

2023 Report: Maryland Soybean Board Continued Assessment of Soybean Foliar Fungicide Efficacy when Applied Through Irrigation

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Project Overview:

The relatively flat topography and sandy soils of the Mid-Atlantic tend to be ideal candidates for the center pivot type irrigation that is employed on over 85% of the irrigated acreage. Irrigation research has historically been conducted in the semi-arid Southwest US, but research from other areas of the U.S. often has limited adaptability to Maryland and Delaware due to climate and soil differences. In recent years there has been an effort to optimize irrigation practices specifically for the Mid-Atlantic. As improvements are made in irrigation timing and nutrient management, new questions, such as the addition of fungicides to irrigation, have been raised. The application of fungicides through irrigation has not been widely investigated in the Mid-Atlantic but could provide an additional application method to farmers. From 2019-2021, initial research on efficacy for management of foliar diseases in corn were conducted at the UD Warrington Irrigation Farm. This work has generated interest from growers to determine if fungicides applied via irrigation may also be viable in soybean production. Project objectives included: 1) Quantify soybean foliar disease severity in response to fungicide treatments applied through irrigation. 2) Compare efficacy of soybean foliar disease management in ground rig versus irrigation applied fungicides. 3) Disseminate research results to Mid-Atlantic irrigated farmers. This project funded graduate student salary for a plant pathology student to support this work. The goal of this project was to assess the efficacy of fungicides applied via fungigation at multiple application timings in comparison to ground rig applications to inform fungicide application method recommendations for soybean farmers.

Project Activities and Methods:

Research on irrigation of agronomic crops in the Mid-Atlantic region has been limited until recent years. Delmarva farmers have been experimenting with fungigation for over 2 decades with few, if any, replicated studies. Adkins, Whaley & Sylvester explored fungigation of corn at the UD Warrington Farm in 2018 to evaluate the accuracy of the chemigation system and provide initial data for setting up more advanced tests. This work was continued by Koehler and Adkins from 2019-2022, where it was shown that fungicides applied through irrigation reduced disease severity of grey leaf spot in corn, with variable yield effects. To date, there have been no replicated trials assessing efficacy of fungicides for foliar diseases of soybean when applied through irrigation. This project sought to address the following objectives:

Objective 1. Quantify soybean foliar disease severity in response to fungicide treatments applied through irrigation.

Soybeans were planted at the University of Delaware's Warrington Irrigation Research Farm in Harbeson, DE on June 1, 2023 at populations of 140,000 seeds per acre. Plants were observed throughout the season for foliar disease and drone imagery was collected throughout the duration of the season.

Objective 2. Compare efficacy of soybean foliar disease management in ground rig versus irrigation applied fungicides.

Soybeans were planted at the University of Delaware's Warrington Irrigation Research Farm in Harbeson, DE on June 1, 2023 at populations of 140,000 seeds per acre. Using a combination of soil electro-conductivity mapping, aerial imagery, soil borings and historical yield maps, the field was divided into 5 tiers (replications) of varying soil type (Tier 1 = 20% wettest/heaviest soil – Tier 5 = 20% driest/lightest soil). Within each soil type tier, the research field was divided into 11 randomized treatments and 5 replications for a total of 55 individual 90' x 90' plots. Fertilizer was applied based on the University of Delaware recommendations for irrigated soybean production. Weather data was collected by a Delaware Environmental Observing System weather station located on the irrigation research farm.

Each plot received one of the following fungicide treatments via chemigation/fungigation or ground rig application and will be replicated five times:

1. No Fungicide
2. Miravis Neo applied at R3 via fungigation
3. Miravis Neo applied at R5 via fungigation
4. Miravis Neo applied at R1 and R3 via fungigation
5. Miravis Neo applied at R3 and R5 via fungigation
6. Miravis Neo applied at R1 + R3 + R5 via fungigation
7. Miravis Neo applied at R3 via ground rig
8. Miravis Neo applied at R5 via ground rig
9. Miravis Neo applied at R1 and R3 via ground rig
10. Miravis Neo applied at R3 and R5 via ground rig
11. Miravis Neo applied at R1 + R3 + R5 via ground rig

Plots were harvested with a plot combine on November 6, 2023 to determine yield, moisture, and test weight differences. Yield data were analyzed to determine treatment differences among fungigation and ground rig application methods and timings.

Objective 3. Disseminate research results to Mid-Atlantic irrigated farmers.

Findings from this project were shared through the University of Delaware's Weekly Crop Update, which reaches over 700 growers, consultants, and stakeholders and provides a platform to discuss disease concerns and other production issues. Results were shared at the 2024

Delaware Ag Week Irrigation and Agronomy Sessions and will continue to be highlighted in grower meetings throughout 2024.

