MIZZOU
ON FARM

MU
STRIP
TRIALS

THANK YOU FROM THE 2022 MU EXTENSION STRIP TRIALS TEAM

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, and the Missouri Fertilizer Control Board.

THE 2022 REPORT INCLUDES RESULTS FROM:

- Foliar fungicide applications to soybean (Pages 4 to 9)
- Summary of Nitrogen Response Trials on Corn (Page 10)
- Summary of ILeVO® Seed Treatment Trials on Soybean (Page 11)

ADDITIONAL ON-FARM STRIP TRIALS IN PROGRESS OR PLANNED INCLUDE:

- Corn response to 1-pass vs 2-pass fungicide applications for tar spot control
- Soybean, corn, and wheat responses to sulfur fertilizer
- Corn-soybean rotation responses to potassium fertilizer
- Forage response to nitrogen
- Effects of planting cover crops before corn

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 2022 Mizzou On-Farm Report, please e-mail *ipm@missouri.edu.*

SOYBEAN RESPONSE TO R3 FOLIAR FUNGICIDE APPLICATIONS

OBJECTIVE

Evaluate the effects of foliar fungicide applications on foliar diseases and soybean yield.

STUDY DESIGN

- Each trial consists of two treatments: fungicide application at the R3 growth stage or no application.

- Treatments are applied to alternating strips throughout the trial and replicated a minimum of four times (Figure 1).

- Strips are ≥500 feet in length. Width is determined by the size of farm equipment.

- Trials are laid out with consideration of field topography, borders, and other environmental factors.

- Strips are scouted for diseases prior to and 2 weeks following treatment.

- Soybean variety, agronomic management practices for the field, and fungicide utilized in the trial are determined by the farmer.

- Yield map data is retrieved and analyzed for differences between fungicide-treated and non-treated strips (Figure 2).

Figure 1 *Map of a foliar fungicide trial. Yellow circles mark the scouting points within each strip. "Yes" indicates the strip was treated with fungicide. "No" designates non-treated strips.*
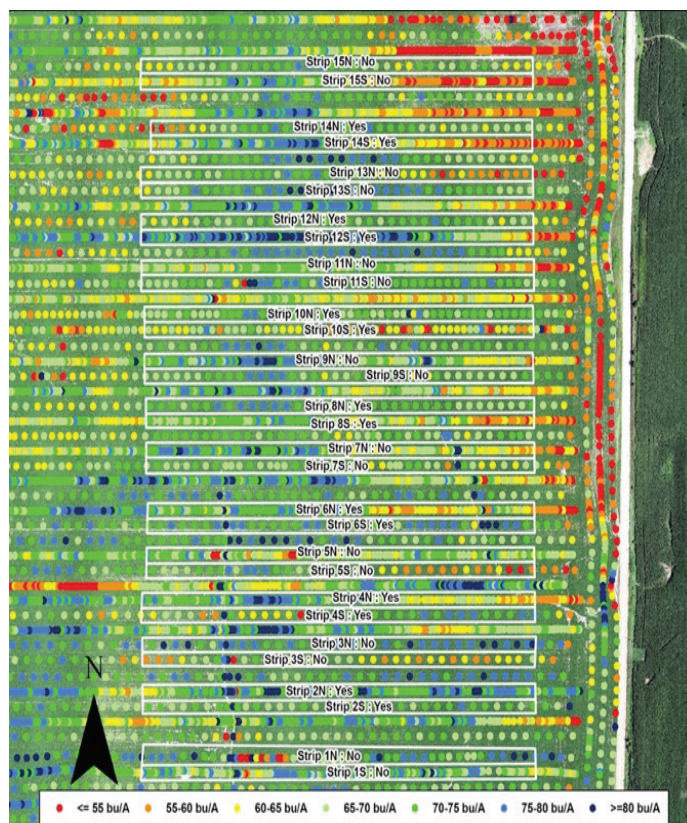

Figure 2 *Soybean yield map. White rectangles mark area used for yield determination of each strip. Imagery taken at 100 m.*

SUMMARY OF SOYBEAN FOLIAR FUNGICIDE STRIP TRIALS FROM 2018-2022

YIELD

Foliar fungicide applications at the R3 growth stage were associated with yield increases at 41 of 54 locations. Median yield increase was 1.5 bushels/acre. At 13 locations yields were lower in fungicide-treated strips compared to non-treated strips. Year-by-year summaries are shown in Table 1. Less precipitation than normal across much of the state in 2022 may have contributed to the number of fields where fungicide treatment did not correspond to increased yields.

