PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM Farmer-Led Research

EXPERIMENT

2024

Soybean Maturities in Delayed Termination Rye

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Cooperators

Tracy Skaar; Hayward, MN

Funding

Cargill

In a Nutshell:

- It is increasingly common for farmers to no-till plant their soybeans into a living cereal rye cover crop and terminate the rye at a later date. Dubbed "planting green", this practice allows for maximum weed suppression and soil protection from cover crops but can impact yields, especially when rye termination is delayed by more than a week or two after planting.
- This was the second year that PFI farmers have established a trial to investigate whether using later maturity soybeans when planting green can offset soybean yield decline caused by delayed rye termination.

Key Findings:

- Despite a very wet spring and early summer that kept many farmers from participating in termination timing trials, Tracy Skaar was able to establish his rye termination treatments at two days (Near-Plant) and fifteen days (Delayed) after planting. He planted soybeans that were 0.8 maturity groups different from each other.
- Skaar found that his Late RM + Near-Plant treatment yielded higher than all three other treatments (Late RM + Delayed, Early RM + Near-Plant and Early RM + Delayed).
- Early RM + Near-Plant soybeans yielded similarly to Late RM + Delayed soybeans, and both yielded higher than the Early RM + Delayed treatment. This suggests that using a later relative maturity soybean may have prevented some of the yield decline caused by delayed rye termination.

BACKGROUND

Planting green is a practice in which farmers plant soybeans into a living cereal rye cover crop and terminate the rye at a later date. While planting green offers increased soil and weed protection by maximizing cover crop growth, it can be associated with a soybean yield decline, especially if rye termination is delayed until several weeks or more after soybean planting [1], [2], [3]. In 2023, six farmers investigated whether planting later maturing soybeans reduced soybean yield decline when planting green and delaying rye termination by more than two weeks. They each established four treatments consisting of pairs of Early/Late RM (relative maturity) soybeans planted green into cereal rye that was then terminated Near-Plant/Delayed. Cooperators, including Tracy Skaar, concluded that later maturity soybeans did not generally offset yield decline [1].

This year, Skaar decided to repeat his trial, again exploring the effect of soybean relative maturity (Early/Late RM) and cereal rye cover crop termination timing (Near-Plant/Delayed) on soybean yield when planting green. In addition to measuring yields and seeing if his 2023 results hold true upon repetition, Skaar was very interested in observing "weed control efficacy of early vs. late terminated rye."

Tracy Skaar terminating rye in his late termination treatment. Dead rye from the earlier termination treatment is visible. Photo taken May 30, 2024.

METHODS

Design

Skaar no-till drilled two varieties of soybeans, one early maturing variety (Early RM) and one later-maturing variety (Late RM), into standing cereal rye. He chose varieties for their trials based on their location and typical practices and planted both varieties on the same day (**Table 1**). He then subjected both maturities of soybean to the following rye termination treatments:

TABLE 1. Trial management at Tracy Skaar's soybean maturities and termination timing trial in 2024.

Previous crop	Corn
Early maturity soybean	1.5 maturity
Late maturity soybean	2.3 maturity
Soybean planting	May 15, 2024
Near-plant cover crop termination	May 17, 2024 Liberty
Delayed cover crop termination	May 30, 2024 Liberty
Weed management	June 14, 2024 Roundup, Moccasin, clethodim 2EC July 16, 2024 Enlist
Harvest date	Oct. 4, 2024

1) **Near-plant:** Cover crop termination two days after planting.
2) **Delayed:** Cover crop termination 15 days after soybean planting.

Thus, there were a total of four treatments: Early RM + Near-Plant Termination, Early RM + Delayed Termination, Late RM + Near-Plant Termination, and Late RM + Delayed Termination. Skaar randomly assigned four replications of each treatment across his fields for a total of 16 strips (**Figure A1**). Field management for the trial is detailed in **Table 1**.

Measurements

Skaar harvested soybeans from each strip and recorded yields and percent moisture. Yields were adjusted to 13% moisture.

