ILLINOIS

Starter Fertilizers for No-till Corn

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Illinois researchers recently investigated the potential for different starter fertilizer applications to enhance early plant growth and yield in no-till corn in a three-year study at four locations. Their data confirm the value of starter fertilizer in no-till corn production in the central Corn Belt showing a high probability of a yield response, especially under adverse growing conditions.

Illinois studies add emphasis to the value of starter fertilization for no-till corn even when initial soil phosphorus (P) and potassium (K) soil tests are high.

The four study sites represented different climate/soil type/crop rotation/soil test regimes (**Table 1**). Corn was planted at 35,000 seeds/A and stands were hand-thinned to 29,000 plants/A at the V6 growth stage.

Banded Starter

Starter fertilizer, banded 2 inches to the side and 2 inches below the seed row (2x2) increased yields in 8 of the 9 site-years, regardless of the previous crop (**Tables 2-4**). When early season P and K soil test levels were near recommended minimums (or broadcast K was applied preplant to bring soil test K to recommended levels), average yield increases were 8 bu/A for nitrogen (N) alone (25+0+0), 13 bu/A for N and P (25+30+0) and 14 bu/A for N, P and K (25+30+20).

Because starter fertilizer leads to more vigorous early growth and earlier maturity, yield benefits from starter were more evident in the late-planted 1995 crop. Poor root growth in the top soil, plus low K levels deeper in the profile, probably caused the greater response to starter K at Ashton and

TABLE 1. Description of starter study locations.

Site	Soil type	Previous crop	pH	Soil test, lb/A P_1	K
Ashton	Typic Argiudoll (sil)	Corn	6.2	91	385
Gridley	Typic Argiudoll (sil)	Soybean	6.4	31	245
Pana	Udollic Ochraqualf (sil)	Soybean	7.2	50	276
Oblong	Aeric Ochraqualf (sil)	Soybean	6.7	31	148

TABLE 2. Effect of 2x2 banded starter fertilizer on no-till corn grain yield (1993).

Starter, lb/A N	P_2O_5	K_2O	Location/Yield, bu/A Ashton	Gridley[1]	Pana	Oblong
0	0	0	122	–	171	187
25	0	0	131	–	175	194
25	30	0	142	–	185	196
25	30	20	138	–	178	196

[1]Gridley location lost due to herbicide injury.

STARTER FERTILIZER provides an important boost for early season growth of no-till corn, even when soil test P and K levels are high. In these plots, the center four rows received no starter, but areas on left and right show increased growth with starter.

Gridley in 1995. These locations did not receive preplant broadcast K.

Seed-placed Starter

The comparison of 2x2-placed and seed-placed (direct seed contact) starter fertilizers is summarized in **Table 5**. Plant growth and grain yield were more consistently increased when starter fertilizer was 2x2-banded instead of seed-placed. There was no difference between dry and liquid fertilizer materials when they were applied at equivalent nutrient rates. Nitrogen fertilizer with a high salt content (ammonium nitrate) or ammonia-releasing compounds (urea, DAP) slowed emergence with seed-placement. Potassium chloride and potassium sulfate gave similar results. Yield responses to dry starter occurred when at least 10 lb/A of N plus P_2O_5 were applied, but these rates slowed emergence in 1994 and 1995 at some locations. Seed-placed 10-34-0 and 9-18-9 liquid fertilizers applied at rates of 10+34+0 and 10+20+10, respectively, did not adversely affect emergence, and yielded the same as 2x2-banded 25+30+20 in 1993 and 1994, but yielded 12 bu/A less at 2 of 3 locations in 1995.

Seed-placed fertilizers should be used with caution. Injury from seed-placed fertilizer was greatest in 1995 when weather was warm and dry after planting. Even though the liquid materials did not slow emergence, there was some

TABLE 3. Effect of 2x2 banded starter fertilizer on no-till corn grain yields (1994).

Starter, lb/A			Location/Yield, bu/A			
N	P_2O_5	K_2O	Ashton	Gridley	Pana[1]	Oblong[2]
0	0	0	177	128	136	136
25	0	0	189	139	152	129
25	30	0	191	142	151	136
25	30	20	189	146	141	150

[1]Severe flooding at Pana.
[2]Soil test K at Oblong was very low; no broadcast K in 1994.

TABLE 4. Effect of 2x2 banded starter fertilizer on corn grain yield (1995).

Starter, lb/A			Location/Yield, bu/A			
N	P_2O_5	K_2O	Ashton	Gridley	Pana[1]	Oblong
0	0	0	95	111	77	116
25	0	0	104	107	81	127
25	30	0	108	117	81	134
25	30	20	112	128	80	134

[1]Severe flooding at Pana.