Results and Discussion:

Fungicide applications were made at R1 (July 28), R3 (August 15 fungigation, August 17 ground rig), and R5 (September 1). Root-knot nematodes were present in the field and there were spots where bean growth was restricted due to nematode pressure. From scouting plot edges, very limited foliar disease was present. Drone imagery was used to capture data on plot changes following fungicide application. NDRE measures the amount of chlorophyll in the plants and can be used to detect variations in crop health. Across the season, the plots receiving ground rig applications had higher NDRE values indicating higher chlorophyll content and greener leaves. Each week, Normalized Difference Red Edge (NDRE) images were quite striking with individual plots visible (Figure 1). This was consistent with NDRE images in 2022 which were also easy to visualize individual plots (Figure 2). However, when plots were taken to yield, there was no statistical separation among treatments in either trial year (Figure 3). Ranking numerically, there was a 6 bu spread from the highest yielding treatment to the control plot in 2022. Wider numerical spread was observed in 2023, but yield potential was lower, largely due to the root-knot nematode pressure present.

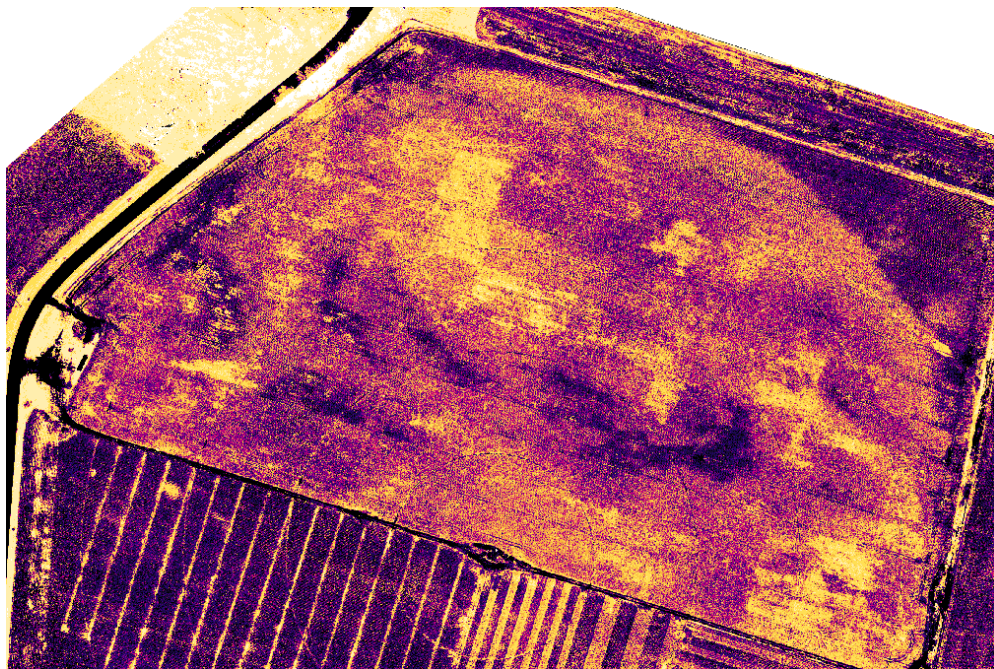


Figure 1: Normalized Difference Red Edge (NDRE) image of plots on October 5, 2023

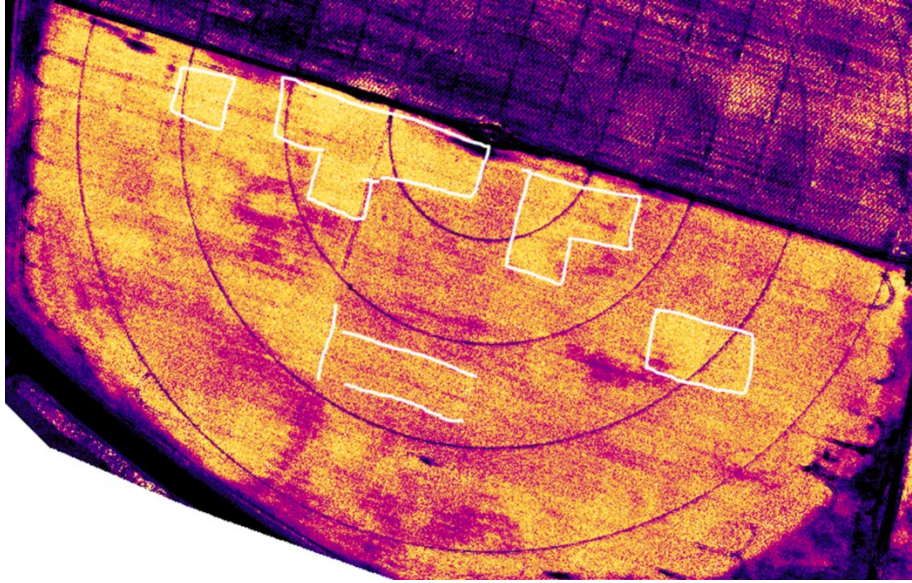


Figure 2: Normalized Difference Red Edge (NDRE) image of plots on August 31, 2022

