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Foliar Fertilization and Fungicide Application for Soybean

Abstract

Numerous trials conducted in Iowa since the 1970s have shown that foliar fertilization results in small, infrequent, and difficult to predict soybean yield responses. Work in the 1970s suggested that spraying N-P-K-S mixtures at late growth stages increased yield, but subsequently hundreds of trials in the Midwest and other regions showed few yield increases. More recent research evaluated N-P-K mixtures with or without sulfur and micronutrients at early stages. It found inconsistent differences between mixtures, a 15% probability of response, and that a single spray with 3 gallon/acre of 3-18-18 gave the most consistent response. Recently, the threat of Soybean Asian Rust has prompted questions about use of fungicide for soybean, alone or in mixture with foliar fertilizers.

Keywords

Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences

Foliar Fertilization and Fungicide Application for Soybean

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Introduction

Numerous trials conducted in Iowa since the 1970s have shown that foliar fertilization results in small, infrequent, and difficult to predict soybean yield responses. Work in the 1970s suggested that spraying N-P-K-S mixtures at late growth stages increased yield, but subsequently hundreds of trials in the Midwest and other regions showed few yield increases. More recent research evaluated N-P-K mixtures with or without sulfur and micronutrients at early stages. It found inconsistent differences between mixtures, a 15% probability of response, and that a single spray with 3 gallon/acre of 3-18-18 gave the most consistent response. Recently, the threat of Soybean Asian Rust has prompted questions about use of fungicide for soybean, alone or in mixture with foliar fertilizers.

To find answers to these questions, one trial was conducted in 2005 and one in 2006 to assess effects of foliar fertilization, a fungicide (*pyraclostrobin*, *Headline*[®]), and their interaction on soybean yield and disease incidence. The soils (Mahaska) tested High or Very High in P and Optimum in K. Eight treatments were replicated three times and are shown in the tables.

Glyphosate-resistant varieties were planted using a 30-in. row spacing. Applications for the V5 growth stage were in late June and for the R2 stage in the middle of July. The rates were 12 oz/acre of the fungicide, 5 gallon/acre of 3-18-18, and 3.33 gallon/acre of 28% UAN (10 lb N/acre). Treatments were sprayed immediately after mixing the solutions, which turned a light white color with no material settling.

Results and Discussion

Leaf burn and foliage duration. Spraying 3-18-18 fertilizer or fungicide caused little or no leaf burn but UAN caused some burning in both years (Table 1). The mixture of UAN and fungicide had no effect on leaf burning. Fungicide application delayed soybean maturity as assessed by remaining green leaf area (Table 2). Foliar fertilization had little effect on maturity, except for a delay in 2005 by 3-18-18 applied at V5 and R2 growth stages.

Yield and grain quality responses. Results in 2005 were not consistent (Table 3). Only yields for the fungicide alone and UAN alone were statistically greater than for the control (4.0 to 7 bushels/acre), but UAN did not differ from any other treatment. We conclude that the fungicide and UAN increased yield, but there were also small effects from other treatments. In 2006, fungicide increased yield, regardless of foliar fertilizer (7 to 11 bushels/acre). Statistically, mixing foliar fertilizer and fungicide did not influence the fungicide effect, although yields were slightly reduced. No treatment affected protein and oil content of soybean grain (data not shown).

Leaf diseases. Treatment effects on diseases were not consistent (Table 4). In 2005, the fungicide decreased incidence or severity of Brown Spot and Downy Mildew. The UAN alone also reduced disease incidence or severity but less than the fungicide. This effect partly explained yield responses. In 2006, fungicide application reduced the severity of Brown Spot and, unexpectedly of Bacterial Blight. This control matched the yield response from the fungicide. Foliar fertilizers did not affect diseases and did not influence fungicide effects.

Conclusions

The results show that fungicide application is likely to increase soybean yield in this region of

Iowa but effects of foliar fertilization are more uncertain. There was no negative effect from mixing fluid fertilizers and the fungicide. These conclusions will be confirmed or modified by new field trials to encompass different growing conditions.

Table 1. Treatment effects on leaf burn.

Treatment	2005	2006
	----- % -----	
Control	0	0
Fungicide	0	0
3-18-18 at V5	0	0
3-18-18 at R2	0	4
3-18-18 at V5 and R2	0	5
3-18-18 at R2 + Fungicide	0	9
UAN at R2	10	17
UAN at R2 + Fungicide	3	23

Table 2. Treatment effects on leaf area remaining late in the season.

Treatment	2005	2006
	----- % -----	
Control	13	4
Fungicide	22	25
3-18-18 at V5	17	4
3-18-18 at R2	17	4
3-18-18 at V5 and R2	33	4
3-18-18 at R2 + Fungicide	11	20
UAN at R2	21	3
UAN at R2 + Fungicide	21	25

Table 3. Treatment effects on grain yield.

Treatment	2005	2006	Avg
	----- bu/acre -----		
Control	55.0	53.8	54.4
Fungicide	61.6	64.5	63.1
3-18-18 at V5	57.7	54.3	56.0
3-18-18 at R2	57.0	53.0	55.0
3-18-18 at V5 and R2	56.7	55.2	56.0
3-18-18 at R2 + Fungicide	57.1	62.0	59.6
UAN at R2	59.0	54.2	56.6
UAN at R2 + Fungicide	58.1	60.9	59.5
Statistics (LSD 0.05)	3.6	2.9	

Table 4. Treatment effects on incidence and severity of soybean diseases.

Site	Treatment	Brown Spot		Bacterial Blight		Downy Mildew	
		Incid*	Sev*	Incid	Sev	Incid	Sev
		%		%		%	
2005	Control	100	3.0	0.3	0.7	67	1.7
	Fungicide	63	0.7	2.0	0.7	20	1.0
	3-18-18 at V5	100	3.0	0.0	0.0	80	2.3
	3-18-18 at R2	100	2.7	0.7	0.7	87	2.3
	3-18-18 at V5 and R2	100	2.7	3.3	0.5	87	2.3
	3-18-18 at R2 + Fungicide	100	1.7	0.3	0.3	20	1.5
	UAN at R2	100	2.0	0.7	0.7	40	1.3
	UAN at R2 + Fungicide	100	1.5	0.7	0.7	50	1.3
2006	Control	100	3.0	100	2.0	-	-
	Fungicide	100	1.0	60	1.0	-	-
	3-18-18 at V5	100	3.0	100	2.2	-	-
	3-18-18 at R2	100	3.0	100	2.2	-	-
	3-18-18 at V5 and R2	100	3.0	100	2.0	-	-
	3-18-18 at R2 + Fungicide	100	1.8	75	1.1	-	-
	UAN at R2	100	3.0	100	2.0	-	-
	UAN at R2 + Fungicide	100	1.0	87	1.0	-	-

*Incid=disease incidence, percent of foliage area. Sev=severity on a scale from 0 (no symptoms) to 5 (>60% chlorotic or necrotic leaf surface). Cercospora Leaf Blight and Frog Eye Spot were present at very low incidence.