

Field evaluation of fungicides for management of Sclerotinia stem rot on soybeans

Carrington, ND (2013)

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KEY FINDINGS:

- Endura (6 or 8 oz/ac) was the only fungicide to result in statistically significant increases in soybean yield under the high Sclerotinia disease pressure observed in this trial.
- The herbicide Cobra (6 fl oz/ac) resulted in excellent Sclerotinia control but no yield response. Cobra was applied at the same time as the fungicides evaluated in this trial (full bloom, R2 growth stage), and the yield gain resulting from the Sclerotinia disease control associated with this treatment was not enough to offset the yield loss associated with burning the canopy at full bloom.

Active ingredients of products tested in this trial: Approach contains 250 grams picoxystrobin per liter, Cobra contains 240 grams lactofen per liter, Domark contains 230 grams tetraconazole per liter, Endura contains 700 grams boscalid per kilogram, Priaxor contains 333 grams pyraclostrobin + 167 grams fluxapyroxad per liter, Proline contains 480 grams prothioconazole per liter, and Topsin contains 540 grams thiophanate-methyl per liter.

SUMMARY OF KEY RESULTS:

Description (application timing) ^z	Sclerotinia incidence: ^x	Sclerotinia severity: ^w	Sclerotinia sev. index: ^v	Yield bu/ac	Test weight 13% moisture lbs/bu	Seeds per pound seeds/lb	
	Sept. 16 ^u percent	Sept. 16 ^u 1 to 3	Sept. 16 ^u 0 to 3				
Non-treated check	64 bc*	2.56 a*	1.66 bcd*	41.2 cd*	59.3 a*	3415 a*	
Endura 70WG 6 oz/ac + NIS 0.25% v/v (A)	36 a	2.37 a	0.88 a	52.1 ab	59.4 a	3205 a	
Endura 70WG 8 oz/ac + NIS 0.25% v/v (A)	47 ab	2.43 a	1.17 abc	53.6 a	59.4 a	3340 a	
Priaxor 500SC 4 fl oz/ac + NIS 0.25% v/v (B)	55 abc	2.50 a	1.42 a-d	45.4 a-d	59.6 a	3357 a	
Proline 480SC 5 fl oz/ac + NIS 0.25% v/v (A)	73 c	2.60 a	1.92 d	43.3 cd	59.8 a	3605 a	
Domark 230ME 5 fl oz/ac + NIS 0.25% v/v (A)	66 bc	2.66 a	1.76 cd	44.4 bcd	59.2 a	3348 a	
Topsin 4.5FL 20 fl oz/ac + NIS 0.25% v/v (A)	48 ab	2.37 a	1.15 abc	49.5 abc	59.6 a	3320 a	
Approach 250SC 9 fl oz/ac + NIS 0.25% v/v (A)	75 c	2.58 a	1.96 d	41.8 cd	59.5 a	3550 a	
Cobra 240EC 6 fl oz/ac + Petroleum COC 0.125 gal/ac (A)	41 a	2.44 a	1.05 ab	41.7 cd	59.4 a	3429 a	
Endura 70WG 6 oz/ac + NIS 0.25% v/v (A) / Priaxor 500SC 4 fl oz/ac + NIS 0.25% v/v (B)	47 ab	2.34 a	1.13 abc	48.7 a-d	59.7 a	3337 a	
Proline 480SC 3 fl oz/ac + NIS 0.25% v/v (A)	71 c	2.69 a	1.93 d	40.2 d	59.6 a	3486 a	
Topsin 4.5FL 20 fl oz/ac + Proline 480SC 3 fl oz/ac + NIS 0.25% v/v (A)	56 abc	2.49 a	1.41 a-d	47.7 a-d	59.3 a	3430 a	
	F:	2.87	1.63	2.96	2.06	0.64	1.57
	F > P:	0.0057	0.1196	0.0045	0.0423	0.7866	0.1399
	CV:	33.4	9.0	37.4	16.7	0.9	6.3

^z Fungicide application timing:

Application A: Fungicides were applied shortly before canopy closure at the R2 growth stage on July 27 at 8:00 to 8:45 am; no Sclerotinia was present; wind speed = 0.8 to 4.4 mph out of the northeast, air temperature = 62.2 to 70.5°F, relative humidity = 36.5 to 56.3%.

