

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. 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 2019, nine corn trials and four 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, a split application of 100 lb/acre N at planting plus 50 lb/acre N at V10 was compared with an application of 150 lb/acre N at planting (Table 3). In Trial 2, an application of 1 qt/acre of Harvest Plus™ at V8 was compared with no Harvest Plus™. Harvest Plus™ contains N, S, B, Mn, and Zn and is marketed by Stoller. In Trials 3 and 4, 3 gal/acre SOIL Cal® at V7 with N was compared with N alone. SOIL Cal® is 12 percent calcium and is marketed by Soil Services, Inc. In Trial 5, Nutriplant® AG at 8 oz/100 lb of seed was compared with no Nutriplant® AG. Nutriplant® AG is marketed by Amway and contains N, P, K, S, B, Co, Cu, Fe, Mn, Mo, and Zn. In Trial 6, 5 gal/acre of 7-24-6 in furrow was compared with no starter fertilizer. In Trial 7, various rates of N applied before planting and at V4 as urea and ESN were investigated. ESN is a slow release N fertilizer. This trial was conducted on sand with irrigation. In Trials 8 and 9, Pivot Bio Proven™ was applied in furrow and compared with a control. Pivot Bio Proven™ is marketed as an N producing microbial product. Trials 4 and 8 were on corn ground and the other trials were on soybean ground (Table 1).

In soybean Trials 1 and 2, Boost™ at 2 gal/acre at V5 to R2 was compared with a control. Boost™ is a molasses-based fertilizer with an analysis of 4-0-3-2S (Table 4). It is marketed by Midwestern BioAg. In Trials 3 and 4, Harvest Plus™ was applied at 1-2 qt/acre at R1-R3 and compared with a control.

Results and Discussion

In corn Trial 1, there was no difference in corn yield between the split application of N and the preplant application (Table 3). In Trial 2, Harvest Plus™ had no effect on corn yield. In Trials 3 and 4, SOIL Cal® had no effect on

corn yield. In Trial 5, Nutriplant[®] AG increased corn yield by 7 bushels/acre ($P = 0.10$). In Trial 6, the 7-24-6 starter fertilizer increased the corn yield by 4 bushels/acre ($P = 0.09$).

In Trial 7, there was an increase in corn yield with the sidedress application of both urea and ESN up to 80 lb N/acre. All treatments included a preplant application of 120 lb N/acre, so the optimum total rate was 200 lb N/acre. There was no difference in yield at each N rate between urea and ESN, indicating no advantage to the slow release N. Trial 7 was on a sandy soil with irrigation, which would increase N losses making the optimum rate higher than on most Iowa soils. 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 Trials 8 and 9, Pivot Bio Proven[™] had no effect on corn yield.

In soybean Trials 1 and 2, Boost[™] had no effect on soybean yield (Table 4). In Trials 3 and 4, Harvest Plus[™] 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. Variety, row spacing, planting date, planting population, previous crop, and tillage practices in the 2019 fertilizer trials on corn.

| Exp. no. | Trial | County | Variety | Row spacing (in.) | Planting date | Planting population (seeds/ac) | Previous crop | Tillage |
|----------|-------|---------------|--------------------------------|-------------------|---------------|--------------------------------|---------------|---------------|
| 190111 | 1 | Sioux | Pioneer PO306AM | 30 | 6/3/19 | 34,000 | Soybean | Disked |
| 190205 | 2 | Buena Vista | Channel CSX52 A18VT2 Pro | 15 | 5/4/19 | 35,000 | Soybean | Mulch till |
| 190607 | 3 | Adair | Pioneer PO919AM | 30 | 4/23/19 | 34,000 | Soybean | No-till |
| 190610 | 4 | Cass | Hoggenmeyer 7774 | 30 | 5/4/19 | 32,000 | Corn | Vertical till |
| 190614 | 5 | Pottawattamie | Wyffles W6896RIB | 30 | 4/22/19 | 34,000 | Soybean | No-till |
| 190805 | 6 | Bremer | Wyffles 3488RIB SS | 30 | 5/14/19 | 34,500 | Soybean | No-till |
| 190901 | 7 | Muscatine | Pioneer P1197 | 30 | 5/10/19 | 34,000 | Soybean | Soil finisher |
| 190413 | 8 | Hamilton | Dekalb DKC6087 SSRIB | 30 | 4/26/19 | 33,800 | Corn | Conventional |
| 190811 | 9 | Bremer | Pioneer 1197AMXT | 30 | 5/5/19 | 34,500 | Soybean | No-till |