Table 1. Year-by-year summary of yield responses across fields.

Year	Number of fields	Median yield increase*	Credible interval (90%)**	Number of fields with no yield increases***
		--------------Bushels per Acre--------------		
2018-2022	54	1.5	1.2 to 1.9	
2018	10	1.8	1.0 to 2.6	3
2019	11	1.1	0.3 to 1.8	3
2020	11	2.2	1.4 to 2.9	0
2021	11	1.4	0.6 to 2.1	2
2022	11	1.0	0.2 to 1.8	5

Yield increase is yield of fungicide treated strips minus yield of non-treated strips.
*** 90% probability that yield differences between fungicide-treated and non-treated strips fall within the listed range.*
**** Fields where fungicide treatment did not result in increased yields.*

The most frequently tested fungicides and results are shown in Table 2. All products listed in Table 2 demonstrated either a yield increase or no difference from non-treated strips. Each product was tested at unique locations and unique environments; therefore, **comparisons** between products **cannot be drawn** from this data.

Table 2. Most-frequently tested fungicide products and associated yield observations.*

Product	Mode of Action Group #	Number of Fields	Years Tested	Yield of Treated Strips – Yield of Non-treated Strips*
Aframe Plus	3, 11	5	2018-2020	1.5
Cover XL	3, 11	5	2018-2020, 2022	NS
Fortix	3, 11	4	2018-2019	0.4
Miravis Top	3, 7	7	2020-2022	2.1
Priaxor	7, 11	6	2018-2022	NS
Radius ESQ	3, 11	5	2020-2022	1.6
Trivapro	3, 7, 11	5	2018-2019, 2021-2022	1.1

Reported in bushels per acre. Only products tested at 4 or more locations are shown. NS =no differences observed between treated and non-treated strips.

DISEASE MANAGEMENT

Septoria brown spot was the only foliar disease observed each year and was documented at 100% of locations. This common disease is not typically associated with yield losses, and no differences in disease indices were observed between fungicide-treated and non-treated strips. Downy mildew and frogeye leaf spot were observed at 20% of locations. Ratings for both diseases ranged from 0.01 to 2.2% following fungicide applications and no differences were observed between treatments.

CONCLUSIONS

Fungicide applications corresponded with increased yields; however, the observed increases may not be profitable dependent upon input costs. We observed low disease pressure at most sites. Annual exposure of low-levels of fungal pathogens to fungicides is likely to hasten the onset of fungicide-resistance issues, which will cause products to be less effective when disease outbreaks occur.

RESULTS FROM INDIVIDUAL LOCATIONS (2022)

LOCATION 1 SUMMARY

95% probability that the fungicide application increased yield by >1 bushel/acre.

80% probability that the fungicide application increased yield by >2 bushel/acre.

Septoria brown spot was the only foliar fungal disease observed. The disease index was low and comparable between fungicide-treated and non-treated strips.

Soybean Variety: B419 Brevant E3
Date planted: 6/20/2022
Seeding rate: 160,000
Previous crop: Soybean
Crop rotation: Soybeans at least 3rd year
Application date: 8/15/2022
Product: Miravis Top
Product rate: 13.7 oz/acre
Applicator width: 90-100 feet

MARION COUNTY
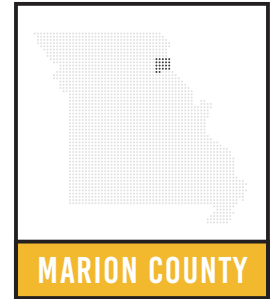
Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips	54.4 (1.6)	--
Control (N)	53.2 (1.4)	--
R3 Fungicide (F)	55.5 (.85)	+2.3

Disease	R3 Fungicide applied 8/18/2022	n	Pre-Spray 8/10/2022 at R2	Post-Spray 8/30/2022 at R4	Delta
				Disease Index[1]	
Septoria	N	20	3.5	6.8	3.3
	Y	20	2.8	6.8	4.0
Treatment Difference					0.7

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

LOCATION 2 SUMMARY

No evidence that fungicide application resulted in increased yield.

