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. Starter fertilizer has been shown to occasionally increase corn yields, but is a lesser tested practice in soybean. 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 and practices on crop yield.

Materials and Methods

In 2020, nine corn, three soybean, and two alfalfa trials were conducted using various methods of macro and micronutrient fertilizing products and practices (Tables 1 and 2). In corn trial 200005, an application of 13 lb/acre of NutriSync® Sulfur (6-0-0 6.3% S) was investigated against a control of no product. In trial 200006, an application of NutriSync® Manganese (0-0-2 3% Mn) was investigated for yield differences. Trial 200007 investigated NutriSync® Zinc (0-0-0 6% Zn) versus a control of no product. Trial 200008 looked at NutriSync® Boron (0-0-0 5% B) for yield differences with no treatment. Trials 200005-200008 were foliar applied on June 24, 2020. Trial 200108 investigated a foliar application on corn of MAX-IN® Boron (0-0-0 8% B) July 24, 2020, at 24 oz/acre rate. Trial 200202 investigated corn yield differences based on timing of 150 lb/acre application of 28 percent N April 29 and June 3, 2020. A zero nitrogen application also was used in this study. Trials 200205 and 200206 both investigated yield differences with the use of Conklin Feast® Micromaster™ Manganese (3-0-10 6% Mn) and none. Trial 200205 was applied with water at the V4 stage. Trial 200206 was applied with a fertilizer (9-18-9) and applied foliar at V5. Trial 200407 investigated corn yield differences utilizing granular Sulf-N® ammonium sulfate AMS (21-0-0-24S) from AdvanSix Corporation applied May 15, 2020 with a granular spreader application. Trial 200604 investigated the use of a starter fertilizer on soybean. The starter fertilizer NACHURS Triple Option® (4-13-17) was applied in furrow at planting and compared with strips with no starter. Trials 200614 and 200615 investigated the use of the product TerraNu® Ignite. TerraNu® Ignite is advertised as a granule of manure digestate, ammonium sulfate, monoammonium phosphate, sulfate of potash, potassium magnesium sulfate, lime, borate, zinc sulfate, manganese sulfate and copper sulfate.

Trial 200003 and 200004 investigated the addition of 20 lb/acre of actual sulfur in the form of a gypsum product to an alfalfa grass mixture at different timings (Table 2). Treatment one had an application of 20 lb/acre of actual sulfur performed once in early spring before first cutting. Treatment two had sulfur applied early spring before first cutting, after first cutting and after second cutting at the rate of 20 lb/acre of actual sulfur per application. These treatments were compared with a control of no additional sulfur inputs throughout the season on the alfalfa grass

mixture. 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.

Results and Discussion

In all the micronutrient corn trials—200006, 200007, 200008, 200108, 200205, and 200206—none showed a significant difference in yield to the level of $P \leq 0.10$. This indicates that although micronutrients are essential for crop growth, most Iowa soils contain sufficient micronutrients for optimum yields. Trials 200005 and 200407 that contained sulfur applications on corn also did not show a significant yield difference to the $P \leq 0.10$ threshold. Corn trial 200202 showed a significant difference in yield when treatments were compared with the no nitrogen treatment. There was no significance between the application timings, but there was a minimum 50 bushel advantage to adding 150 lb/acre of 28 percent N to the soil. Trial 200604 showed an 18 bushel/acre significant ($P < 0.01$) advantage to using the starter fertilizer on soybean. This trial location was on Marshall Silty Clay loam soils. This trial would indicate a large advantage to starter fertilizer with soybean, which has been documented in the past. However, this is a demonstration trial and a single point of data and should not be extrapolated to all starter fertilizer application on soybean. Trial 200614 and 200615 investigated TerraNu® Ignite fertilizer and had one trial showing a significant yield advantage of two bushels/acre by using the product. Trial 200614 using the BASF 2830GTLL product labeled a "workhorse" variety showed the two bushels/acre advantage. Trial 200615 using the BASF 2760GTLL "racehorse" variety had no significant ($P = 0.10$) yield advantage. Trials 200003 and 200004 showed no significant yield differences from the addition of 20 lb/acre of actual sulfur, regardless of treatment, in the alfalfa grass mixtures when compared with the control (Table 4).

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. Variety, row spacing, planting date, planting population, previous crop, and tillage practices in the 2020 fertilizer trials on corn and soybean.

