

Alternative Cover Crops to Cereal Rye

In a Nutshell:

- Most field crops farmers in the Upper Midwest who use cover crops use winter cereal rye. However, there are other grain and non-grain species that could potentially be used as cover crops.
- A group of PFI farmers decided to trial alternative cover crop species to cereal rye in the 2024-2025 season.
- Farmers were each motivated to conduct the trial for different reasons. Some wondered if an alternative to rye might compete less with following cash crops or harbor less disease. Others were looking for alternative forage sources or covers that could be more easily seeded via drone.

Key Findings:

- Five farmers trialed fall-planted cover crops of their choice including winter barley, triticale, winter wheat, triticale and a mix of rapeseed, turnip, kale and cameline. They compared survival and biomass production to cereal rye.
- Tim Shellabarger was the only farmer whose alternative cover, winter wheat, successfully overwintered. It grew significantly less biomass than cereal rye, but Shellabarger thinks it would grow more if he planted it earlier in the fall.
- After their alternative cover crops winter killed, Tracy Skaar and Josh Hiemstra each conducted trials on how cover crop vs. no cover crop treatments affected their cash crop yield. They found that cereal rye cover crop modestly decreased their yield.

BACKGROUND

Most field crops farmers in the Upper Midwest who use cover crops use winter cereal rye. Cereal rye reliably establishes after late fall planting and overwinters well throughout the upper Midwest. Depending on planting and termination timing, cereal rye can produce adequate biomass to decrease nitrate runoff, prevent erosion and even suppress weeds [1], [2]. Despite cereal rye's reliability, some farmers are interested in alternative cover crops, especially before corn. One primary reason is that farmers and researchers have observed that corn yields can sometimes decrease a bit when corn follows a cereal rye cover crop, especially when planting green [3], [4], [5]. Proper cover crop management, including terminating the cover crop 10-14 days before planting, can minimize yield effects, but in most cases that means terminating the cereal rye before it has amassed enough biomass to suppress weeds.

There are many grain and non-grain species that could potentially be used as alternative cover crops before corn. To assess these potential alternatives, farmers need to determine whether they can successfully establish the species as a cover crop after corn or soybean harvest, whether it overwinters, and whether it produces significant biomass. To these ends, five PFI farmers decided to plant replicated strip trials comparing a rye and non-rye cover crop in fall of 2024.



Winter wheat (left) and cereal rye (right) heights at Tim Shellabarger's on Nov. 24, 2024.

Cooperators

Braxton Clubb – Vinton, IA
Josh Hiemstra – Brandon, WI
Joe Rowe – Manly, IA
Tim Shellabarger – Blue Grass, IA
Tracy Skaar – Hayward, MN

The farmers had diverse reasons for participating in the trial. Josh Hiemstra, Tim Shellabarger and Tracy Skaar are all interested in growing alternative cover crops before corn. As Skaar said, they wanted “to see if cover crops other than rye provide less competition.” Additionally, Shellabarger has been looking for different combinations of cover crops and cash crops that fit well in his rotation to add some diversity to his farm. Braxton Clubb often grazes his cattle on cover crops and was interested in rye alternatives for quality cattle feed. And Joe Rowe’s main goal was to “find cover crops that are viable for aerial seeding - specifically drone seeding.”

METHODS

Design

In fall 2024, cooperators planted four replicates of each of their rye and non-rye cover crop treatments in randomized, paired strips (**Figure A1**). Species trialed and planting and management details on each farm are presented in **Table 1**.

After their alternative cover crops winter-killed, Hiemstra and Skaar each continued their trial as a rye cover crop vs. no-cover trial and assessed cereal rye’s impacts on their corn and soybean yield, respectively. Hiemstra terminated his cover crop on May 6, 2025, using vertical tillage and planted his corn on June 7, 2025, into tilled ground on 30-in. rows. He harvested on Oct. 16. Tracy no-till planted his soybeans in 30-in. rows on May 13, 2025, and terminated his cover crop with his first weed management pass of Enlist/Roundup on June 1. He followed with another weed management treatment of Liberty on July 3.