Across three years of trials with this farmer, there was a 50% probability that a fungicide application resulted in a yield increase of >1.7 bushel/acre/year and a 90% chance the increase was >0.5 bushel/acre/year. (Data not shown)

Septoria brown spot and downy mildew were observed. Disease indices were low and comparable between fungicide-treated and non-treated strips.

Soybean Variety: Agrigold G4813XF
Date planted: 6/3/2022
Seeding rate: 140,000
Previous crop: Corn
Crop rotation: Corn/soybean
Application date: 8/22/2022
Product: Lucento
Product rate: 5 oz/A
Applicator width: 90 feet

CAPE GIRARDEAU COUNTY

Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips	36.7 (4.4)	--
Control (N)	36.7 (4.6)	--
R3 Fungicide (F)	36.7 (4.7)	0

Disease	R3 Fungicide	n	Pre-Spray 8/13/2022 (at R3)	Post-Spray 9/7/2022 (at R6)	Delta
				Disease Index[1] (% points with disease)	
Septoria	N	20	1.80	1.76	0.04
	Y	20	1.80	1.76	0.04
Treatment Difference					0
Downy Mildew	N	20	1.175	1.80	-0.6
	Y	20	1.23	1.80	-0.3
Treatment Difference					0.0

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

LOCATION 3 SUMMARY

10% probability that the fungicide application increased yield by >1 bushel/acre.

Septoria brown spot was the only foliar fungal disease observed. Severity and incidence were low and comparable between treatments.

Soybean Variety: AgriGold 3755
Date planted: 6/5/2022
Seeding rate: 175,000
Previous crop: Corn
Crop rotation: Corn/soybean
Application date: 8/24/2022
Product: Radius ESQ
Product rate: 7 oz/a
Applicator width: 90 feet

PIKE COUNTY

Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips	61.0 (2.5)	--
Control (N)	61.3 (2.3)	--
R3 Fungicide (F)	60.7 (2.9)	-0.6

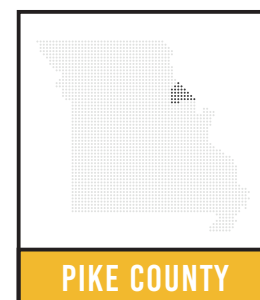| Disease	R3 Fungicide	n	Disease Index[1] Pre-Spray 8/23/2022 (at R5)	Post-Spray 9/9/2022 (at R6)	Delta
Septoria	N	20	6.3	6.8	0.5
	Y	16	6.4	7.2	0.8
Treatment Difference					-0.3

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

LOCATION 4 SUMMARY

No evidence that fungicide application increased yield.

Septoria brown spot and downy mildew were observed. The disease index was low and comparable between fungicide-treated and non-treated strips.

Soybean Variety: P42A96x
Date planted: 6/14/2022
Seeding rate: 139,000
Previous crop: Corn
Crop rotation: Corn/soybean
Application date: 8/3/2022
Product: Revytek
Product rate: 8 oz/acre
Applicator width: 100 feet

MONTGOMERY COUNTY
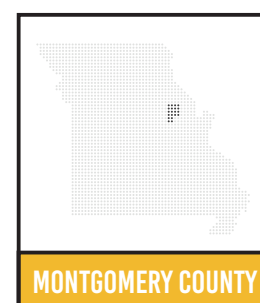
Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips	73.3 (12.6)	--
Control (N)	74.7 (12.3)	--
R3 Fungicide (F)	72.2 (14.2)	-2.5
All strips minus the 3 low yielding strips.*	80.9 (6.5)	--
Control (N)	80.4 (5.7)	--
R3 Fungicide (F)	81.4 (8.5)	+1.0

