

Soybean Foliar Fungicide Evaluation in Northeast Iowa

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Introduction

Sudden death syndrome (SDS) has been reported in 21 states, and the losses due to SDS were estimated at \$3.06 billion for a period from 1988 to 2010. Sclerotinia stem rot or white mold (WM) is another major soilborne disease in commercial soybean production, particularly in intensive production regions of the United States, Argentina, and northern China. Its occurrence depends on various seasonal factors. White mold management measures are typically a preventive program, which includes application of fungicides and herbicides like Cobra. The objective of this study was to assess foliar applications of fungicides either alone or in combination with other fungicides or herbicide on SDS, WM, and grain yield.

Materials and Methods

Experiment set up. Trials were set in a randomized complete block design with four replications each with 10 ft wide (four 30-in. rows) x 45.5 ft long plots at the Northeast Research and Demonstration Farm, Nashua, Iowa. To maintain optimum weed control, 3 oz/acre Zidua and 40 oz/acre Roundup Weathermax herbicides were sprayed May 6, 2016, and May 14, 2017, followed by 6 oz/acre Select and 32 oz/acre Roundup Weathermax herbicides July 9 in 2016 and 2017. Asgrow 2035 brand soybeans were planted no-till at 188.8k PPA in 30-in. row spacing with a Kinze 3000 planter May 13, 2016, and May 14, 2017. Fungicides were sprayed at R1 and R3 growth stages, (July 7

and 28, 2016, and July 13 and August 14, 2017), using a CO₂ backpack with 10-ft hand boom and XR8003 tips at 20 gallon/acre water carrier volume (Tables 1 and 2). Plots were harvested using a John Deere 4420 combine with Shivvers grain moisture meter and Avery-Weigh Tronix weigh scale indicator. Yields were measured in bushels/acre converted to 13 percent grain moisture.

Fungicides and active ingredients in 2016. Aproach Prima (Picoxystrobin 17.94% + Cyproconazole 7.17%), BAS793F (experimental), Cobra (Lactofen 24%), Domark 230ME (Tetraconazole 20.5%), Endura (Boscalid 70%), Priaxor (Fluxapyroxad 14.33% + Pyraclostrobin 28.58%), Proline 480SC (Prothioconazole 41%), and Topsin 4.5 FL (Thiophanate-methyl 45%) were used in this evaluation in 2016.

Fungicides and active ingredients in 2017. Most of the 2016 chemistry was repeated in 2017 except Cobra, Domark 230ME, and Proline 480SC.

Sudden death syndrome and white mold. Pre- and post-fungicide spray disease ratings were recorded weekly from one week before application through two weeks before harvest. However, only mean final SDS disease index and percent WM incidence and severities were presented in Table 1 and WM incidence and severities in Table 2.

Data analysis. Data were analyzed using PROC ANOVA in SAS 9.4. Fisher's least significant difference was used to detect the significant differences among the means ($P = 0.05$).

Results and Discussion

In 2016, both SDS and WM were observed (Table 1). No significant difference in incidence and severity (SDS DX) was observed between the sprayed or unsprayed treatments. Although WM pressure in fall 2016 was less than 2017, efficacy of some of the fungicides varied based on application rates, timing, and their chemistry. Significantly low WM incidence was observed for Endura @ 6 or 8 oz/acre sprayed at R1, Cobra @ 6 oz/acre at R1 + Priaxor @ 4 oz/acre at R3, and two sprays of Proline 480SC at R1 and R3 compared with unsprayed control ($P < 0.05$) (Table 1). R1 + R3 treatments combined yielded on average +1.1 bushels/acre more than the untreated control. R1 treatments combined yielded an average -1.9 bushels/acre below the untreated control, with no significant yield increase for any particular foliar treatment. However, in 2017 only WM was observed in these trials

(Figure 1). In 2017, at least three spray treatments (BASF 793F at 7 oz/acre in R1, and both Topsin at 20 oz/acre and Aproach at 9 oz/acre at R1 and R3) showed significantly low WM incidence compared with control ($P < 0.05$) (Table 2). Two sprays of Aproach in R1 and R3 @ 9 oz/acre showed significantly higher yields compared with single spray of BAS 793F @ 14 oz/acre at R1. However, only Endura @ 6 oz/acre + Priaxor @ 4 oz/acre, Endura @ 6 oz/acre followed by Topsin @ 20 oz/acre at R3, and Aproach @ 9 oz/acre at R1 and R3 treatments combined, yielded, on average, +1.59 bushels/acre more than the untreated control (Table 2).

