

On-Farm Soybean Fertilizer Trials

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Introduction

All cropping systems require fertilizer inputs in order to maintain crop yields. Farmers continue to search for ways to increase soybean yields, such as applying micronutrients and using foliar applications of fertilizer. Although micronutrients are just as essential to plant growth as macronutrients, past research has indicated most Iowa soils can supply the micronutrient needs of soybeans.

Materials and Methods

In 2014, five trials utilizing various methods of fertilizing soybeans were investigated (Table 1). All trials were conducted on-farm by farmer cooperators using the farmers' equipment. Strips were arranged in a randomized complete block design with at least three replications per treatment. Strip length and width varied from field to field depending on equipment size and size of field. All strips were machine harvested for grain yield.

In Trial 1, a foliar application of fertilizer containing sulfur (S), boron (B), manganese (Mn), and zinc (Zn) to soybeans at the R1 growth stage was compared with untreated soybeans. Soil samples were collected to a 6-in. depth before spraying on the day of the foliar application and analyzed for nutrients. All analyses were made on dried soil. In Trial 2, a foliar application of fertilizer containing nitrogen (N), S, B, Mn, and Zn to soybeans at

the V6 stage was compared with untreated soybeans. In Trials 3 and 4, a foliar application of fertilizer containing 30 lb/acre N and 4 lb/acre S was compared with untreated soybeans. In Trial 5, soybeans planted with two application rates of starter fertilizer (five and eight gallons/acre of 3-18-18) were compared with soybeans planted without starter. The starter was applied 3 in. to the side and 0.75 in. below the seed. Prior to planting, the soil in this field tested high in phosphorus (25 ppm) and low in potassium (150 ppm).

Results and Discussion

No increase in soybean yields was seen with the foliar application of micronutrients in either Trial 1 or 2 (Table 2). This agrees with past research that has shown yield increases are not common with micronutrient applications to soybeans on most of Iowa's soils. In 2013, in on-farm trials investigating foliar applications of micronutrients to soybeans, there was a yield increase in only one of 10 trials. The percent organic matter in the soil in Trial 1 was 8.4 percent (Table 3), which would likely be more than sufficient to supply the micronutrient needs of the crop.

With the soil test in Trial 1, no yield increase from zinc and manganese were expected because soil levels were high according to interpretations in Iowa (only for zinc) and the north-central region. There are no interpretations for boron in Iowa, and we should have seen a yield increase in this trial according to interpretations in Illinois, but no increase according to interpretations in South Dakota. Results will be used with other ongoing research to establish interpretations.

There was no effect of the foliar application of N and S to soybeans in Trials 3 and 4. Neither application rate of the starter fertilizer in Trial 5 had any effect on soybean yield.

Table 1. Variety, row spacing, planting date, planting population, previous crop, and tillage practices in on-farm soybean fertilizer trials in 2014.

Exp. no.	Trial	County	Variety	Row spacing (in.)	Planting date	Planting population (seeds/A)	Previous crop	Tillage
140402	1	Cerro Gordo	Croplan R2T2240	30	5/24/14	160,000	Corn	No-till
140163	2	Lyon	Pioneer 92Y22	30	5/15/14	140,000	Corn	Strip till
140715	3	Louisa	Asgrow 3832	30	5/3/14	150,000	Corn	Conventional
140717	4	Des Moines	Asgrow 3832	30	5/4/14	150,000	Corn	Conventional
140405	5	Worth	AgVenture 22E1	30	5/18/14	148,000	Corn	Conventional

Table 2. Yield from on-farm soybean fertilizer trials in 2014.

Exp. no.	Trial	Treatment	Yield (bu/A)			P-value ^x
			Treatment	Control	Response	
140402	1	Micro Mix [1 qt/A Winfield Max-in ZMB [®] (S, B, Mn, Zn) + 1 pt/A Max-in Boron] @ R1	55	55	0	0.77
140163	2	1 qt/A Brandt Smart Trio [®] (4% N, 3% S, 0.25% B, 3% Mn, 3% Zn) @ V6	55	54	1	0.49
140715	3	75 lb/A of 40-0-0-5.5 (30 lb/A N & 4 lb/A S) @ R3	76	78	-2	0.49
140717	4	75 lb/A of 40-0-0-5.5 (30 lb/A N & 4 lb/A S) @ R3	62	64	-2	0.18

^xP-Value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-Value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.

Table 2. Yield from on-farm soybean fertilizer trials in 2014, continued.

Exp. no.	Trial	Treatment	Yield (bu/A) ^x	P-value ^y
140405	5	8 gal/A Starter	48 a	0.25
		5 gal/A Starter	46 a	
		Control	46 a	

^xValues denoted with the same letter are not significantly different at the significance level 0.05.

^yP-Value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-Value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.

Table 3. Soil analysis from one on-farm soybean micronutrient trial in 2014.

Exp. no.	Trial	Phosphorus (ppm) ^x	Potassium (ppm) ^x	pH	Organic matter			
					(%)	Boron (ppm) ^y	Zinc (ppm) ^c	Man-ganese (ppm) ^z
140402	1	47	248	6.7	8.4	1.3	1.5	8.9

^xMehlich- 3 method

^yHot-water method

^zDTPA method