Measurements

Rowe took stand counts of his established cover crops by measuring the number of cover crop plants in two 5.25 ft² areas in each replicate. Hiemstra, Rowe and Shellabarger similarly measured cover crop biomass production by cutting biomass at the ground surface from 2 locations of known area per replicate, drying the biomass, and weighing it. They collected biomass from any surviving cover crop just before spring termination. Skaar and Hiemstra each harvested corn from each of their rye cover and no-cover strips and reported crop yields and grain moisture content for each strip.

Data Analysis

We used an ANOVA (Analysis of Variance) at a 95% confidence level to determine if there were significant differences in cover crop biomass between rye and non-rye treatments or corn yield between rye and no cover-crop treatments. This means that any treatments we declare statistically different would be expected to occur 95 times out of 100 under the same conditions. We can perform this analysis because the cooperators had completely randomized and replicated experimental designs (**Figure A1**).

TABLE 1: Trial management details and cover crop survival at the five participating farms in 2024-2025.					
	CLUBB	HIEMSTRA	ROWE	SHELLABARGER	SKAAR
Species and varieties trialed	Winter cereal rye (VNS), winter wheat (Pioneer) and triticale (Pioneer and Cropland)	Winter cereal rye (VNS) and hairy vetch	Winter cereal rye (VNS), mix of rapeseed, turnip, kale and camelina	Winter cereal rye, winter wheat	Winter cereal rye, winter barley
Previous crop	Alfalfa	Soybean	Corn and soybean, split field	Soybean	Corn
Seeding date and method	Oct. 15, 2024, Oct. 30, 2024 (drilled)	Oct. 9, 2024, drilled	Sept. 15, drone seeded rye and mix	Oct. 26, 2024, drilled	Oct. 24, 2024, drilled
Seeding rate	80 lb/ac	50 lb/ac (rye) 20 lb/ac (vetch)	55 lb/ac (rye), 4 lb/ac (mix)	75 lb/ac	80 lb/ac (rye), 100 lb/ac (barley)
Survival	Only rye	Only rye	Only rye	Both species survived	Only rye
Stand count date (s)	NA	NA	Nov. 3, 2024	NA	NA
Biomass sampling date(s)	NA	May 6, 2025	May 18, 2025	April 12, 2025	NA



Winter barley winterkilled on Tracy Skaar's southern MN farm, but winter cereal rye cover crop was green and growing in April 2025 (left). Skaar then conducted a rye cover vs. no cover trial and by July 3, he noticed significantly more weeds in his no-cover strips (right photo, center) than his cover strips.

RESULTS AND DISCUSSION

Shellabarger was the only participant whose alternative to rye cover crop overwintered successfully and produced significant biomass. He found that his winter wheat germinated and grew well but only produced about half the biomass as his cereal rye before he terminated it on May 18 (**Figure 1**). He plans to try the trial again with an earlier planting date and thinks that the wheat growth will improve with more establishment time before winter.

In contrast, Clubb, Hiemstra and Skaar all had nearly 100% winter kill of their alternative species (triticale and winter barley, hairy vetch, and winter barley, respectively). Clubb thinks that his other species would have survived if he planted them earlier but also does not know if earlier planting is feasible in his rotation. Hiemstra noted that while he planted the vetch early enough, it took a while to germinate and probably was planted too deep. Alternative cover crops to rye that must be planted earlier than rye to ensure germination and to survive the winter might not be a good fit for farmers with busy harvest schedules or for those who do not want to take a risk with an unsuccessful cover crop.

Rowe's mix also mostly winter killed but that was expected given the species in the mix (**Table 1**). He was more disappointed that he did not see much germination or growth from the mix going into the winter, meaning the diverse plants did not provide much agronomic or environmental benefit. On his Nov. 3, 2024 plant count, he counted on average only 0.4 plants/ft² in his mix compared to 1.6 plants/ft² in his rye plots. On May 18, 2025, he found that the surviving camelina did not have enough biomass to cut for biomass measurements, compared to 0.2 tons/acre of biomass in his drone-applied rye treatment.

