Maryland Soybean Board Grant Report: 2018

Assessing the Impacts of Row Spacing and Fungicide Timing on Disease Control and Profitability in Double Crop Soybean Production Systems

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Background and Justification

Planting soybean in fields after winter barley or wheat, known as double cropping, is a popular means of producing soybeans in Maryland. Double cropping is valuable to Maryland producers as it increases total production without requiring additional acreage, helping growers meet the demands of increasing food production on reduced land resources, while providing significant environmental benefits. Many producers plant double cropped soybeans on 15” or 7-7.5” rows.

The majority of research on fungicides has been conducted on full season soybeans. Differences in length of growing season, spacing, and environment prevent the extrapolation of this work to a double cropped fungicide program. Due the shorter growing season for soybeans, there is less time for yield-limiting diseases to develop and impact plant development and growth. Furthermore, double crop soybeans are exposed to drier weather than full season soybeans, in a typical year. However, this effect could potentially be negated in some instances when spacing between rows is reduced. Planting on narrow rows allows the canopy to close sooner, shading out weeds and increasing photosynthetic efficiency. However, the benefits of rapid canopy closure may result in increased canopy humidity, and potentially increase foliar disease and associated yield impacts.

A brief survey of consultants agricultural agents, and growers conducted by Nathan Kleczewski, former Delaware Extension Pathologist, indicated that approximately 20-30% of double cropped soybeans receive a fungicide application. To assess the impact of row width and fungicide utility on double crop soybeans, Dr. Kleczewski was awarded a grant from the Maryland and Delaware Soybean Boards in 2017 and conducted successful trials during the 2017 growing season. We propose to conduct a set of replicated small plot studies in Delaware and Maryland to continue this research and collect additional data to assess: 1) efficacy and profitability of fungicides in double cropped systems; 2) impacts of row spacing on fungicide efficacy and optimal timing. Continuing this research started by Dr. Kleczewski is necessary to improve the robustness of the dataset and better understand the impacts of row spacing, utility and economics of foliar fungicides in double cropped soybeans.

Objectives

1. Evaluate the effects of row spacing on disease development in double crop soybean systems.
2. Evaluate the efficacy and utility of foliar fungicides for disease control and/or profitability.

Methods

Several small-plot field trials were established in Maryland and Delaware (Table 1) in the summer of 2018 to evaluate the efficacy of foliar fungicides applied to double crop soybeans. Locations in 2018 included: Wye Research and Education Center (WYE) in Queenstown, MD; University of Delaware's Carvel Research and Education Center, Thurmond Adams Research Farm (UDREC) in Georgetown, DE; and Western Maryland Research and Education Center (WMREC) in Keedysville, MD.

Table 1. Planting and harvest dates for each location.

	2018	
Location	**Planted**	**Harvested**
UDREC	July 2, 2018	October 30, 2018
WMREC	June 3, 2018	November 29, 2018
WYE	July 6, 2018	November 23, 2018

Plots were 10 feet wide x 30 feet long, arranged in randomized complete blocks with five replications. The plots were split by row spacing, utilizing 15 inch (wide row) and 7.5 inch (narrow row) rows. Plots were direct seeded using a no-till drill into wheat stubble in June/July at a population of 200,000 seeds $acre^{-1}$ with untreated seed of Dynagro variety S39RY65. This variety was chosen for all locations because of its good yield stability and yield potential in Maryland and Delaware variety trials, as well as its low foliar disease resistance rating. Treatments consisted of: narrow row, untreated control (7 C); narrow row, R1 fungicide application (7 R1); narrow row, R3 fungicide application (7 R3); wide row, untreated control (15 C); wide row, R1 fungicide application (15 R1); and wide row, R3 fungicide application (15 R3). Fertility, insect, and weed management practices were in accordance with Extension recommendations. Plots were treated with the fungicide 28.58% pyraclostrobin + 14.33% fluxapyroxad (Priaxor®) at either beginning of flowering (R1) or beginning pod fill (R3) using a pull-type sprayer equipped with 80V02 Turbo TeeJet flat fan nozzles, delivering 15 gallons $acre^{-1}$ at 35 psi to the center of each plot.

Normalized difference vegetative index (NDVI) readings were collected from the center of each plot, running the length of each plot using a handheld Greenseeker. Readings were taken as field conditions permitted (approximately weekly) starting at beginning seed (R5) and ending at maturity (R8). Greenstem ratings to measure stay-green characteristics were visually assessed as a percent of green plants per plot at maturity.

Plots were harvested at maturity using a small plot combine from the center 5 feet of each plot. Test weight, moisture, and yield data were collected at this time.