Disease	R3 Fungicide applied 8/3/2022	n	Disease Index[1] Pre-Spray 8/2/2022 (at R2)	Post-Spray 8/18/2022 (at R?)	Delta
Septoria	N	16	2.7	1.9	- 0.8
	Y	20	2.5	1.9	- 0.6
Treatment Difference					-0.2
Downy Mildew	N	16	0	0.31	0.31
	Y	20	0	0.25	0.25
Treatment Difference					-0.06

*20 to 35 bu/a variations in yield caused us to analyze yield data two ways. Once with all strips (white rows) and once with the lowest-yielding strips removed (gold rows). Removing the lowest-yielding strips (55, 58, and 62 bu/a) had no impact on the conclusions.

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

LOCATION 5 SUMMARY

50% probability that the fungicide application increased yield by >1 bushel/acre in 2022.

In 5 years of trials with this farmer, there was a 95% change the fungicide application increased yield >0.5 bu/acre/year and a 50% chance the application increased yield by >1.7 bushel/acre/year.

Septoria brown spot was the only foliar fungal disease observed. The disease index was low and comparable between fungicide-treated and non-treated strips.

Soybean Variety: Donmario DM3756E
Date planted: 5/20/2022
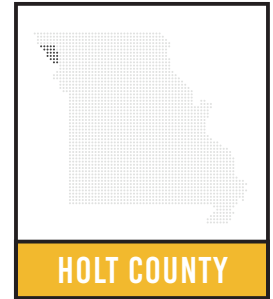**Seeding rate:** 160,000
Previous crop: Corn
Crop rotation: Corn/soybean
Applicate date: 8/6/2022
Product: Priaxior
Product rate: 7.44 oz/acre
Applicator width: 90ft

HOLT COUNTY

Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips	69.7	--
Control (N)	69.2	--
R3 Fungicide (F)	70.2	+1.0

Disease	R3 Fungicide applied 8/6/2022	n	Pre-Spray 7/21/2022 (at R2)	Post-Spray 8/22/2022 (at R5)	Delta
			Disease Index[1]		
Septoria	N	24	1.1	11.1	10
	Y	21	1.0	10.6	9.6
Treatment Difference					-0.4

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

LOCATION 6 SUMMARY

20% probability that the fungicide application increased yield by ≥1 bushel/acre.

Septoria brown spot and downy mildew were observed. There were no differences in disease index between treated- and non-treated strips.

Soybean Variety: 42T31E
Date planted: 5/31/2022
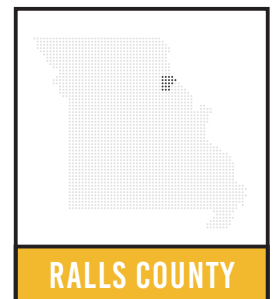**Seeding rate:** 160,000
Previous crop: Corn
Crop rotation: Corn/soybean
Application date: 8/13/2022
Product: Veltyma
Product rate: 7 oz/acre
Applicator width: 100 feet

RALLS COUNTY

Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips	70.0 (3.0)	--
Control (N)	69.9 (3.7)	--
R3 Fungicide (F)	70.0 (2.6)	+0.1

Disease	R3 Fungicide	n	Pre-Spray 8/13/2022 (at R3)	Post-Spray 8/30/2022 (at R5)	Delta
			Disease Index[1]		
Septoria	N	15	2.8	19.4	16.6
	Y	15	2.8	19.4	16.6
Treatment Difference					0
Downy Mildew	N	15	0.2	0.05	-0.15
	Y	15	0.2	0.05	-0.15
Treatment Difference					0

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

LOCATION 7 SUMMARY

>95% probability that the fungicide application increased yield in 2022.

Across three years of testing with this farmer, there was a 95% probability the fungicide application resulted in a yield increase of >1.2 bushel/acre/year and a 50% probability the benefit was >2.3 bushel/acre.

