MIZZOU ON FARM

MU STRIP TRIALS

2024 REPORT

THANK YOU FROM THE 2024 MU EXTENSION STRIP TRIALS TEAM

John Lory, Associate Professor & State Extension Nutrient Management Specialist
Mandy Bish, Assistant Professor & State Field Crop Pathology Specialist
Justin Calhoun, Assistant Professor & State Soil and Cropping Systems Specialist
Kent Shannon, Assistant Professor & Agriculture Engineering Specialist
Anthony Ohmes, Agronomy Field Specialist
Charles Ellis, Agriculture Engineering Field Specialist
Nick Wesslak, Agronomy Field Specialist
Rusty Lee, Agronomy Field Specialist
Wayne Flanary, Agronomy Field Specialist
Hunter Lovewell, Agronomy Field Specialist
David Kleinsorge, Research Specialist
Krystal Kimmel, GIS Specialist II
Brian Berwanger, Research Specialist
Jared Fogue, Media Producer II

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MISSOURI SOYBEANS

MIZZOU ON-FARM RESEARCH includes University of Missouri certified strip trials, which are conducted on Missouri fields to address crop production questions. This research is made possible by partnerships among Missouri farmers, MU Extension, MU Division of Plant Science & Technology, Missouri Soybean Merchandising Council, Missouri Corn Growers Association, the Missouri Fertilizer Control Board, and a North Central SARE grant.

THIS REPORT INCLUDES RESULTS FROM:

Contact your local MU Extension Office and request to speak with the Agronomy Field Specialist for the most up-to-date list of strip trial options.

If you have questions or feedback on the 2024 Mizzou On-Farm Report, please e-mail ***ipm@missouri.edu.***

PLANTING SOYBEAN "INTO THE GREEN"

This report summarizes 17 trials where soybean was planted into a green cover crop.

OBJECTIVE

High biomass from cover crops benefits soil health.

Additionally, sometimes farmers have trouble terminating when planned earlier in the season.

Does planting soybean "into the green" affect soybean yield?