After their alternative cover crops winter killed, Hiemstra and Skaar pivoted to a cereal rye cover crop vs. no cover crop trial. They found that the cover crop significantly decreased their corn and soybean yields, respectively (**Figure 2**). Hiemstra reports that he believes that covers will positively impact his farm economics in the long term. "I will sacrifice a little yield knowing that when considering soil health and crop quality and health there is still ROI with rye ahead of corn." In the future, he will increase his N rate a little bit in corn following rye, especially in cold or wet springs. Similarly, Skaar was not discouraged to see a little yield decrease in his cover cropped fields. "Prior trials I have done would suggest that I waited too long to terminate the rye in this trial, which reduced the yield. However, weed pressure was definitely reduced where rye cover crop was used."

Tim Shellabarger finds that winter wheat yields about half as much biomass as cereal rye as a cover crop

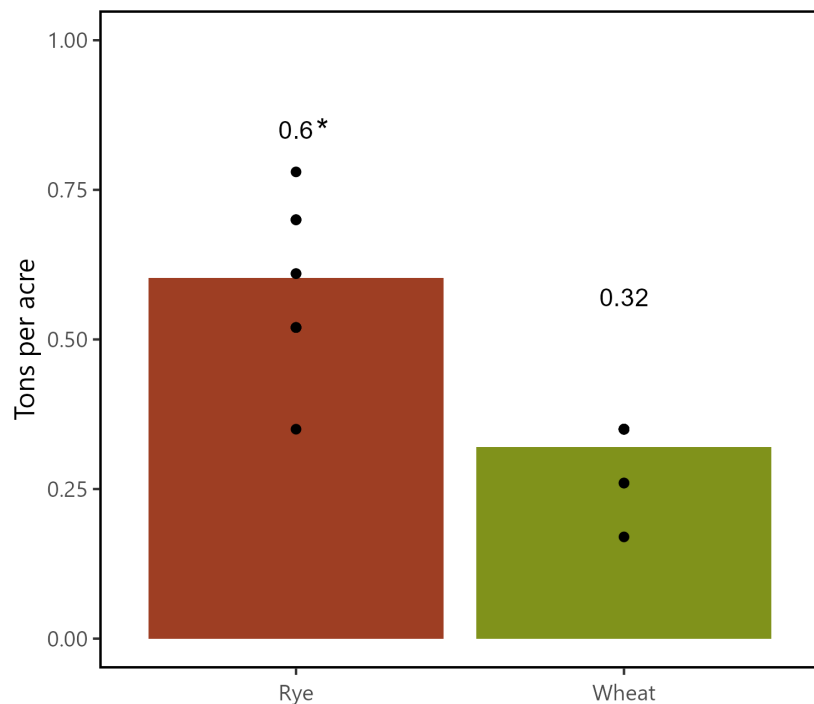
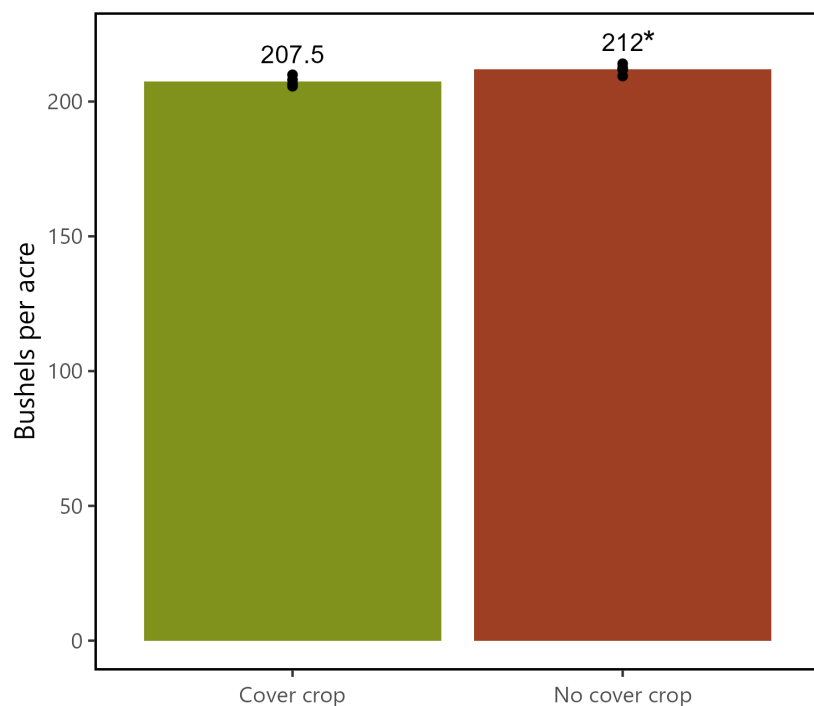


