratima Poudel, Michael J. Mulvaney, Yogendra Upadhyaya, Pratap Devkota, Christopher J. Pelzer, Matthew R. Ryan, Peter J. Tomlinson, DeAnn R. Presley, Kraig L. Roozeboom, Alexis Correa, Amir Sadeghpour, Gulsin Sener, Casey Kula, Matthew D. Ruark, Ashley Waggoner, John M. Wallace, Jared Adam, Jarrod Miller, Alex Woodley, Lisa M. Fultz, Pedro Carrillo, Heather M. Darby, Lindsey Ruhl, Shalamar D. Armstrong, Asmita Gautam, Andrea Basche.

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