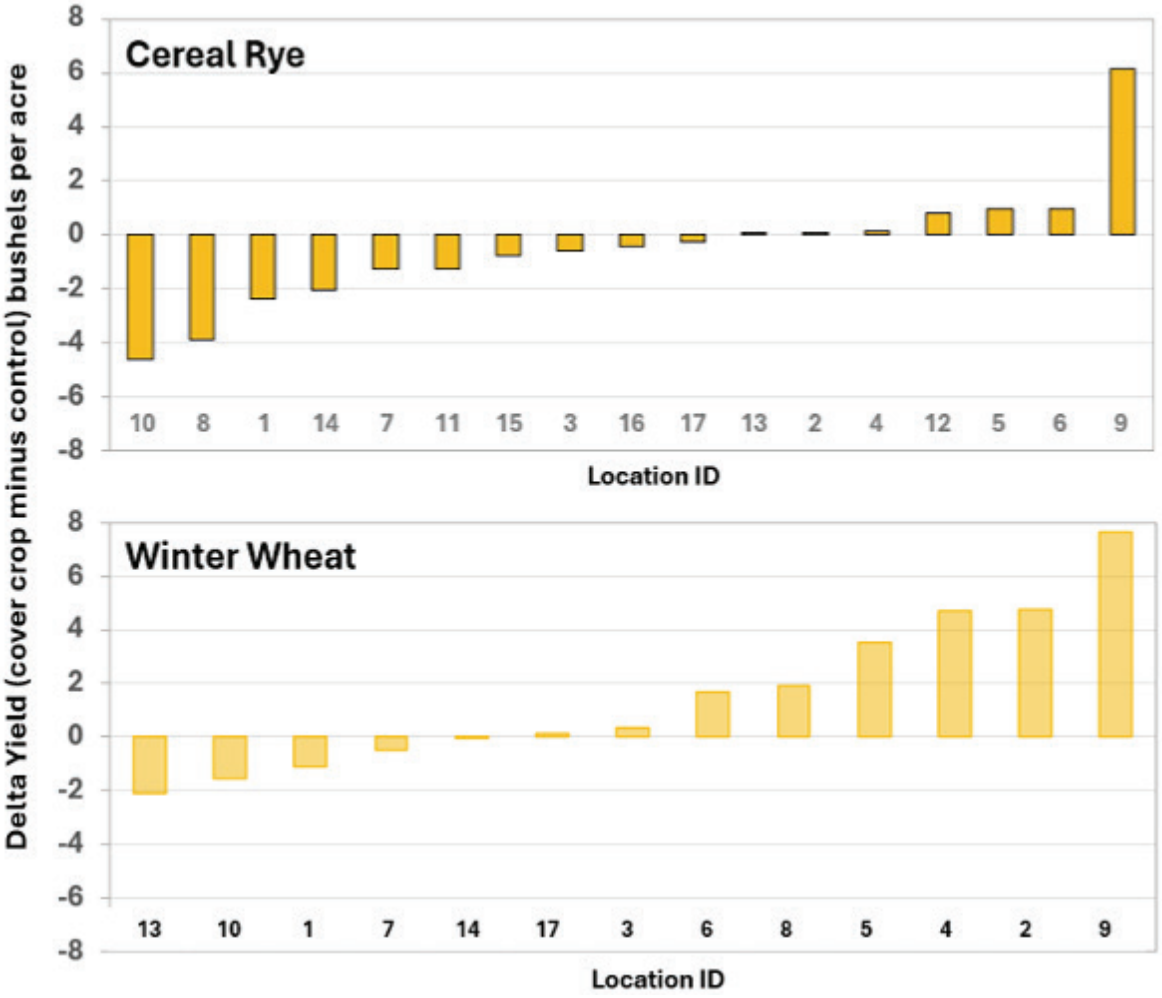
STUDY DESIGN

- Farmers planted cover crop strips typically by drilling after corn harvest. Treatments were cereal rye, winter wheat, and a no-cover control.
- There were 17 trials between 2016 and 2023, but the winter wheat treatment was only included in 13 of them.
- Minimum of three replicates.
- Most farmers terminated their cover crop within two days after planting.
- Test compared soybean yield in strips with cover crop to the no-cover control based on the farmer's yield map.
- All decisions on cover- and grain-crop management were made by the farmer and implemented using their equipment.

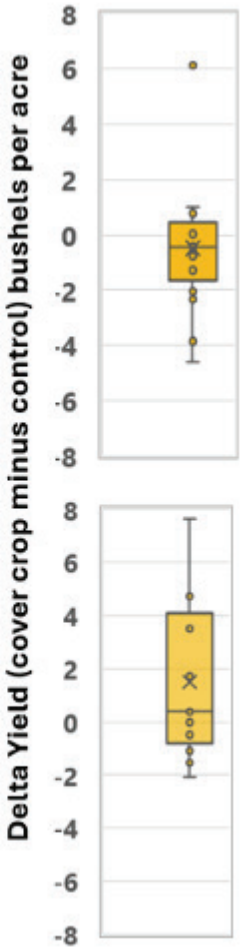
Selected details of 17 cover crop trials.

ID	County	Site	Year	Years in CC	Soybean planting date	CC Termination Date	Termination, days after planting	Cereal Rye Delta Yield (B/A)	Winter Wheat Delta Yield (B/A)	Notes
1	Cooper	1605	2016	0	5/11/16	5/11/16	0	-4.0	-1.1	CC headed
2	Holt	1804	2018	3	4/29/18	5/18/18	19	4.9	5.9	
3	Dade	1906	2019	2	7/2/19	7/2/19	0	1.0	3.2	
4	Lincoln	1907	2019	3	6/10/19	6/10/16	0	2.1	4.7	
5	Lincoln	C001	2019	4	5/17/19	5/17/19	0	1.9	3.9	
6	Lincoln	C002	2019	4	5/17/19	5/17/19	0	7.1	4.0	
7	Lincoln	C001	2021	6	5/14/21	5/21/21	7	-3.4	-1.0	Voles
8	Lincoln	C002	2021	6	5/14/21	5/21/21	7	-0.3	4.3	Voles
9	Scotland	C004	2021	6	4/27/21	4/30/21	3	10.7	6.4	CC boot
10	Scotland	C005	2021	6	4/27/21	4/30/21	3	-5.2	-0.4	CC boot
11	Lincoln	C101	2021	1	5/23/21	5/24/23	1	-3.3	-	Voles
12	Lincoln	C102	2021	1	6/7/21	6/8/21	1	3.0	-	
13	Lincoln	C001	2023	8	4/26/23	4/26/23	0	-2.2	-2.6	CC headed
14	Lincoln	C002	2023	8	4/26/23	4/26/23	0	-1.1	0.4	CC headed
15	Lincoln	C101	2023	3	4/26/23	4/26/23	0	-2.0	-	CC headed
16	Shelby	C010	2023	8	4/29/23	4/27/23	-2	-1.1	-	
17	Boone	C004	2023	7	-	-	0	-0.3	-0.2	

Thank you to the innovative farmers who introduced us to this management strategy and made this report possible.



