On-Farm Corn and Soybean Fertilizer Demonstration Trials

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Introduction

All cropping systems require fertilizer inputs to maintain crop yields. However, excess fertilizer, especially nitrogen (N) and phosphorus (P), can increase problems with water quality. Micronutrients are required for all crops. It is important for farmers to use the appropriate rates and methods of fertilizer application to optimize yields and minimize the impact on the environment. The purpose of these trials was to investigate the effect of various fertilizer practices on crop yield.

Materials and Methods

In 2018, five corn trials and eight soybean trials using various methods of fertilizing the crop were conducted (Tables 1 and 2). Most trials were conducted on-farm by farmer cooperators. Some of the trials were conducted on research farms. Strips were arranged in a randomized complete block design with at least three replications per treatment. Strip width and length varied from field-to-field depending on field and equipment size. All strips were machine harvested for grain yield.

In corn Trial 1, three rates of N fertilizer were side-dressed at V10 after a base rate of 80 lb N/acre at planting and compared with the at-planting-only application (Table 3). In Trial 2, five rates of N fertilizer, from 25 lb/acre to 150 lb/acre, were compared with no N fertilizer. In Trial 3, starter plus Dynahume™ was compared with starter only. Dynahume™ contains humic acid and is marketed by Schaeffer Crop Enhancements. In Trial 4, 5 lb N/acre starter fertilizer was compared with no starter. In Trial 5, various rates of N applied at planting and at V10 as urea and ESN were investigated. ESN is a slow release N fertilizer. This trial was conducted on sandy soil with irrigation. All corn trials were on soybean ground.

In soybean Trial 1, three rates of N were foliar applied at R1 and compared with no N application (Table 4). In Trial 2, Prioxor® with and without Borpak™ were foliar applied at R2. Borpak™ contains boron and is marketed by AgXplore. In Trials 3 and 4, foliar applications of Borpak™ and Stomaboost™ were applied to R1 soybeans and compared with no application. Stomaboost™ is marketed by Schaeffer Crop Enhancements and contains N, P, and potassium, and micronutrients. In Trials 5, 6, and 7, SOIL Cal® was applied preemergence and compared with no application. SOIL Cal® is 12 percent calcium and is marketed by Soil Services, Inc. In Trial 8, Max-in® Ultra ZMB® was applied at V6 and compared with no application. Max-n® Ultra ZMB® contains sulfur, boron, manganese, and zinc and is marketed by Agrisolutions.

Results and Discussion

In corn Trial 1, all side-dress applications of N increased the corn yield compared with the at-planting-only application of 80 lb/acre (Table 3). There was not a significant difference in yield among the three side-dress applications of 30, 60 and 90 lb/acre following the 80 lb/acre at planting. In Trial 2, the spring application of 150 lb N/acre increased the corn

yield compared with no N, but the yield was not significantly greater than with the 50 lb/acre rate. In Trial 3, the in-furrow application of Dynahume had no effect on corn yield. In Trial 4, the 5 lb/acre N applied as starter had no effect on the corn yield. The field received a fall application of swine manure containing 120 lb/acre N. In corn Trial 5, there was no difference in corn yield with the various rates of ESN and urea N fertilizers, indicating the rate of 120 lb/acre before planting plus 40 lb/acre at V4 of either the urea or ESN was sufficient to obtain optimum yields.

In most trials, N rates of about 100 to 150 lb/acre were sufficient to get optimum corn yields on soybean ground. At current corn and N prices, the recommended rate of N would be approximately 125 lb/acre on soybean ground. This is the Maximum Return to Nitrogen rate calculated using the corn nitrogen rate calculator at http://extension.agron.iastate.edu/soilfertility/nrate.aspx. Weather conditions are important in determining how corn responds to N rates and application timings, so different results might be seen in other years.

In soybean Trial 1, foliar applied N did not increase soybean yields (Table 4). In Trial 2, foliar applied Borpak™ had no effect on soybean yield. In Trials 3 and 4, foliar applied Dynahume™ and Stomaboost™ had no effect on soybean yield. In Trial 5, SOIL Cal® applied preemergence increased the soybean yield by 1 bushel/acre, but there was no effect on soybean yield with SOIL Cal® in Trials 6 and 7. In Trial 8, foliar applied Max-n® Ultra ZMB® had no effect on soybean yield. Although micronutrients are essential for crop growth, most Iowa soils contain sufficient micronutrients for optimum yields.

NOTE: The results presented are from replicated demonstration trials. Statistics are used to detect differences at a location and should not be interpreted beyond the single location.

Table 1. Hybrid, row spacing, planting date, planting population, previous crop, and tillage practices in the 2018 fertilizer trials on corn.