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Table 1. Effect of foliar fungicides on soybean sudden death syndrome (SDS), white mold (WM) and grain yields during 2016.*

Treatments ³	Application		SDS DX*	WM (%)		Yield bu/ac	Yield change over control
	Rate (oz/ac)	Timing		Inc.	Sev.		
1. Control	-	-	0.16a	0.61a	75.0a	81.7bac	0
2. Endura + NIS ¹	6	R1	0.20a	0.10c	56.3a	79.4bac	-2.3
3. <i>Priaxor + Domark + NIS</i>	4+4	R1	0.09a	0.37bac	75.0a	81.3 bac	-0.5
4. Endura + NIS	8	R1	0.37a	0.15bc	75.0a	78.9bc	-2.8
5. BAS 793F + NIS	7	R1	0.13a	0.26bac	56.3a	78.8bc	-2.9
6. BAS 793F + NIS	14	R1	0.05a	0.52ba	75.0a	80.7bac	-1.0
7. <i>Cobra + COC²</i>	6	R1	0.16a	0.20bac	75.0a	76.6c	-5.1
8. Endura + Priaxor + NIS	6+4	R1	0.20a	0.37bac	75.0a	81.9bac	0.2
9. Endura + Priaxor + NIS	6+4	R1+R3	0.25a	0.35bac	56.3a	85.0a	3.3
10. Endura + Topsin + NIS	4+20	R1+R3	0.09a	0.28bac	75.0a	83.3ba	1.6
11. Topsin + NIS	20	R1	0.24a	0.25bac	56.3a	80.7bac	-1.0
12. Aproach Prima+ NIS	6.8+6.8	R1+R3	0.13a	0.23bac	56.3a	82.4bac	0.7
13. <i>Cobra + COC</i>							
14. Priaxor + NIS	6+4	R1+R3	0.15a	0.14bc	56.3a	81.2 bac	-0.5
Proline 480SC+ NIS	3+3	R1+R3	0.18a	0.17bc	56.3a	82.2bac	0.5

*DX = (SDS incidence x SDS severity) ÷ 9. Incidence = (infected plants x 100) ÷ total plants/plot. Severity = percent plant damaged due to WM and is not per plot.

Means within a column followed by the same letter(s) are not significantly different at 5% level of significance (P < 0.05).

¹Non-ionic surfactant (NIS) at 0.25% v/v, Preference from Winfield Solutions.

²Crop oil concentrate (COC) at 0.125% per gallon, Superb HC from Winfield Solutions. No spray phytotoxicity was observed except in Cobra + COC sprayed with 90% and Cobra + Priaxor 50%.

³Treatments in italics were not repeated in 2017.

Table 2. Effect of foliar fungicides on soybean white mold and grain yields during 2017.

Treatments	Application		White mold (%)		Yield bu/ac	Yield change over control
	Rate (oz/ac)	Timing	Inc.	Sev.		
1. Control	-	-	1.14a	100a	75.06ba	0
2. Endura + NIS ¹	6	R1	0.98ba	100a	74.67ba	-0.39
3. Endura + NIS	8	R1	0.79ba	100a	73.95ba	-1.11
4. BAS 793F + NIS	7	R1	0.50b	100a	72.89ba	-2.17
5. BAS 793F + NIS	14	R1	0.87ba	100a	71.99b	-3.07
6. Endura + Priaxor + NIS	6+4	R1	0.82ba	100a	75.49ba	0.43
7. Endura + Priaxor + NIS	6+4	R1+R3	0.83ba	100a	72.80ba	-2.26
8. Endura + Topsin + NIS	6+20	R1+R3	0.90ba	100a	75.48ba	0.42
9. Topsin + NIS	20	R1 & R3	0.61b	100a	73.91ba	-1.15
10. Aproach + NIS	9	R1	0.74bac	100a	72.73ba	-2.33
11. Aproach + NIS	9	R1 & R3	0.56b	100a	76.09a	1.03

Incidence = (Infected plants x 100) ÷ total plants per plot. Severity = percent plant damaged due to white mold and is not per plot. Means within column followed by the same letter(s) are not significantly different at 5% level of significance ($P < 0.05$).

¹Non-ionic surfactant (NIS) at 0.25% v/v, Preference from Winfield Solutions. No spray phytotoxicity was observed.

**Figure 1. Symptoms of soybean white mold.**