Location mean differences for soybean ordered with maximum yield penalty to the left.



Box plots of location mean differences.

RESULTS

- Missouri farmers planting soybean into a green winter wheat cover crop had a 90% probability of increasing soybean yield 0.3 to 2.0 B/A.
- Risk of yield loss is greater with cereal rye. Odds of loosing more than 1 B/A are about 10% with the mean loss across all farms at -0.5 B/A.
- For cereal rye, 60% of the locations had less than a one-bushel/acre impact on soybean yield (either plus or minus).
- Winter wheat resulted in over 60% of the tests having no impact or a positive impact on yield.
- Years in cover crop and days after corn planting until cover crop termination had no impact on soybean yield.

Cover Crop	N	Mean	90% credible interval
		Soybean Yield (bushels per acre)	
Cereal Rye	17	-0.5	-1.3 to 0.3
Winter Wheat	13	+1.3	0.3 to 2.0

SUMMARY

- Planting into a green winter wheat cover shows potential to benefit soybean yield.
- Some farmers will see more negative outcomes, particularly with cereal rye.

FULL REPORT AVAILABLE AT:

https://extension.missouri.edu/programs/strip-trial-program/strip-trials

Contact "MU Certified" strip trial program if you want to test planting into

Funded by Missouri Soybean Merchandising Council Project and Missouri Corn Growers and their checkoff

COVER CROPS BEFORE CORN

No cover crop treatment reliably had no effect or a positive effect on corn yield.