Exp. no.	Trial	County	Hybrid	Row spacing (in.)	Planting date	Planting population (seeds/ac)	Previous crop	Tillage
180127	1	Sioux	Pioneer PO574AM	30	5/17/18	35,000	Soybean	No-till
180411	2	Wright	Beck's 5113AM	30	5/18/18	35,000	Soybean	Conventional
180604	3	Cass	NuTech 5F308AM	30	4/28/18	32,500	Soybean	No-till
180816	4	Bremer	Channel 209-53STXRIB	30	5/8/18	34,500	Soybean	No-till
180901	5	Muscatine	Dyna-Gro D52VC91RIB	30	5/7/18	35,600	Soybean	Disked

Table 2. Variety, row spacing, planting date, planting population, previous crop, and tillage practices in the 2018 fertilizer trials on soybean.

Exp. no.	Trial	County	Variety	Row spacing (in.)	Planting date	Planting population (seeds/ac)	Previous crop	Tillage
180410	1	Wright	Beck's 204L4	30	6/118	150,000	Corn	Strip Till
180503	2	Story	Pioneer P28T08	30	5/25/18	140,000	Corn	Fall rip, spring field cultivate
180601	3	Cass	Epley 260RR	30	5/24/18	150.000	Rye	No-till
180602	4	Cass	Epley 260RR	30	5/24/18	150,000	Rye	No-till
180605	5	Cass	Epley 294RR	30	5/14/18	150,000	Corn	Disked
180606	6	Cass	Epley 294RR	30	5/14/18	150,000	Corn	Disked
180607	7	Pottawattamie	Golden Harvest 2981X	15	5/22/18	142,000	Corn	No-till
180123	8	Sioux	Pioneer P19A14X	30	5/7/18	140,000	Corn	No-till

Table 3. Yield from corn fertilizer trials in 2018.

Exp. no.	Trial	Treatment	Yield (bu/ac)[a]	P-value[b]
180127	1	80 lb/ac N as 32%UAN at planting	169 a	<0.01
		80 lb/ac N as 32% UAN at planting plus 30 lb/ac N as 32%UAN at V10	193 b	
		80 lb/ac N as 32% UAN at planting plus 60 lb/ac N as 32%UAN at V10	203 bc	
		80 lb/ac N as 32% UAN at planting plus 90 lb/ac N as 32%UAN at V10	213 c	
180411	2	No nitrogen	89 a	<0.01
		25 lb/ac N as 32% UAN one day before planting	110 ab	
		50 lb/ac N as 32% UAN one day before planting	125 abc	
		75 lb/ac N as 32% UAN one day before planting	131 abc	
		100 lb/ac N as 32% UAN one day before planting	152 bc	
		150 lb/ac N as 32% UAN one day before planting	164 c	
180604	3	5 gal/ac 9-18-9-1 plus Dynahume at 1 pt/ac applied in-furrow	183 a	0.90
		5 gal/ac 9-18-9-1 applied in-furrow	184 a	
180816	4	10,000 gal/ac liquid swine manure (120 lb/ac N) in the fall	214 a	0.21
		10,000 gal/ac liquid swine manure (120 lb/ac N) in the fall plus 5 lb/ac N as 32% UAN in 2X2 placement	218 a	
180901	5	120 lb/ac N as ESN 4 days before planting plus 40 lb/ac at V4	149 a	0.64
		120 lb/ac N as ESN 4 days before planting plus 80 lb/ac at V4	158 a	
		120 lb/ac N as ESN 4 days before planting plus 120 lb/ac at V4	163 a	
		120 lb/ac N as urea 4 days before planting plus 40 lb/ac at V4	144 a	
		120 lb/ac N as urea 4 days before planting plus 80 lb/ac at V4	141 a	
		120 lb/ac N as urea 4 days before planting plus 120 lb/ac at V4	161 a	

[a]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.05.
[b]P-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 4. Yield from soybean fertilizer trials in 2018.

Exp. no.	Trial	Treatment	Yield (bu/ac)[a]	P-value[b]
180410	1	No Nitrogen	48 a	0.08
		30 lb/ac N as 32% UAN at R1	48 a	
		45 lb/ac N as 32% UAN at R1	50 a	
		60 lb/ac N as 32% UAN at R1	48 a	
180503	2	Borpak at 1 pt/ac plus priaxor at 8 oz/ac at R2	51 a	0.95
		Priaxor at 8 oz/ac at R2	51 a	
180601	3	Dynahume at 1 qt/ac plus stomaboost at 1 qt/ac at R1	52 a	0.96
		Control	52 a	
180602	4	Dynahume at 1 qt/ac plus stomaboost at 1 qt/ac at R1	43 a	0.85
		Control	43 a	
180605	5	3 gal/ac of SOIL Cal broadcast preemergence	53 a	0.02
		Control	52 b	
180606	6	6 gal/ac of SOIL Cal broadcast preemergence	50 a	0.48
		Control	49 a	
180607	7	3 gal/ac of SOIL Cal applied preemergence	50 a	0.90
		Control	50 a	
180123	8	Max-in Ultra ZMB at 1 qt/ac at V6	84 a	0.81
		Control	84 a	

[a]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.05.
[b]P-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.