Septoria brown spot was the only foliar fungal disease observed in 2022. The disease index was low and comparable between fungicide-treated and non-treated strips.

Soybean Variety: Pioneer P36T08E
Date planted: 5/9/2022
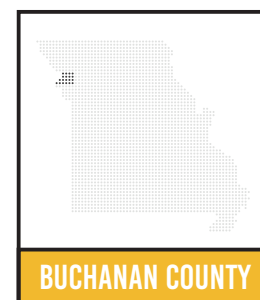**Seeding rate:** 140,000
Previous crop: Corn
Crop rotation: Corn/soybean
Applicate date: 7/21/2022
Product: Cover XL
Product rate: 14 oz/acre
Applicator width: 100 ft

BUCHANAN COUNTY

Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips	70.7 (2.7)	--
Control (N)	68.8 (3.0)	--
R3 Fungicide (F)	72.1 (1.5)	+3.3

			Disease Index[1]		
Disease	R3 Fungicide applied 7/21/2022	n	Pre-Spray 7/20/2022 (at R2)	Post-Spray 8/5/2022 (at R3)	Delta
Septoria	N	17	7.0	17.7	10.7
	Y	17	6.9	17.2	10.3
Treatment Difference					-0.4

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

LOCATION 8 SUMMARY

This site was divided into 3 trials: non-irrigated, irrigated low yielding, and irrigated high yielding. 75% probability the fungicide application increased yield by >1 bushel/acre at the non-irrigated site. 45% probability the application increased yield by >1 bushel/acre at the irrigated low yielding site. 55% probability the fungicide application increased yield by >1 bushel/acre at the irrigated high yielding site.

Septoria brown spot was the only foliar fungal disease observed. The disease index was low and comparable between fungicide-treated and non-treated strips.

Soybean Variety: Asgrow 42XF2
Date planted: 4/27/22
Seeding rate: 130,000
Previous crop: Soybean
Crop rotation: Soybean/soybean
Application date: 7/26/2022
Product: Miravis
Product rate: 13.7 oz/acre
Applicator width: 100 ft

MISSISSIPPI COUNTY

Treatments	Mean (SD)	Delta Control
	bushels/acre	
All strips Non-irrigated	79.5 (5.8)	--
Control (N)	77.6 (6.4)	--
R3 Fungicide (F)	81.7 (4.8)	+4.1
All strips – Low-Yielding, Irrigated	40.9 (6.9)	--
Control (N)	39.3 (4.4)	--
R3 Fungicide (F)	42.5 (9.2)	+1.6
All strips – High-Yielding, Irrigated	80.8 (2.7)	--
Control (N)	80.0 (2.4)	--
R3 Fungicide (F)	81.6 (3.0)	+1.6

			Disease Index[1]		
Disease	R3 Fungicide	n	Pre-Spray 7/1/2022 (at R2)	Post-Spray 8/11/2022 (at R4-5)	Delta
Septoria	N	20	1.9	9.9	8.0
	Y	20	1.9	9.9	8.0
Treatment Difference					0

[1]Disease index is calculated by multiplying the percent plants with disease (incidence) times the severity of the disease and adjusting the project to a scale of 0 to 100. Reported value is mean of all scouted points in that treatment.