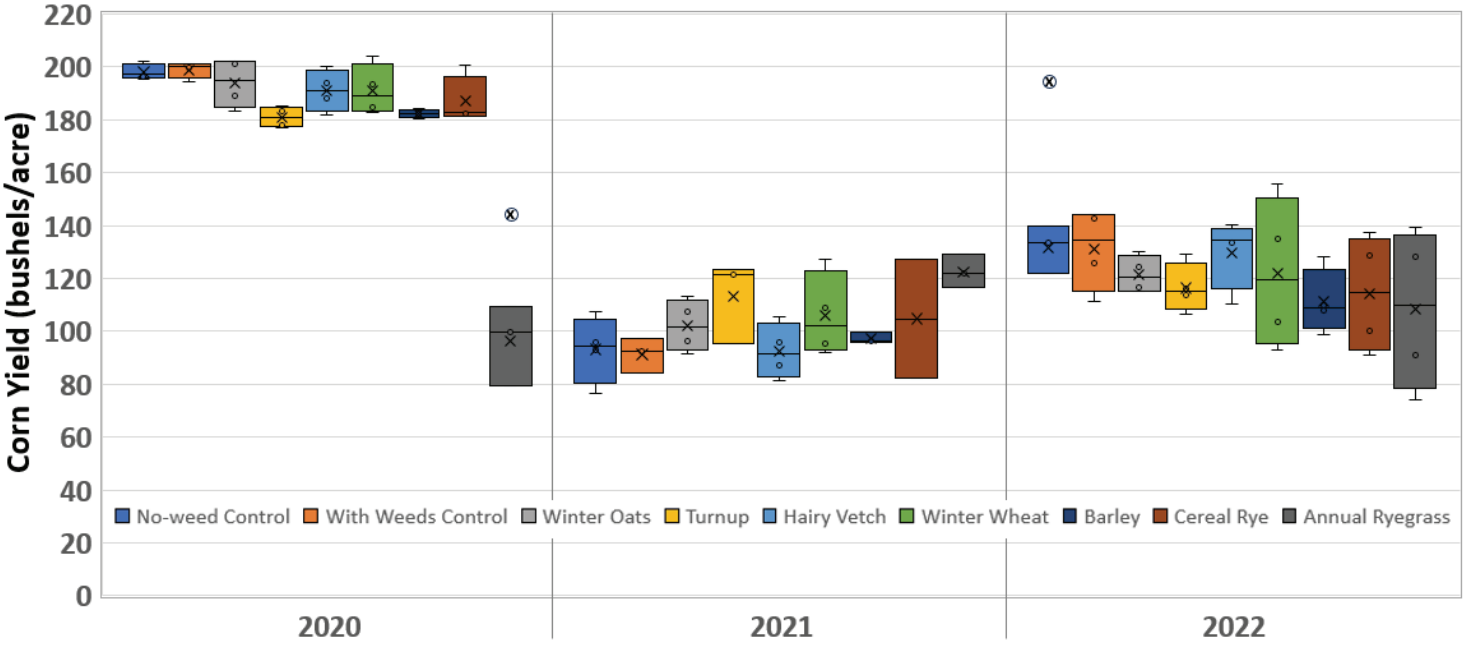
OBJECTIVE

Assess the impact of cover crop after soybean on cover crop biomass and corn yield.

STUDY DESIGN

- Cover crops planted with a drill in early Oct. 2019, 2020, and 2021 following soybean.
- Compared cereal rye, winter wheat, annual rye grass, winter oats, barley, turnip, and hairy vetch.
- Treatments in a randomized block design. New site each year.
- All cover crops terminated using herbicides.

Cover crop type impact on corn yield. All cover crops terminated within a week of planting corn.



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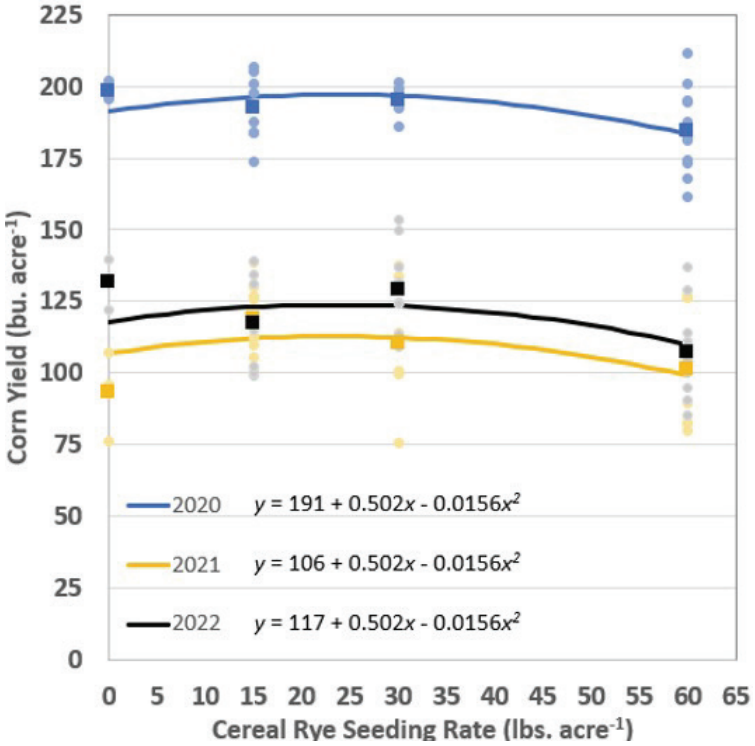
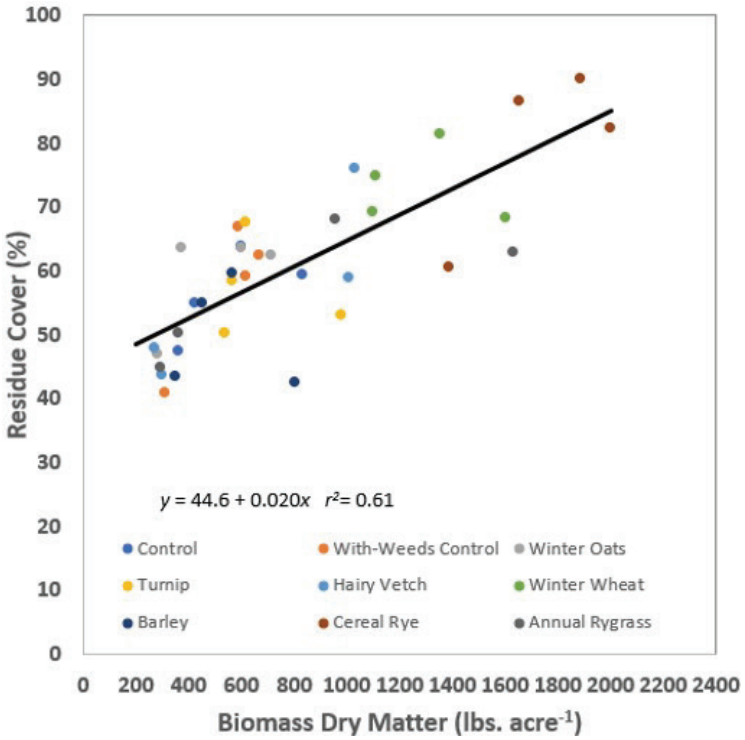
RESULTS SUMMARY.