FIGURE 1. Cover crop biomass at Tim Shellabarger's before cover crop termination on April 12, 2025. Columns represent the average cover crop biomass for each treatment. Points represent biomass from each individual plot. Asterisk (*) indicates cereal produced statistically greater biomass than winter wheat at the 95% confidence level.



The triticale and winter wheat that Braxton Clubb drilled in small plots winter killed while the surrounding cereal rye successful came through the winter. Photo taken May 2025.

Josh Hiemstra finds that corn after rye cover crop yielded lower than corn after no cover crop



Tracy Skaar finds that soybeans after rye cover crop yielded less than soybeans after no cover crop

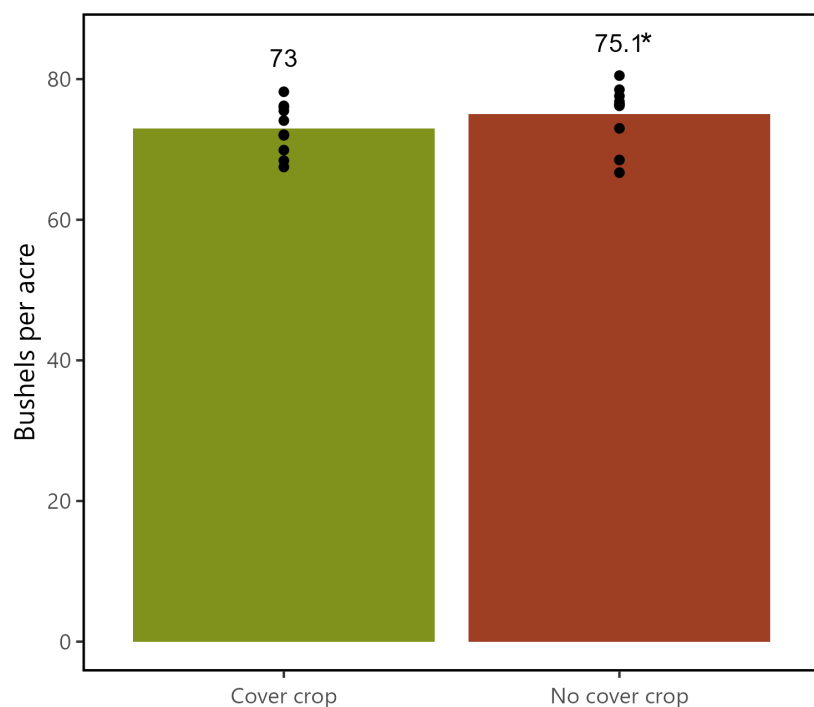


FIGURE 2. Corn yields at Josh Hiemstra's (top) and soybean yields at Tracy Skaar's (bottom) in their cover crop vs. no cover crop trials. Columns represent the average crop yield for each treatment. Points represent yields from each individual plot. Asterisk (*) indicates that plots without cover crop yielded significantly higher at the 95% confidence level.