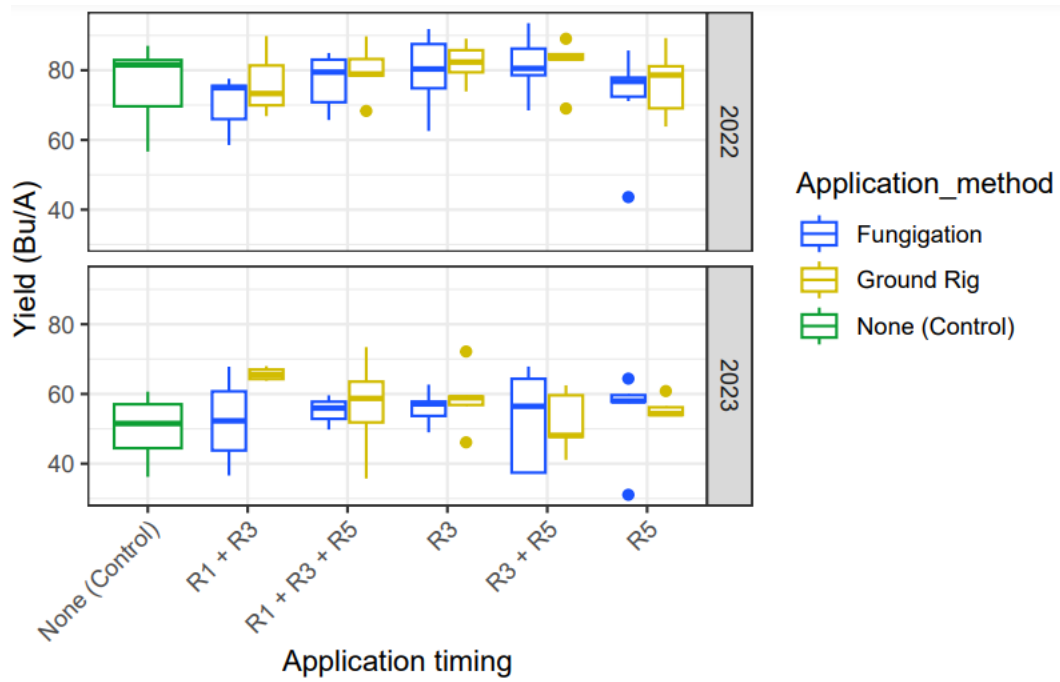


Figure 3: Yield Data from 2022 and 2023 Soybean Fungicide Application Method Trial

Results of this trial show that fungicide in absence of disease will likely not contribute to significant yield protection. No significant differences among treatments were observed. If making a fungicide application, the recommendation remains to use a single R3 timing. Adding in R3+R5 or R1+R3+R5 did not lead to increased yield in either application method. While the NDRE indices seemed to favor ground rig application, notable consistent differences in yield were not present for fungigation v. ground rig plots. Fungicides work to protect yield, so in situations with low disease pressure, wide variation in yield is not expected. Although there were differences in NDRE values, the lack of yield response between fungigation or ground rig shows that application method is not driving significant yield change in low disease settings. In years with higher disease pressure, greater differences in yield would be expected. In low disease scenarios, if fungicides are applied, R3 remains the optimal timing and both fungigation and ground rig application methods are options.

Project Budget:

Plant Pathology Graduate Student Salary (25% effort, 29,333 annually)	= \$7,333
Fringe benefits 13.1%	= \$961
Misc. supplies (field stakes, flags, etc)	= <u>\$1,200</u>
Total Proposed Budget	= \$9,494

Research Dissemination and MSB Recognition:

- January 10, 2024: Irrigation Session, Delaware Ag Week, Harrington, DE
- January 11, 2024: Agronomic Day, Delaware Ag Week, Harrington, DE

Public Summary:

Center pivot irrigation is widely used across the Mid-Atlantic. Irrigation research has historically been conducted in the semi-arid Southwest US, with limited adaptability to Maryland and Delaware due to climate and soil differences. In recent years there has been an effort to optimize irrigation practices specifically for the Mid-Atlantic. As improvements are made in irrigation timing and nutrient management, new questions, such as the addition of fungicides to irrigation, have been raised. The application of fungicides through irrigation has not been widely investigated in the Mid-Atlantic but could provide an additional application method to farmers. Project objectives included: 1) Quantify soybean foliar disease severity in response to fungicide treatments applied through irrigation. 2) Compare efficacy of soybean foliar disease management in ground rig versus irrigation applied fungicides. 3) Disseminate research results to Mid-Atlantic irrigated farmers. In 2023, disease pressure was limited with insufficient disease levels to take severity ratings. Ground rig applications had higher NDRE values indicating higher chlorophyll content in plants receiving fungicide application by this method. Although there were visual differences in NDRE, no significant effect on yield was observed. This was consistent with findings from year 1 of the study. In low disease pressure, fungicides may not provide an economic return on investment. If disease is present or a fungicide application is desired, R3 remains the recommended timing and fungicide application by ground rig or fungigation can be viable options. Further assessment of fungigation efficacy is needed under conditions of high foliar disease pressure.

Please contact Alyssa Koehler Betts (akoehler@udel.edu) with any additional questions.