- This study confirms planting cover crops after soybean ahead of corn increases yield variability and risk of yield loss. No cover crop treatment reliably had no effect or a positive effect on corn yield.
- The impact of cover crop on corn yield is complex and likely a mix of positive and negative effects that are dependent on local weather and crop-management decisions.
- High cereal rye seeding rates reduced corn yield. (Figure to the right).
- More biomass translates into more in-season residue. (Figures below).
- Cover crop biomass at termination did not affect corn yield. This suggests that common practices such as early termination of cover crops may not reliably reduce yield risk to corn.

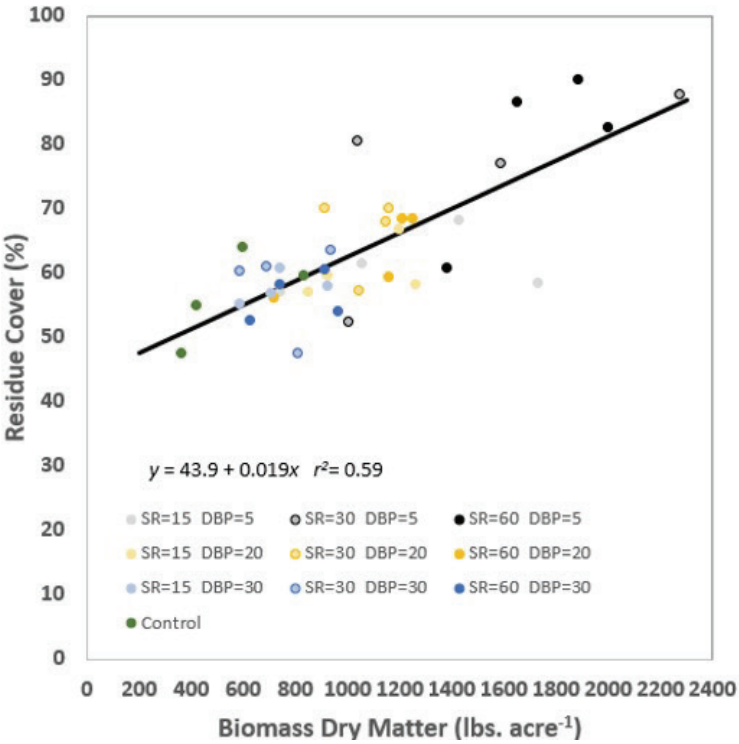
LOWERING CEREAL RYE SEEDING RATES INCREASED CORN YIELD.



INCREASING COVER CROP BIOMASS AT TERMINATION INCREASED IN-SEASON RESIDUE.



Impact of cover crop species biomass terminated five days before planting on residue cover at corn emergence in 2022.



Impact of cereal rye management on cover crop biomass at termination on residue cover at corn emergence in 2022. Cereal rye seeding rate (SR) and termination date indicated as days before corn planting (DBP).