CONCLUSIONS AND NEXT STEPS

After this initial trial, some participating farmers think that they will just stick with growing winter rye as a cover crop. Others, however, are willing to try again. Shellabarger and Clubb are conducting follow-up trials in the 2025-2026 growing season and plan to assess cover crop impact on corn yield. With increasing interest in growing a cover crop before corn, PFI farmers will likely continue to experiment with non-rye cover crops that may improve their soil without affecting corn yield.



Josh Hiemstra noted that from early-to-mid vegetative stages, his corn plants in his no-cover strips (left) were visually bigger than his corn plants in his rye cover cropped strips. Photo taken June 11, 2025.

APPENDIX – TRIAL DESIGN AND WEATHER CONDITIONS

Rye	Non-Rye	Non-Rye	Rye	Non-Rye	Rye	Rye	Non-Rye
Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
REP 1		REP 2		REP 3		REP 4	

FIGURE A1. Example experimental design used by Clubb, Hiemstra, Rowe, Skaar and Shellabarger.

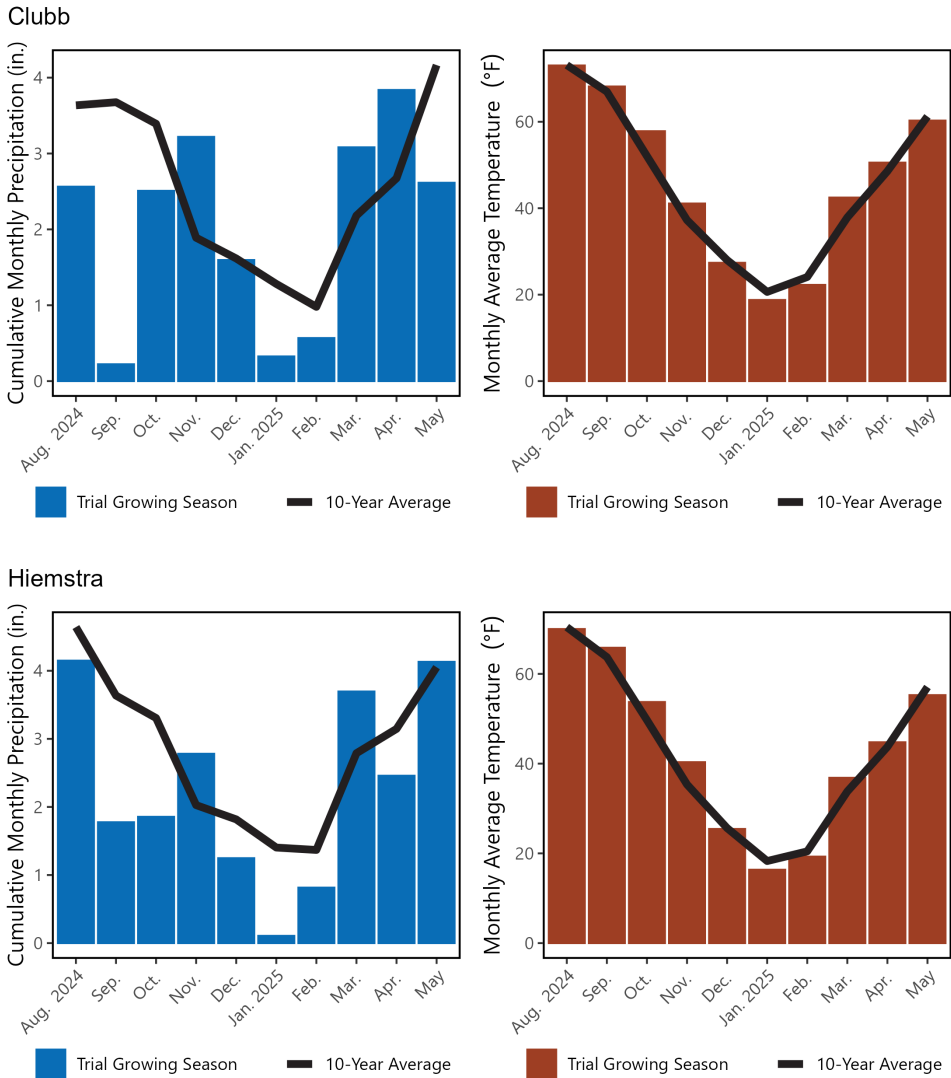
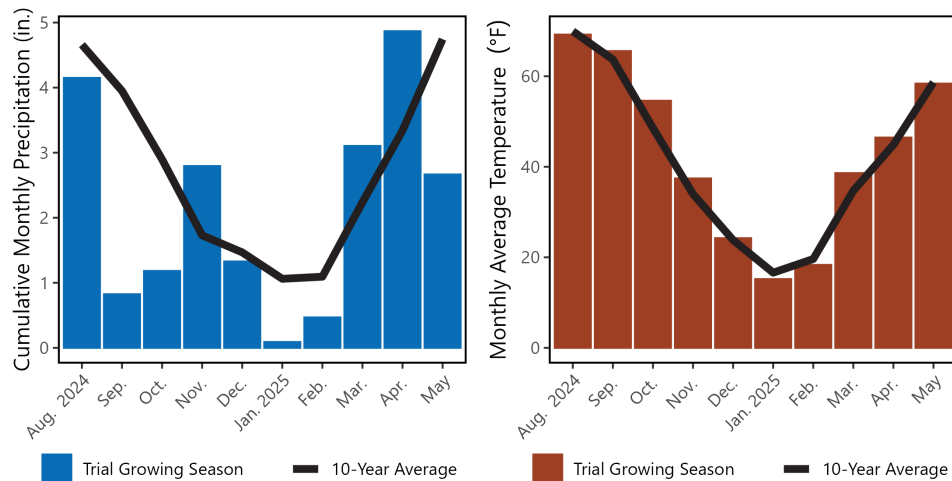
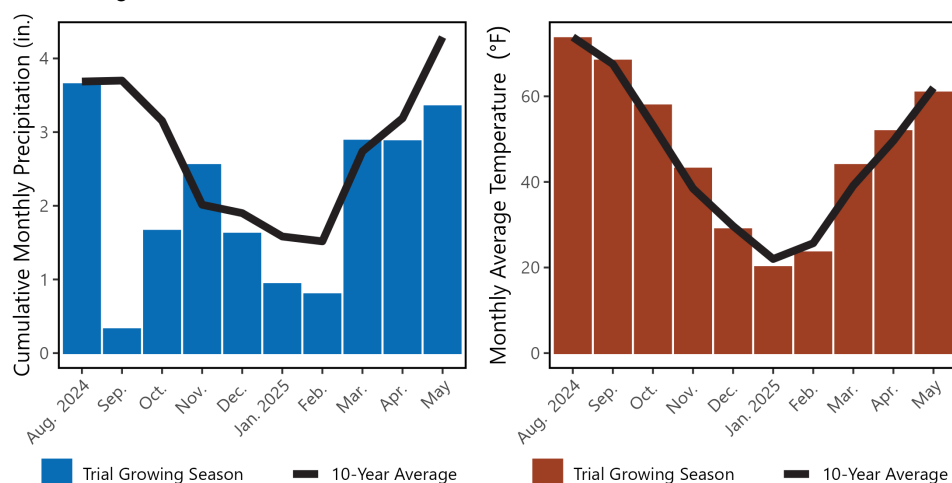


FIGURE A2. Modelled mean monthly temperature and rainfall at each trial site during the study period and the ten-year historic averages. Data is from the NasaPOWER climate dataset. [6], [7]