SUMMARY OF NITROGEN RESPONSE TRIALS ON CORN

OBJECTIVE
Evaluate if farmer N rate meeting corn crop needs, particularly those that had cover crop following soybean.
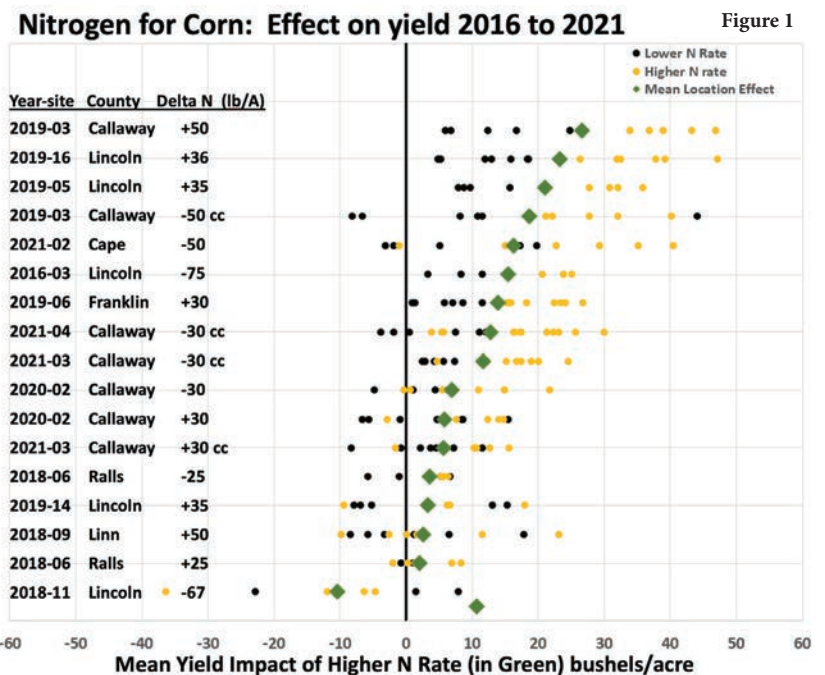
STUDY DESIGN

- Each trial had two or three treatments
  1. Farmer selected nitrogen rate.
  2. Farmer rate plus at least 30 pounds nitrogen per acre.*
  3. Farmer rate minus at least 30 pounds nitrogen per acre.*

  Farmer chooses plus, minus, or both and the delta in rate.

- Data summarized from 17 trials in six Missouri counties.
- Most trials applied as side-dress applications.
- Farmers typically had at least four strips of each selected treatment.
- Yield maps collected from the test area.
- Report compares impact of the highest two nitrogen rates applied.

RESULTS

- >50% probability that the highest nitrogen rate increased corn yield 10 bushels per acre.
- Half of the most responsive sites were testing a higher nitrogen rate.
  - Result imply farmer rates on these fields frequently were below the economic optimum.
- Majority of the low-response sites were from 2018, a drought year.
- Evidence suggests farmers had trouble optimizing nitrogen rate on both conventional fields and fields with cover crop.
- Yield data from each location is summarized in Figure 1.
  - Each row represents one location.
  - Gold (high N rate) and black (lower N rate) symbols are individual strip yields compared to the average yield at the location.
  - Green diamonds are the mean effect of highest N rate. Diamonds to the right of the zero line imply fertilizer nitrogen increased yield.

Figure 1

Nitrogen for Corn: Effect on yield 2016 to 2021

Legend: ● Lower N Rate ● Higher N rate ◆ Mean Location Effect

Year-site	County	Delta N (lb/A)
2019-03	Callaway	+50
2019-16	Lincoln	+36
2019-05	Lincoln	+35
2019-03	Callaway	-50 cc
2021-02	Cape	-50
2016-03	Lincoln	-75
2019-06	Franklin	+30
2021-04	Callaway	-30 cc
2021-03	Callaway	-30 cc
2020-02	Callaway	-30
2020-02	Callaway	+30
2021-03	Callaway	+30 cc
2018-06	Ralls	-25
2019-14	Lincoln	+35
2018-09	Linn	+50
2018-06	Ralls	+25
2018-11	Lincoln	-67

Mean Yield Impact of Higher N Rate (in Green) bushels/acre

CONCLUSIONS

Preliminary evidence that farmer rates are near or below optimum on the tested fields. A program priority is to identify ways to substantially expand farmers testing their nitrogen rates on their field.

WHAT A TEST LOOKS LIKE ON YOUR FIELD:
Your rate vs. + and/or - at least 30 lbs. N/A

Benefits:
- +/- easiest to implement – more likely to work.
- Straight forward to analyze.
- +/- uses does not change amount of fertilizer N applied to the field.

Cautions:
- At least four reps (better with more).
- Easier with smaller applicators.
- Check that application width works with combine width.
- Multiple years needed to get answers.