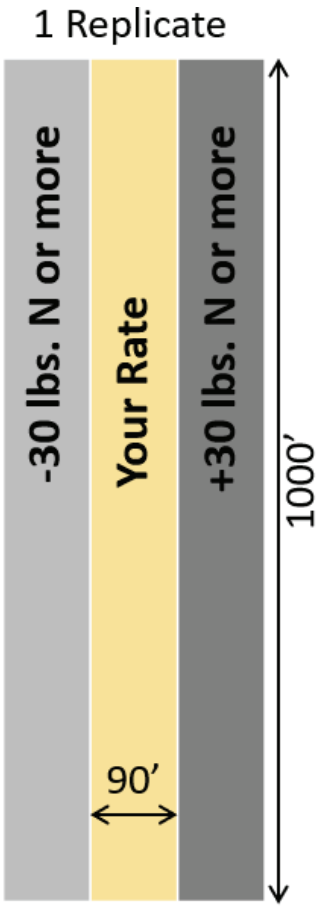
Full report available at https://extension.missouri.edu/programs/strip-trial-program/strip-trials

COST/BENEFIT OF NITROGEN FERTILIZER STRIP TRAILS

Many of our N strip trials have documented farmer rate was below optimum

OBJECTIVE

Document the cost of lost yield from a nitrogen strip trial.



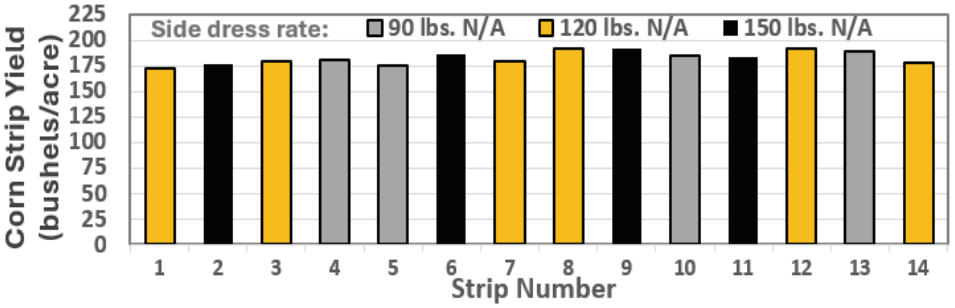
EXAMPLE STUDY DESIGN

Trial size:

- Applicator width 90 feet.
- Strip length 1000 feet.
- Strip size two acres.
- 3 treatments X 5 replicates = 15 strips cover 30 Acres.

CASE 1: YOUR RATE IS ABOVE OPTIMUM.

Side-dress nitrogen applied as urea. 50 lbs. N/A applied a planting.

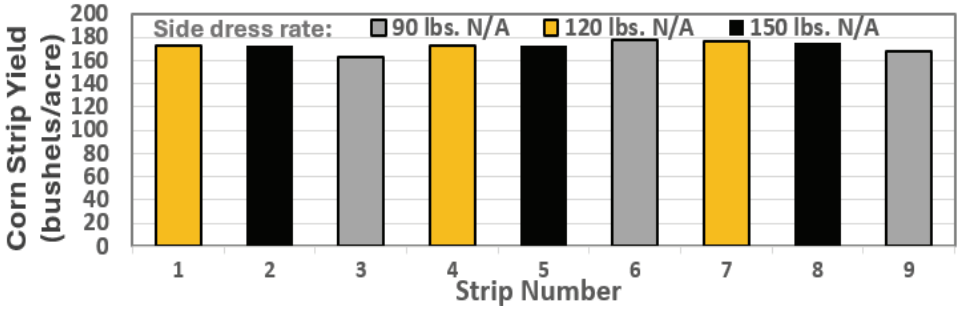


Sidedress Delta	Yld (bu/A)	Delta (bu/A)
-30 lbs. N/A	183	+1
Your Rate	182	-
+ 30 lbs. N/A	184	+2

→ **N greater than optimum: No clear response to N.**

CASE 2: YOUR RATE IS OPTIMUM.

Side-dress nitrogen applied as urea. 50 lbs. N/A applied a planting.



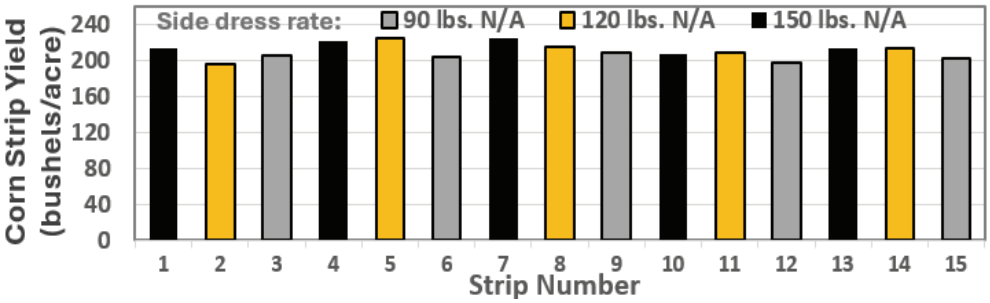
Sidedress Delta	Yld (bu/A)	Delta (bu/A)
-30 lbs. N/A	168	-6
Your Rate	174	-
+ 30 lbs. N/A	174	0