Rowe



Shellabarger



Skaar

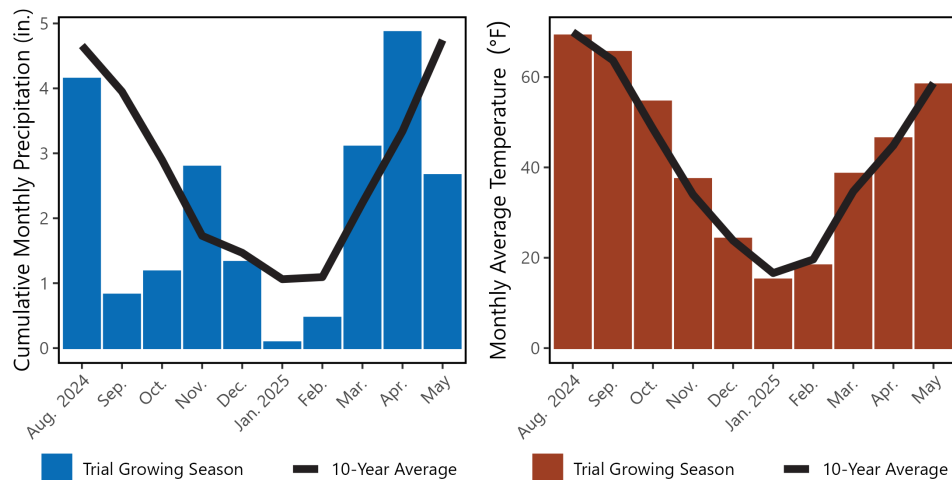


FIGURE A2. Modelled mean monthly temperature and rainfall at each trial site during the study period and the ten-year historic averages. Data is from the NasaPOWER climate dataset. [6], [7]

REFERENCES

1. V. Nichols, R. Martinez-Feria, D. Weisberger, S. Carlson, B. Basso, and A. Basche, "Cover crops and weed suppression in the U.S. Midwest: A meta-analysis and modeling study," *Agric. Environ. Lett.*, vol. 5, no. 1, p. e20022, 2020, doi: 10.1002/acl2.20022.
2. D. Elmquist *et al.*, "Biomass Thresholds for Cereal Rye Cover Crop Goals," *Crops and Soils*. Accessed: Jul. 13, 2026. [Online]. Available: <https://cropsandsoils.extension.wisc.edu/articles/biomass-thresholds-for-cereal-rye-cover-crop-goals/>
3. S. Gailans, "Winter Cereal Rye Cover Crop Effect of Cash Crop Yield - Year 10 - Practical Farmers of Iowa," PFI, 2019. Accessed: Jul. 14, 2026. [Online]. Available: <https://practicalfarmers.org/resources/research-reports/winter-cereal-rye-cover-crop-effect-of-cash-crop-yield-year-10/>
4. S. Gailans, "Effect of Planting Green on Corn Seedling Disease, Stalk Rot and Yield – Year 2 - Practical Farmers of Iowa," PFI, 2022. Accessed: Jul. 14, 2026. [Online]. Available: <https://practicalfarmers.org/resources/research-reports/effect-of-planting-green-on-corn-seedling-disease-stalk-rot-and-yield-year-2/>
5. "Reducing the Risk of Corn Seedling Disease, Yield Loss After Cereal Rye Cover Crop," *Integrated Crop Management*. Accessed: Jul. 13, 2026. [Online]. Available: <https://crops.extension.iastate.edu/cropnews/2016/12/reducing-risk-corn-seedling-disease-yield-loss-after-cereal-rye-cover-crop>
6. A. Sparks, *_nasapower: NASA-POWER Data from R_*. (2024). [Online]. Available: <https://CRAN.R-project.org/package=nasapower>
7. A. H. Sparks, "nasapower: A NASA POWER Global Meteorology, Surface Solar Energy and Climatology Data Client for R," *J. Open Source Softw.*, vol. 3, no. 30, p. 1035, Oct. 2018, doi: 10.21105/joss.01035.



PFI COOPERATORS' PROGRAM

PFI's Cooperators' Program helps farmers find practical answers and make informed decisions through on-farm research projects.

The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs.

If you are interested in conducting an on-farm trial contact Stefan Gailans @ 515-232-5661 or stefan@practicalfarmers.org.