Data analysis

We evaluated the effects of the soybean relative maturity and termination timing on soybean yield using an Analysis of Variance Test (ANOVA) with each combination of soybean relative maturity and termination timing considered a separate treatment. Because the ANOVA indicated that there were differences between treatments, we then calculated the Tukey's Honest Significant Difference (HSD) at 95% confidence level to determine which treatments varied from each other. If the difference between the means of two treatments is greater than the HSD, we consider the two yields significantly different. 95% confidence means that we expect the same results to occur 95 times out of 100 if the trial were repeated under the same conditions. We could make these statistical calculations because Skaar's experimental design included four replicates of each treatment assigned in a randomized block design across the field (**Figure A1**).

Tracy Skaar's soybean maturity and cover crop termination trial at harvest. Skaar noted that there was no discernable difference in weediness between termination timing treatments at this point in the season, but weediness was overall much lower than it is when he does not plant green on his farm. Photo taken Oct. 4, 2024.

RESULTS AND DISCUSSION

Skaar found that his Late RM + Near-Plant Termination soybeans yielded significantly higher than his other three treatments (**Figure 1**). This is a similar result to what he found on his farm last year, when his both of his Near-Plant Termination treatments yielded significantly better than his Delayed Termination treatments [4]. In 2023, he terminated his rye in the Near-Plant treatments three days after planting and in the Delayed treatments 19 days after planting, a comparable timeframe to the two and 15 days he waited this year (**Table 1**). Between all six cooperators who participated in the trial last year, three found that Near-Plant termination consistently outyielded Delayed termination, though the yield difference between termination timings at Skaar's farm was the most pronounced.

Skaar thinks that his results from both this year and last year suggest that he should terminate his cover crop fairly quickly after planting his soybeans whenever possible. He reports that "I didn't think there would be as big a yield difference on a wet year like 2024." Increased competition for light, nutrients and water are the main reasons that soybean yield decreases when cover crop termination is delayed, and Skaar's results in a wet year show that a greater supply of one of these resources may not fix the whole issue contributing to yield decline.

Skaar was also interested in observing whether he saw increased weed suppression in his delayed termination treatment. Though he did not quantitatively assess weed coverage this year, he noted that at harvest, he saw no difference in weediness between Near-Plant and Delayed treatments.

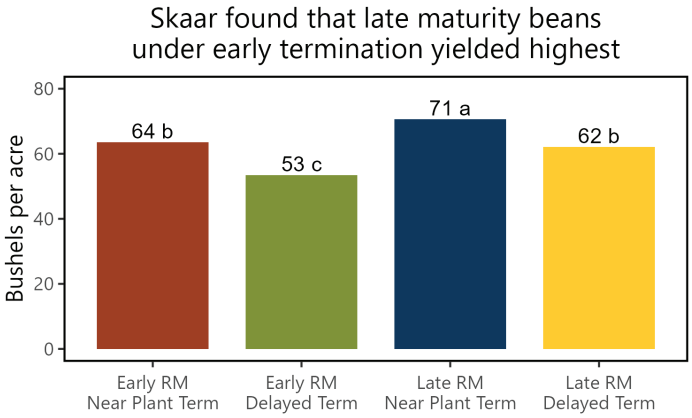

FIGURE 1. Average yields of each of Tracy Skaar's soybean maturity and termination timing treatments in 2024. Different letters above bars indicate significantly different yields at the 95% confidence level. We determined statistical differences using the honest significant difference (HSD = 4 bu/ac).

CONCLUSIONS AND NEXT STEPS

After conducting this second trial showing that delaying rye termination by more than two weeks significantly decreases soybean yield, Skaar concluded that "I will be terminating cover crop earlier [in the future]." PFI cooperators will surely continue experimenting with termination timing when planting green to try to maximize cover crop benefits while minimizing potential for yield decline.

APPENDIX — TRIAL DESIGN AND WEATHER CONDITIONS

Early Bean Near-Plant Term	Early Bean Delayed Term	Late Bean Delayed Term	Late Bean Near-Plant Term	Late Bean Delayed Term	Late Bean Near-Plant Term	Early Bean Near-Plant Term	Early Bean Delayed Term	Late Bean Delayed Term	Early Bean Delayed Term	Late Bean Near-Plant Term	Early Bean Near-Plant Term	Early Bean Near-Plant Term	Late Bean Near-Plant Term	Late Bean Delayed Term	Early Bean Delayed Term
REP 1				REP 2				REP 3				REP 4			

FIGURE A1. Example of Skaar's experimental design, with four replicates of each of his four treatments assigned randomly within four blocks across his field.