Application B: August 8 at 3:15 to 3:25 pm; soybeans at the early R4 growth stage with no plants exhibiting wilting symptoms characteristic of Sclerotinia; wind speed = 5 to 8 mph out of the northwest with occasional gusts up to 13.1 mph, air temperature = 70°F, relative humidity = 56%.

^x Sclerotinia stem rot incidence was assessed by evaluating 75 plants in each plot (25 plants in each of three locations per plot).

^w Sclerotinia severity: Average disease severity among plants expressing Sclerotinia stem rot. A 1 to 3 scale was employed: 1 = lesions on lateral branches only, 2 = lesions on main stem, no wilt, and normal pod development, 3 = lesions on main stem resulting in wilting, poor pod fill, and plant death. In each plot, 75 plants were evaluated (25 plants in each of three locations per plot).

^v Sclerotinia disease severity index: Average disease severity across all plants, including those without any disease. A 0 to 3 scale was employed: 0 = no symptoms, 1 = lesions on lateral branches only, 2 = lesions on main stem, no wilt, and normal pod development, 3 = lesions on main stem resulting in wilting, poor pod fill, and plant death. In each plot, 75 plants were evaluated (25 plants in each of three locations per plot).

^u On Sept. 16, the soybeans were at the mid-R7 growth stage (several pods on the main stem had reached their mature color).

* Within-column means followed by different letters are significantly different ($P < 0.05$; Fisher's protected least significant difference).

IMPORTANT NOTICE:

- Fungicide performance can differ in response to which diseases are present, levels of disease when products are applied, environmental conditions, plant architecture and the susceptibility to disease of the variety planted, crop growth stage at the time of fungicide application, and other factors.
- This report summarizes fungicide performance as tested at the NDSU Carrington Research Extension Center under the conditions partially summarized in this report. Fungicide efficacy may differ under other conditions; when choosing fungicides, always evaluate results from multiple trials.
- This report is shared for educational purposes and is not an endorsement of any specific products.

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METHODS:

- **Location of trial:** NDSU Carrington Research Extension Center, Carrington, ND.
- **GPS coordinates of research trial location:** 47.5084, -99.1311
- **Tillage:** Disked May 9 and May 13, 2013 (with a Wishek disk) and cultivated on May 14 (deep cultivation) and May 15 (shallow cultivation).
- **Rhizobium inoculant:** Cell-Tech granular nitrogen fixing inoculant for soybean (*Bradyrhizobium japonicum*, 100 million viable cells per gram; Novozymes BioAg, Saskatoon, SK Canada) was mixed with the seed and applied at a rate of 2 dry ounces per 1000 feet of row.
- **Maintenance herbicide applications:** Gly Star 5 Extra (24 fl oz/ac; 5.4 lbs ai per gallon of glyphosate in the form of its isopropylamine salt = 4 lbs per gallon of the acid glyphosate); Agri Star, manufactured by Albuagh, Inc., Ankeny, IA) and Blue Diamond Activator (2 qt per 100 gallons; 100% ammonium sulfate; NWC N.D., Inc., Emerado, ND) were applied prior to soybean emergence on June 3. Touchdown Total (24 fl oz/ac; 5.1 lbs ai per gallon of glyphosate in the form of its isopropylamine salt = 4.17 lbs per gallon of the acid glyphosate), Warrant (1.25 qt/ac; acetochlor, 33% and 3 lbs ai/gallon), and Blue Diamond Activator (2 qt per 100 gallons; 100% ammonium sulfate; NWC N.D., Inc., Emerado, ND) were applied at the VC to V1 growth stage (unifoliolate to first trifoliolate leaves unfolded) on June 22.
- **Variety:** Dairyland 'DSR0404/R2Y'. Untreated seed was used.
- **Experimental design:** randomized complete block **Replicates:** 6
- **Seeded plot size:** 5 ft (center-to-center) x 25 ft long **Harvested plot size:** 5 ft (center-to-center) x approx. 19 ft long
- **Untreated buffer plots were established between treatment plots.** Buffer and guard plots consisted of 7 rows, each 7 inches apart. Seeding rate was unchanged. Narrow row spacing was utilized in the buffer and guard plots in order to promote the development of apothecia and ascospores of *Sclerotinia sclerotiorum*.
- **Row spacing:** 14 inches **Rows per plot:** 4
- **Previous crop:** Sunflowers
- **Planting date:** May 26, 2013 **Seeding rate:** 165,000 pure live seeds/ac
- **Fungicide application A:** Fungicides were applied shortly before canopy closure at the R2 growth stage on July 27 at 8:00 to 8:45 am; no Sclerotinia was present; wind speed = 0.8 to 4.4 mph out of the northeast, air temperature = 62.2 to 70.5°F, relative humidity = 36.5 to 56.3%.
- **Fungicide application B:** August 8 at 3:15 to 3:25 pm; soybeans at the early R4 growth stage with no plants exhibiting wilting symptoms characteristic of Sclerotinia; wind speed = 5 to 8 mph out of the northwest with occasional gusts up to 13.1 mph, air temperature = 70°F, relative humidity = 56%.
- **Fungicide application details:** Fungicides were applied with a 57-inch hand boom equipped with four equally spaced Spraying Systems TeeJet XR 8001VS flat-fan nozzles at a spray volume of 15 gal water/A operated at 35 psi.
- **Phytotoxicity:** Percent crop injury compared to the non-treated check. A rating of zero indicates no crop injury. This assessment was taken 7 days after a fungicide application was made.
- **Disease establishment:** The trial was established on a site with a previous history of Sclerotinia epidemics. In addition, sclerotia of *Sclerotinia sclerotiorum* obtained from a sunflower processing plant were applied to plots on June 13. Three to five sclerotia were placed approx. 0.5 inches deep in each of six locations per plot. Prior to placement in the field, the sclerotia were artificially vernalized by alternating them between a freezer (-20°C for at least 12 hours) and room temperature (20 to 25°C for at least 8 hours) a minimum of eight times.
- **Sclerotinia disease assessment:** Sclerotinia incidence and severity were assessed on September 16 at the early R7 growth stage (one normal pod on the main stem has reached its mature pod color) using the 0 to 3 scale developed by Craig Grau (Grau and Radke 1984; Plant Disease 68: 56-58): 0 = no symptoms, 1 = lesions on lateral branches only, 2 = lesions on main stem, no wilt, and normal pod development, 3 = lesions on main stem resulting in wilting, poor pod fill, and plant death. In each plot, 75 plants were evaluated (25 plants in each of three locations per plot).
- **Harvest date:** October 10
- **Seed yield and quality:** Plot-level grain moisture levels were assessed at the time of seed yield and quality assessment, and all seed yield, test weight, and kernel weight data were adjusted to 13% grain moisture.
- **Statistical analysis:** Data were evaluated with analysis of variance. The assumption of constant variance was assessed by plotting residuals against predicted values, and the assumption of normality was assessed with a normal probability plot. All data met model assumptions. Single-degree-of-freedom contrasts were performed for all pairwise comparisons of isolates; to control the Type I error rate at the level of the experiment, the Fisher's protected least significant difference multiple comparison procedure was employed. Analyses were conducted with replicate and treatment as main factor effects, and they were implemented in PROC GLM of SAS (version 9.2; SAS Institute, Cary, NC).

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