→ **N near optimum: Lose yield on low N rate.**

Nitrogen Trials supported by Missouri Soybean Merchandising Council, Missouri Corn Grower Association and their Checkoff, and Missouri Fertilizer Board

CASE 3: YOUR RATE IS BELOW OPTIMUM.

Side-dress nitrogen applied as urea. 50 lbs. N/A applied a planting.



Sidedress Delta	Yld (bu/A)	Delta (bu/A)
-30 lbs. N/A	204	-8
Your Rate	212	-
+30 lbs. N/A	216	+4

→ **N below optimum: Yield increases at every rate.**

HOW MUCH DOES KNOWLEDGE ABOUT YOUR N RATES COST?

Case : Your N rate	Net Yield Loss	Cost of a 30-acre trial	
	Bushels/Acre	Corn $5/B	Corn $7/B
Above optimum (1)	~0	0	0
Near optimum (2)	(0+0-6)/3 = -2	$300	$420
Below optimum (3)	(-8+0+4)/3 = -4	$600	$840

- Case 1: Your rate above optimum - yield not affected by N rate so no cost to trial.
- Case 2: You are near optimum - Some lost yield in low-N strips (the cost of knowledge)
- Case 3: You are below optimum - significant money lost on the low N strips – but it documents you were losing $20 to $30 per acre on the rest of your field!
- Extra cost of fertilizer always equals 0 because higher rate is offset by lower rate strip.

OTHER GOOD OPTIONS:

- High N strips at planting to highlight N need at side dress.
- A plus N trial – costs some extra fertilizer but tests if your rate is too low.
- Recommend tracking N response over multiple years to understand to year-to-year variability.

Nitrogen Trials supported by Missouri Soybean Merchandising Council, Missouri Corn Grower Association and their Checkoff, and Missouri Fertilizer Board

Contact your local Extension Office or "MU Certified" Strip Trial Program if interested in a nitrogen trial (https://extension.missouri.edu/programs/strip-trial-program).

ASSESSMENT OF FOLIAR FUNGICIDES TO SOYBEAN

64 on-farm strip trials from 2018 to 2024

OBJECTIVE

Evaluate soybean response to fungicide applications at the R3 growth stage.

SUMMARY

- Fungicide-treated soybean yielded 1.8 bushels per acre higher compared to non-treated soybean across 66 locations (Table 1).
- Frogeye leaf spot disease resulted in yield losses of non-treated soybean at one location. The soybean hybrid at that location lacked genetic tolerance to the disease.
- Septoria brown spot disease was observed at each location but was not associated with yield losses.

STUDY DESIGN

Each trial consisted of 2 treatments:
1. fungicide application
2. no fungicide application

5 replicates per treatment

Strips were ≥500' long and width dictated by the spray and harvest equipment

Farmers selected the fungicide and all agronomic practices.

The most common selections:
- Seeding rates of 140,000 seed/acre
- 15" row spacing
- Soybean maturity group 3.8
- Product with 2 modes of action (group 3 + 11)