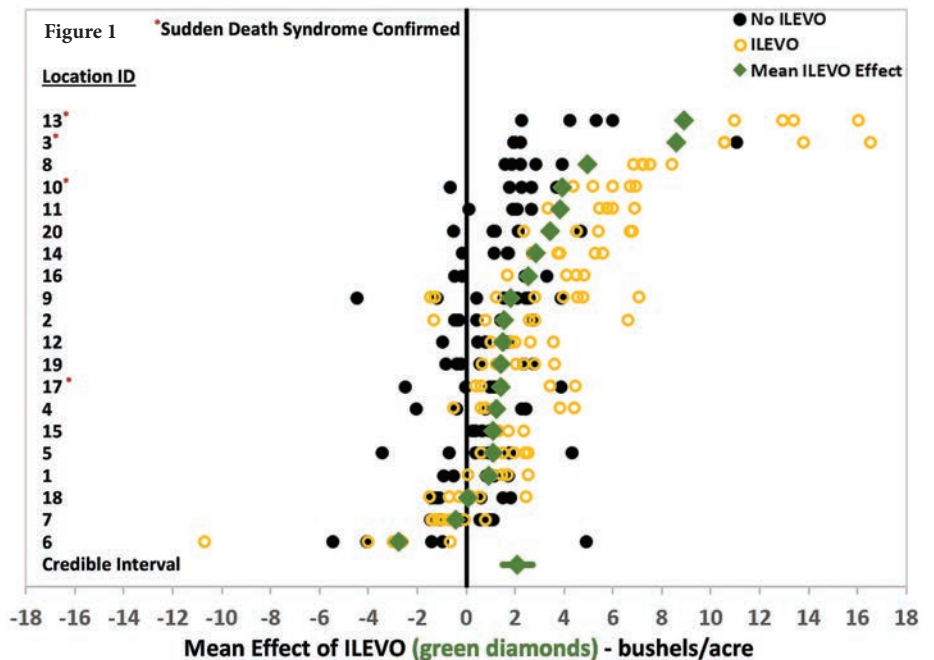# SUMMARY OF ILEVO® SEED TREATMENT TRIALS ON SOYBEAN

OBJECTIVE
Evaluate a high rate of ILeVO® seed treatment on sudden death syndrome (SDS), soybean cyst nematodes, and soybean yield.

STUDY DESIGN

- Each trial consisted of two treatments:
  1. Farmer selected seed treatment without ILeVO®
  2. Farmer selected seed treatment plus ILeVO® at ≥1.5 ounces per 140,000 seed.
- Treatments were planted in alternating strips and replicated a minimum of 4 times per location.

- Two soil samples were collected per strip for SCN egg counts at planting and harvest.
- In-season SCN female counts were conducted.
- Locations were monitored for SDS during the season.
- Yield map data were retrieved for each strip.
- 20 trials were completed in 9 counties from 2017 to 2018.

RESULTS

- >50% probability that ILeVO® increased yield by 2 bushels/acre.
- When SDS was **not** observed, the benefit was unlikely to exceed 1 bushel/acre.
- 50% probability that ILeVO increased yield by >3.5 bushel/acre when SDS was observed.
- Yield data from each location is summarized in figure 1.
  - Each row represents 1 location.
  - Black (no ILeVO®) and gold (ILeVO®) symbols are individual strip yields compared to average yield at the location.
  - Green diamonds are the mean effect of ILeVO® at the location.
- SCN densities and reproduction were highly variable within locations.

Figure 1 — Sudden Death Syndrome Confirmed. Location ID. Legend: ● No ILEVO, ○ ILEVO, ◆ Mean ILEVO Effect. Mean Effect of ILEVO (green diamonds) - bushels/acre.

CONCLUSIONS

The full report can be accessed with the information in figure 2. We plan to begin seed treatment trials again in 2024 with support from Missouri Soybean Merchandising Council. Please use the contact information on page one if you are interested in participating.

Figure 2 For the full ILeVO® Seed Treatment Report either:

1) Scan the QR Code

OR

2) visit *extension.missouri.edu/programs/strip-trial-program/strip-trials/ilevo-trials.*

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