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Effects of an Experimental Seed Treatment from DuPont on Sudden Death Syndrome Symptoms and Soybean Yield

E.A. Adee

Summary

Sudden death syndrome (SDS) is a soybean disease that perennially limits yields in the Kansas River Valley. Soybean cyst nematode (SCN) and saturated soils contribute to the severity of the disease. Selecting varieties with some degree of tolerance to SDS is the only cultural practice that can reduce the severity of SDS and improve yields. Variety selection alone, however, doesn't necessarily make soybean production profitable; an added complication is managing irrigation scheduling to avoid saturated soils. A study with seed treatments applied to soybean was conducted at the Kansas River Valley Experiment Field in 2014, with treatments applied to two soybean varieties susceptible to SDS. The study was irrigated earlier and more often than normal for soybean to promote the disease. In the most severely infested plots, more than 50% of the leaf area expressed symptoms of SDS by the R6 growth stage. Treatments with an experimental seed treatment from DuPont (Wilmington, DE) reduced the amount of foliar disease in all varieties and increased yields up to 10 bu/a, or more than 25%.

Introduction

Soybean SDS is caused by the fungus *Fusarium virguliforme*, which infects plants through the roots, primarily before they start to flower. Foliar symptoms generally begin to show up as interveinal chlorosis and necrosis in the leaves at growth stage R3, after the seed has started to develop in the pods.

An interaction between SDS and SCN has been reported, and SCN is prevalent in the soils of the Kansas River Valley. Saturated soils also have been implicated as contributing to the development of SDS. Depending on how early the symptoms become visible and their severity, yield losses can be very significant. In severe cases, plants in which the symptoms begin early (i.e., before the seed development stage) can fail to produce any seed.

This disease has been a perennial problem in the Kansas River Valley, causing severe yield reductions in soybean to the point that the crop cannot be profitably produced in some fields. Crop rotations and tillage have had little effect on reducing the severity of the disease and reducing the subsequent yield loss. No soybean varieties are totally resistant to the fungus, but some varieties have varying degrees of tolerance that can

reduce yield losses. Irrigating soybean at the wrong time also could increase the severity of SDS, further complicating production in the Kansas River Valley, where irrigation is often necessary to produce a profitable crop.

Another method of trying to increase soybean productivity in fields with a risk of SDS is seed treatment applied to the seeds at planting. Seed treatments could help protect the roots against initial infection by *F. virguliforme*.

Procedures

Soybean were planted into a field with a history of SDS at the Rossville Unit of the Kansas River Valley Experiment Field in 2014. Seed treatments were applied by DuPont (Wilmington, DE) to two soybean varieties susceptible to SDS, Sloan and Pioneer 93Y91 (Pioneer Hi-Bred, Johnston IA). The treatments included: the DuPont experimental seed treatment at 0.65X, 1.0X, 2.0X, 3.0X; a competitor's seed treatment; and an untreated check. Soybean were planted May 6 at 140,000 seeds/a into 10-ft × 30-ft plots, with four replications in a randomized complete block design. The soil was Eudora silt loam, and the previous crop was soybean. Irrigation with a linear-move sprinkler irrigation system was started on June 24. Total irrigation was 7.81 in., and 21.4 in. of rain was received during the growing season. Preemergence herbicide applied at planting was Authority Maxx (FMC Corporation Agricultural Products Group, Philadelphia, PA) (5 oz) and Cinch (Syngenta Crop Protection, LLC, Greensboro, NC) (1.5 pt). Postemergence herbicide was Roundup PowerMax (Monsanto Company, St. Louis, MO) (22 oz), Assure II (DuPont, Wilmington, DE) (12 oz), and Warrant (Monsanto Company) (1.5 qt). Foliar symptoms of SDS were rated weekly starting July 21, when the soybean were at the R4 (pods full length) stage, through August 18, when plants were at the R6 (full seed) growth stage. Ratings were based on incidence and severity of the symptoms. An area under the disease progress curve (AUDPC), a unitless number describing the development of defoliation effects over time, was derived by plotting periodic measurements of disease over time and integrating the area under the disease curve. A GreenSeeker meter (Trimble Navigation, Ag Division, Westminster, CO) was also used to collect normalized difference vegetation index (NDVI) readings from each plot at the R6 growth stage; NDVI readings are higher when there are abundant green leaves to absorb the light used in photosynthesis. The plots were harvested September 22.

Results

The experimental seed treatment from DuPont reduced the severity of foliar symptoms of SDS (Table 1). The single rating at R6 on August 18 and the AUDPC, which measured disease severity throughout the season, both showed a reduction in SDS severity. The NDVI rating taken at R6 also showed higher ratings for the treatments with the experimental product from DuPont, especially at higher application rates. Yields were higher with the two higher rates of the experimental product (Table 1), which agrees with the higher NDVI ratings and the lower severity ratings for SDS. There was no interaction between variety and seed treatment (data not shown) because the product performed similarly with both varieties.

These data suggest the experimental product from DuPont has the potential to increase soybean yield in the presence of SDS. The environment was very favorable for SDS, and both varieties in the trial were highly susceptible to SDS, showing that this product can reduce yield loss even when the pressure from SDS is severe. Caution should be used in drawing strong conclusions because these data are from only one site, but the results are promising.

Table 1. Influence of an experimental seed treatment for sudden death syndrome (SDS) on soybean yield, Kansas River Valley Experiment Field, Rossville, 2014

Seed treatments	Yield bu/a	SDS foliar	SDS severity AUDPC ²	NDVI ¹
		at R6 %		
DuPont ³ experimental treatment, 0.65X	29.7 c ⁴	39.1 b	410 b	0.705 bc
DuPont experimental treatment, 1.0X	31.9 bc	45.3 b	377 b	0.739 ab
DuPont experimental treatment, 2.0X	35.3 ab	41.0 b	326 b	0.750 a
DuPont experimental treatment, 3.0X	40.0 a	26.6 b	232 b	0.767 a
Competitor's product	28.4 c	68.0 a	806 a	0.669 c
Untreated check	29.6 c	71.1 a	777 a	0.688 c
LSD 0.05	4.8	15.7	183	0.036

¹ Normalized difference vegetation index determined by a GreenSeeker meter (Trimble Navigation, Ag Division, Westminster, CO).

² Area under the disease progress curve, a unitless number describing the development of defoliation effects over time.

³ DuPont (Wilmington, DE).

⁴ Values with the same letter are not statistically different at $P < 0.05$.