Trial	County	Variety	Row spacing (in.)	Planting date	Planting population (seeds/ac)	Previous crop	Tillage
Corn							
200005	Lucas	Pioneer P1380	30	4/30/20	30,000	Soybean	Vertical till
200006	Lucas	Pioneer P1380	30	4/30/20	30,000	Soybean	Vertical till
200007	Lucas	Pioneer P1380	30	4/27/20	30,000	Soybean	Vertical till
200008	Lucas	Pioneer P1380	30	4/27/20	30,000	Soybean	Vertical till
200108	Sioux	Pioneer P9492AM	30	5/29/20	34,000	Alfalfa	Conventional
200202	Buena Vista	Champion 52A18VT2 Rib	30	4/22/20	35,000	Soybean fall winter wheat CC	No-till
200205	Crawford	Wyffels 6408	30	4/23/20	33,000	Corn	Fall/spring disc/cultivate
200206	Crawford	Golden Harvest G14R38	30	4/23/20	33,000	Corn	Fall/spring disc/cultivate
200407	Hancock	Wyffels 5516	30	4/23/20	35,000	Soybean	Conventional
Soybean							
200604	Pottawattamie	BASF CZ 2830 GTLL	30	4/25/20	140,000	Corn	No-till
200614	Pottawattamie	BASF CZ 2830 GTLL	15	5/1/20	140,000	Corn	No-till
200615	Pottawattamie	BASF CZ 2760 GTLL	15	5/1/20	140,000	Corn	No-till

Table 2. Variety, planting date, and year in the 2020 fertilizer trials on alfalfa.

Trial	County	Variety	Planting date	Year
200003	Lucas	Optimum 4.2 alfalfa/grass	2019	1
200004	Lucas	Optimum 4.2 alfalfa/grass	2019	1

Table 3. Yield from corn and soybean fertilizer trials in 2020.

Trial	Treatment	Application date	Yield (bu/ac)[a]	P-value[b]
Corn				
200005	13 lb/ac of Nutrisync Sulfur	6/24/20	177 a	0.21
	Control		190 a	
200006	3 lb/ac of Nutrisync Manganese	6/24/20	184 a	0.71
	Control		188 a	
200007	7 lb/ac of Nutrisync Zinc	6/24/20	194 a	0.37
	Control		205 a	
200008	5.5 lb/ac Nutrisync Boron	6/24/20	196 b	0.17
	Control		212 a	
200108	7 lb/ac MAX-IN Boron	7/24/20	210 a	0.55
	Control		210 a	
200202	150 lb/ac of 28% N	4/29/20	219 a	<0.01
	150 lb/ac of 28% N	6/3/20	215 a	
	No nitrogen		165 b	
200205	7 lb/ac of Conklin Manganese	V4	191 a	0.44
	Control		192 a	
200206	7 lb/ac of Conklin Manganese	V5	207 a	0.71
	Control		206 a	
200407	142.8 lb/ac of Sulf-N AMS	5/15/20	154 a	0.23
	Control		164 a	
Soybean				
200604	2 gal/ac NACHURS Triple Option	4/25/20	73 a	<0.01
	Control		55 b	
200614	TerraNu Ignite	5/3/20	77 a	0.05
	Control		75 b	
200615	TerraNu Ignite	5/3/20	75 a	0.19
	Control		73 a	

[a]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.10.
[b]P-value = the calculated probability that the difference in yields can be attributed to the treatments and no 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. This is consistent for demonstration trials.

Table 4. Yield for on-farm sulfur on alfalfa/grass trial in 2020.

		Yield (tons/ac)[a]				
Trial	Sulfur source and rate (lb/ac)	1st cutting	2nd cutting	3rd cutting	Total	P-value (total)[b]
200003	Gypsum at 20- single application	3.71 a	1.96 b	1.76 a	7.43 a	0.97
	Gypsum at 20- application after each cutting	3.35 b	2.07 ab	1.83 a	7.25 a	
	No sulfur	3.34 b	2.28 a	1.83 a	7.45 a	
200004	Gypsum at 20- single application	3.24 a	2.39 a	1.77 a	7.40 a	0.96
	Gypsum at 20- application after each cutting	3.49 a	2.36 a	1.72 a	7.57 a	
	No sulfur	3.21 a	2.42a	1.73 a	7.36 a	

[a]Values denoted with the same letter within a cutting are not statistically different at the significance level of 0.10.
[b]P-value = the calculated probability that the difference in yields can be attributed to the treatments and no 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. This is consistent for demonstration trials.