All data were analyzed using a mixed model and treatment differences separated using effects separated using Fisher's LSD.

<u>Results and Discussion</u>

Table 2 shows a significant treatment ($P=0.0063$) and location effect ($P<0.0001$) on yield but no significant treatment ($P=0.9362$) or location effect ($P=0.5849$) on relative yield (calculated as a percent compared to the mean yield for untreated control for the trial location) or test weight.

Table 2. Mix model ANOVA results for all sites replicated in Delaware and Maryland in 2018.

	Yield		Relative Yield		Test Wt.	
Source	**F Ratio**	**Prob > F**	**F Ratio**	**Prob > F**	**F Ratio**	**Prob > F**
Treatment	3.533	0.0063	0.2547	0.9362	1.7527	0.1329
Location	36.4310	<0.0001	0.5849	0.5596	0.9499	0.3913

Figure 1 shows treatment effect on average yield and relative yield across all locations 2018. There were no significant differences in relative yield between treatments; however, the wide row treatments did yield significantly higher at the WYE location. There was a lot of variability in the yield at the WMREC location, which could be due to excessive rainfall. WMREC location received the most rainfall during the growing season out of the three trial locations (see Appendix).

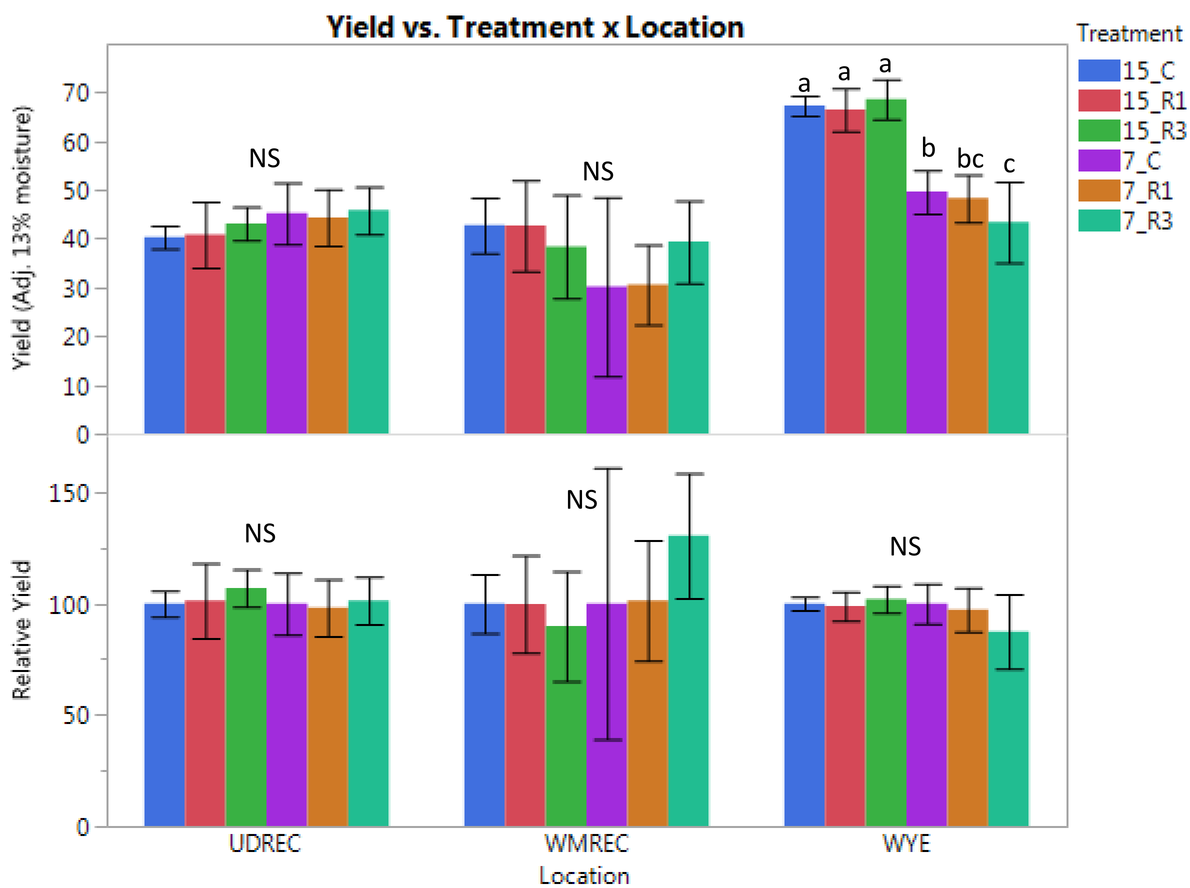

Figure 1. Treatment effect on yield. Yield (bu/a) (top) and relative yield (bottom). Each error bar is constructed using 1 standard deviation from the mean. Treatments connected with the same letter are not significantly different from each other (α=0.05). There was no significant treatment effect on relative yield (α=0.05).