THE AREA in the center of this photo received 10 lb/A N as urea in direct seed contact. Note the reduced stand compared to adjacent areas which received no urea N. Urea should be avoided in seed-placed starters for corn.

growth stunting at the V1 growth stage. Greenhouse studies have also shown leaf tip burning and twisting with both 10-34-0 and 9-18-9 at rates of 10+34+0 and 5+10+5, respectively. The lower rates of seed-placed fertilizer (10-15 lb/A N + K_2O) that can be safely used are not always enough to provide maximum yield benefits.

Surface-applied Starter

Dribbling (surface bands) or broadcasting N (25+0+0) or N + P (25+64+0) improved yields by the same amount as liquid seed-placed fertilizers at 4 of 6 site-years. However, liquid seed-placed treatments out yielded the surface applications by more than 8 bu/A at 2 of the 6 site-years, and the 2x2 banded 25+30+20 yielded 11 bu/A more than the surface-applied starter treatments in 4 of 6 site-years.

Conclusions

1. Inclusion of both N and P (25+30+0) in a 2x2-banded starter increased

TABLE 5. Effect of seed-placed and banded starter fertilizer on no-till corn grain yields (1993-1995).

Starter, lb/A				Location/Yield, bu/A			
N	P_2O_5	K_2O	Source[1]	Ashton 3 years	Gridley 2 years	Pana 1993	Oblong[2] 3 years
No starter							
0	0	0		124	122	138	142
Dry starter							
10	10	0	AN TSP	135	128	143	149
10	10	10	AN TSP KCl	136	126	139	152
10	26	0	DAP	141	126	134	150
Liquid starter							
5	10	5	9-18-9	133	128	140	149
10	20	10	9-18-9	135	130	126	152
5	17	0	10-34-0	132	124	134	152
10	34	0	10-34-0	141	120	141	155
2x2 Banded							
10	10	10	AN TSP KCl	143	131	135	150
25	30	20	AN TSP KCl	142	138	137	150

[1]AN = Ammonium nitrate; TSP = triple superphosphate; KCl = potassium chloride; DAP = diammonium phosphate.
[2]Soil K test at Oblong was very low, no broadcast K applied in 1994.

early season plant growth and corn yield, even when initial soil P and K tests were high. About two-thirds of the increase could be attributed to N. The starter response was greatest and most consistent in 1995, when late planting and adverse growing season conditions were experienced.

2. Seed-placed fertilizers increased early growth and yield, but increases were not as great as for banded starter fertilizer. Liquid starter fertilizers with low salt indices did not slow emergence. Seed placed fertilizers should not be used in sandy soils, but can be used in heavier soils at rates less than 10-15 lb/A of $N+K_2O$. Urea or urea-containing formulations should not be placed near the seed.
3. Dribbling fertilizers on the soil surface near the seed furrow resulted in higher average yields than no starter controls, but yield increases were not statistically significant and were not as high or as consistent as the 2x2 banded or seed-placed fertilizers.
4. Yield ranking of the starter treatments tested, averaged over all locations was: 2x2 banded>seed-placed liquid>surface dribble>no starter.

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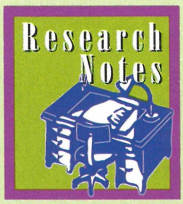

Phosphate Fertilizer Management for Soybeans in Two Tillage Systems

Management of phosphorus (P) fertilizer for soybean production on calcareous soils that have low or very low soil P test levels has not been fully researched. The possibility of applying P prior to the soybean crop instead of the corn crop may offer potential for added profit. A study at the University of Minnesota West-Central Experiment Station, begun in the fall of 1994, is evaluating the impact of major factors (tillage system, row spacing, P placement, P rate, frequency of P application) on the yield of both soybeans and corn in rotation. Soil test P levels prior to the study were 2.3 parts per million (ppm) Bray P-1 and 4.3 ppm Olsen. Soil pH was 7.8.

Higher yields were recorded with the fall chisel tillage system and the use of narrow (7-inch) rows. For both tillage systems, broadcast rather than fall banded P produced the higher yield. Regardless of P placement, row spacing and tillage system, yields increased as rate of applied P increased. Residual effect of the biennial application will be measured with corn.

TABLE 1. Relevant soil test values for the experiment site.

pH	7.8
Phosphorus (Bray), ppm	2.3
Phosphorus (Olsen), ppm	4.3
Potassium, ppm.	166.0

Source: Dr. George Rehm, Extension Soil Scientist, Department of Soil, Water, and Climate, University of Minnesota, St. Paul, MN.