Table 1. Yield differences between fungicide-treated and non-treated soybean

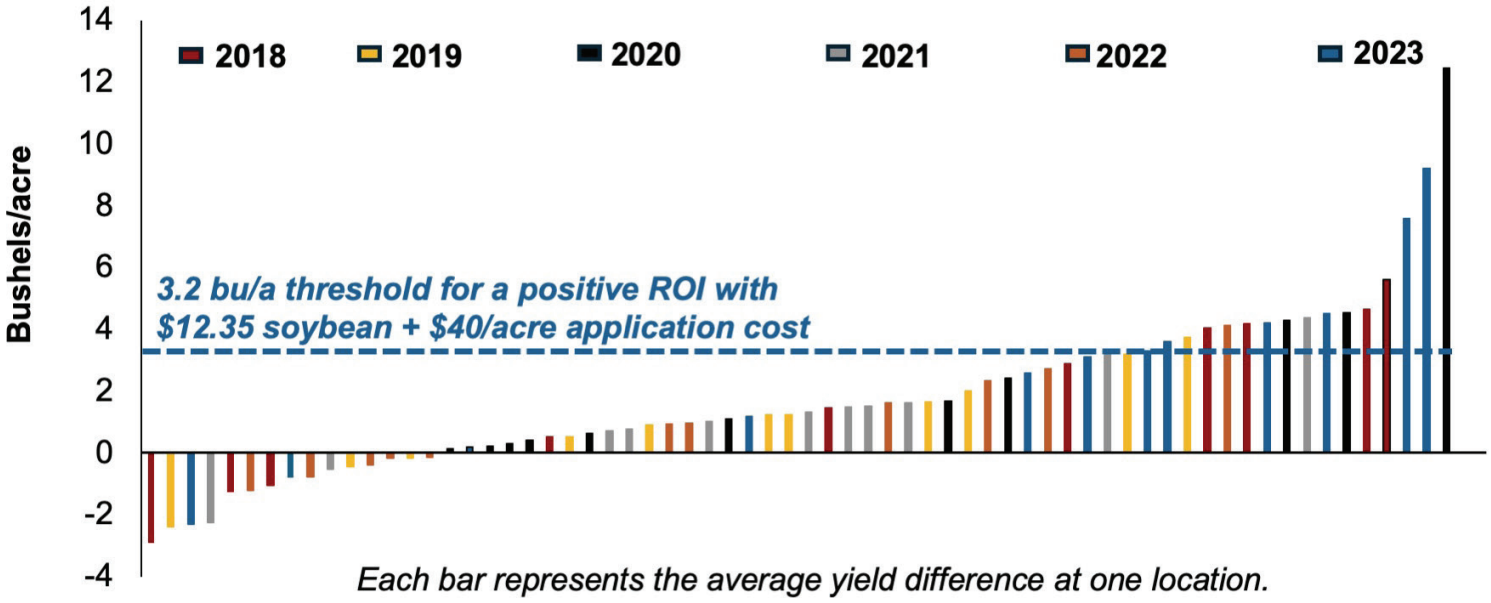
Year	Number of fields*	Yield difference**	Credible Interval (90%)
		- - - Bushels per Acre - - -	
All sites	**64**	**1.8**	**1.4 to 2.1**
2018	**10**	**1.9**	**1.0 to 2.8**
2019	**11**	**1.1**	**0.3 to 1.9**
2020	**11**	**2.2**	**1.4 to 3.0**
2021	**11**	**1.4**	**0.6 to 2.1**
2022	**11**	**1.0**	**0.2 to 1.8**
2023	**10***	**3.0**	**2.1 to 3.9**

*Fungicide-treated and non-treated strips were replicated an average of five times at each field.
**Soybean were harvested with the farmer's combine and yield data from the yield monitor were used.
Yield differences = Yield of fungicide-treated soybean minus yield of non-treated soybean.

WHEN DOES A FUNGICIDE APPLICATION TO SOYBEAN CORRESPOND TO A POSITIVE RETURN ON INVESTMENT?

- Yield increases following a fungicide application need to be ~**3.2 bushels per acre higher** than non-treated soybean for a positive return on investment.
- ~23% of the R3 fungicide strip trials reached this threshold from 2018 to 2023 (Figure 1).
- The highest yield increase following a fungicide application was 12 bushels/acre.
- Some locations had lower yields in fungicide-treated strips compared to non-treated strips.

Figure 1. Average Yield Difference of Fungicide-Treated Strips Minus Non-treated Strips



AGRONOMIC PRACTICES HAVE BEEN SIMILAR ACROSS MANY OF THE TRIALS. WHY IS THERE SO MUCH VARIATION IN YIELD RESPONSES?

We are evaluating weather data at each location and information on agronomic practices to identify factors that may influence yield responses following a fungicide application (Table 1).

Table 1. Preliminary Results on factors that correlated with yield increases.

Correlated with yield increases	Not associated with yield increases
Rainfall within 48 hours after application	Season-long rainfall
Warmer air temperature 48 hours after application	Season-long air temperatures
Frogeye leaf spot disease pressure	Number of Modes of Action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