Table 2. Variety, row spacing, planting date, planting population, previous crop, and tillage practices in the 2019 fertilizer trials on soybean.

| Exp. no. | Trial | County | Variety | Row spacing (in.) | Planting date | Planting population (seeds/ac) | Previous crop | Tillage |
|----------|-------|------------|-----------------------------|-------------------|---------------|--------------------------------|---------------|---|
| 190113 | 1 | Sioux | Pioneer P19A14X | 30 | 6/6/19 | 140,000 | Corn | Field cultivate |
| 190114 | 2 | Sioux | Pioneer P19A14X | 30 | 5/14/19 | 140,000 | Corn | No-till |
| 190504 | 3 | Boone | Miller 2653 Liberty Link | 30 | 5/26/19 | 140,000 | Corn | Fall disk ripped, Spring field cultivate |
| 190714 | 4 | Washington | Pioneer P29A85L | 30 | 6/12/19 | 160,000 | Corn | Fall chisel, Spring soil finisher |

Table 3. Yield from corn fertilizer trials in 2019.

| Exp. no. | Trial | Treatment | Yield (bu/ac) ^a | P-value ^b |
|----------|-------|---|----------------------------|----------------------|
| 190111 | 1 | 100 lb/ac N as 32% UAN preplant plus 50 lb/ac N as 32% UAN at V10 | 195 a | 0.42 |
| | | 150 lb/ac N as 32% UAN preplant | 197 a | |
| 190205 | 2 | Harvest Plus at 1 qt/ac at V8 | 238 a | 0.57 |
| | | Control | 237 a | |
| 190607 | 3 | SOIL Cal at 3 gal/ac with 140 lb/ac N as NH3 at V7 | 189 a | 0.16 |
| | | 140 lb/ac N as NH3 at V7 | 198 a | |
| 190610 | 4 | SOIL Cal at 3 gal/ac with 150 lb/ac N as NH3 at V7 | 188 a | 0.29 |
| | | 150 lb/ac N as NH3 at V7 | 184 a | |
| 190614 | 5 | Nutriplant AG at 8 oz/100 lb of seed | 185 a | 0.10 |
| | | Control | 178 a | |
| 190805 | 6 | 7-24-6 at 5 gal/ac in-furrow | 235 a | 0.09 |
| | | No starter | 231 a | |
| 190901 | 7 | 120 lb/ac N as ESN 4 days before planting plus 40 lb/ac at V4 | 196 c | <0.01 |
| | | 120 lb/ac N as ESN 4 days before planting plus 80 lb/ac at V4 | 230 b | |
| | | 120 lb/ac N as ESN 4 days before planting plus 120 lb/ac at V4 | 248 ab | |
| | | 120 lb/ac N as ESN 4 days before planting | 164 d | |
| | | 120 lb/ac N as urea 4 days before planting plus 40 lb/ac at V4 | 202 c | |
| | | 120 lb/ac N as urea 4 days before planting plus 80 lb/ac at V4 | 240 ab | |
| | | 120 lb/ac N as urea 4 days before planting plus 120 lb/ac at V4 | 258 a | |
| | | 120 lb/ac N as urea 4 days before planting | 163 d | |
| 190413 | 8 | Pivot Bio Proven at 119 oz/ac in-furrow | 203 a | 0.97 |
| | | No starter | 203 a | |
| 190811 | 9 | Pivot Bio Proven at 12.8 oz/ac in-furrow | 185 a | 0.21 |
| | | No starter | 192 a | |

^aValues denoted with the same letter within a trial are not statistically different at the significance level of 0.05.

^bP-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 2019.

| Exp. no. | Trial | Treatment | Yield (bu/ac) ^a | P-value ^b |
|----------|-------|-------------------------------|----------------------------|----------------------|
| 190113 | 1 | Boost at 2 gal/ac at V5 | 65 a | 0.90 |
| | | Control | 66 a | |
| 190114 | 2 | Boost at 2 gal/ac at R2 | 64 a | 0.41 |
| | | Control | 64 a | |
| 190504 | 3 | Harvest Plus at 1 qt/ac at R1 | 56 a | 0.30 |
| | | Control | 59 a | |
| 190714 | 4 | Harvest Plus at 2 qt/ac at R3 | 61 a | 0.19 |
| | | Control | 63 a | |

^aValues denoted with the same letter within a trial are not statistically different at the significance level of 0.05.

^bP-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.