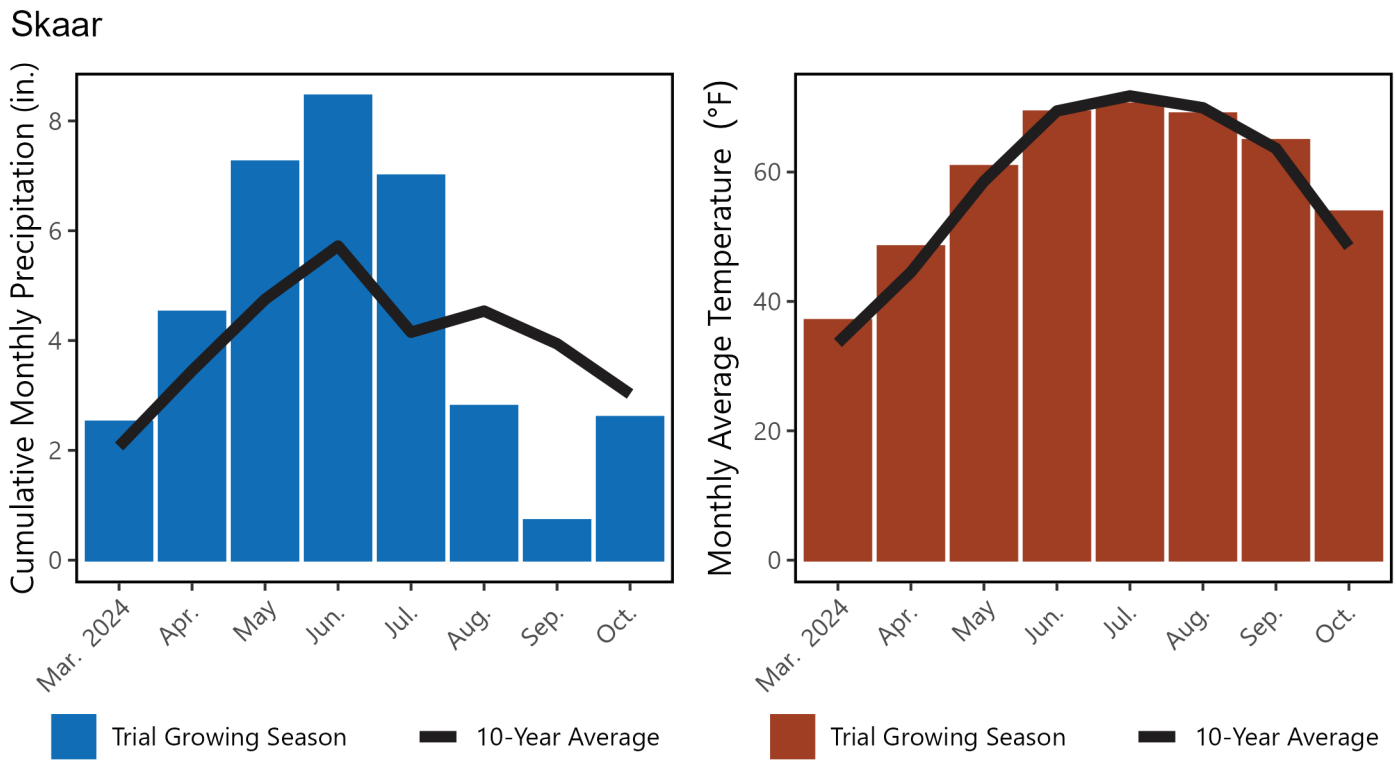

FIGURE A2. Monthly precipitation accumulation (left) and mean temperature (right) at Hayward, MN. [5], [6]

REFERENCES

[1] S. Gailans, S. Bennett, T. Sieren, and J. Bakehouse, "Terminating Cereal Rye After Planting Soybeans," Practical Farmers of Iowa, 2019. [Online]. Available: https://practicalfarmers.org/wp-content/uploads/2020/04/FINAL_Terminating-Cereal-Rye-After-Planting-Soybean.pdf

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