Table 3 shows the ANOVA results for green stem ratings taken at maturity. Foliar fungicides can occasionally keep plants greener for longer. We did not observe any green stem treatment effects, nor any significant differences in NDVI measured after fungicide application.

Table 3. Mix model ANOVA results for green stem ratings at maturity for all sites replicated in Delaware and Maryland.

	Green Stem	
Source	**F Ratio**	**Prob > F**
Treatment	1.0329	0.4094

The most prevalent disease present in this trial was frogeye leafspot, but it was not prevalent enough at any of the locations to warrant a disease rating.

2018 Summary

Heavy and frequent rainfall throughout 2018 may have contributed to a significant amount of the variability we observed in the data. Foliar fungicides applied at R1 or R3, on narrow or wide row soybeans, did not provide any agronomic or plant health benefits. There was no significant treatment effect on relative yield, test weight, NDVI, or green stem. Location had a significant effect on yield and there was a treatment effect on yield at the WYE, where all three wide row (15” rows) soybean treatments yielded significantly more than narrow row treatments (7.5” rows). This was the only location in which we observed this trend, and it is opposite of what Dr. N. Kleczewski had found in his 2017 trials.

Based on the data collected by N. Kleczewski in 2017 and the variability and challenges brought by 2018; more data needs to be collected over multiple years and sites to improve the robustness of the dataset and to make sound production recommendations for growers in our region.

Acknowledgements

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Appendix

Weather Summary: UDREC, Georgetown 2018

Month	Max Temp. (F)	Max Temp. (°C)	Avg Temp. (F)	Avg Temp. (°C)	Min Temp. (F)	Min Temp. (°C)	Precip. (in)	Precip (mm)
April	81	27	52	11	33	1	5.38	136.652
May	90	32	68	20	41	5	10.23	259.842
June	93	34	73	23	54	12	6.82	173.228
July	97	36	77	25	52	11	3.74	94.996
August	96	36	78	26	56	13	2.06	52.324
September	95	35	74	23	54	12	7.06	179.324
October	89	32	60	16	32	0	4.22	107.188
November	73	23	47	8	23	-5	6.55	166.37
							46.06	1169.924

Weather Summary: CMREC, Beltsville 2018

Month	Max Temp. (F)	Max Temp. (°C)	Avg Temp. (F)	Avg Temp. (°C)	Min Temp. (F)	Min Temp. (°C)	Precip. (in)	Precip (mm)
April	84	29	52	11	30	-1	3.67	93.218
May	90	32	69	21	39	4	8.46	214.884
June	92	33	71	22	50	10	5.43	137.922
July	96	36	76	24	55	13	8.69	220.726
August	94	34	77	25	56	13	6.5	165.1
September	92	33	73	23	55	13	8.96	227.584
October	87	31	58	14	31	-1	4.13	104.902
November	73	23	43	6	25	-4	7.44	188.976
							53.28	1353.312

Weather Summary: WMREC, Keedysville 2018

Month	Max Temp. (F)	Max Temp. (°C)	Avg Temp. (F)	Avg Temp. (°C)	Min Temp. (F)	Min Temp. (°C)	Precip. (in)	Precip (mm)
April	86	30	51	11	27	-3	5.02	127.508
May	92	33	70	21	46	8	8.16	207.264
June	94	34	73	23	52	11	8.51	216.154
July	97	36	78	26	59	15	6.4	162.56
August	95	35	78	26	58	14	8.96	227.584
September	95	35	72	22	54	12	9.5	241.3
October	88	31	60	16	35	2	2.19	55.626
November	75	24	42	6	24	-4	7.61	193.294
							56.35	1431.29

Weather Summary: WYE, Queenstown 2018

Month	Max Temp. (F)	Max Temp. (°C)	Avg Temp. (F)	Avg Temp. (°C)	Min Temp. (F)	Min Temp. (°C)	Precip. (in)	Precip (mm)
April	84	29	53	12	35	2	3.19	81.026
May	89	32	70	21	62	17	8.42	213.868
June	93	34	73	23	53	12	4.27	108.458
July	98	37	79	26	59	15	8	203.2
August	93	34	79	26	62	17	2.36	59.944
September	84	29	76	24	68	20	6.55	166.37
October	87	31	61	16	41	5	7.04	178.816
November	71	22	46	8	23	-5	6.99	177.546
							46.82	1189.228