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Starters Bump Corn Yields 17 bu/A Versus No-Starter Controls

Minnesota 2004 study showed that yields tended to be greater when sulfur was included in the starter in a wet, cool year.

Summary: *Concentrations of NPKS in the whole plant at the V6 stage were slightly but inconsistently affected by starter rates and placement positions. However, NPKS uptake at this stage was greatly affected by the starter rates due primarily to the huge effects of starter fertilizer rate and materials on dry matter yield. Corn grain yields in 2004 were increased an average of 17 bu/A by starter fertilizer treatments over the no-starter control. Yields were not increased statistically over that obtained with the 6 + 20 + 6 + 4 pop-up treatment (199 bu/A). Yields tended to be greater when sulfur (S) was included in the starter fertilizer in this wet and cool year. Differences in yield were not found between the 2" x 0 and 2" x 2" placement positions indicating fl exibility in starter placement options. Grain moisture at harvest was reduced up to 4.6 points by starter fertilizer, resulting in lowered drying costs. Profitability was increased substantially on this very high P-testing soil (28 ppm Bray P1) by relatively low rates of NPKS starter fertilizers applied with the seed.*

Historically, starter fertilizers commonly have not been recommended for corn production on high or very high phosphorus (P)-testing soils due to poor yield response even though early growth responses may have been seen. However, as corn yields have continued to increase, tillage intensity has tended to decrease and corn planting has come earlier accompanied by various stress

Table 1. Concentrations of NPKS in whole small corn plant (V6) at Waseca, 2004.

Rate/A	Placement	Sources	N	P	K	S
				%		
0+0+0+0	None	None	3.78	0.409	3.35	0.225
6+20+6+4	Pop-up	APP+KTS	3.51	0.423	3.46	0.201
20+20+6+4	2 x 0	APP+UAN+KTS	3.62	0.395	3.42	0.215
20+20+6+4	2 x 2	APP+UAN+KTS	3.64	0.390	3.23	0.216
20+20+0+4	2 x 0	APP+UAN+KTS	3.52	0.380	3.40	0.217
20+20+0+4	2 x 2	APP+UAN+KTS	3.60	0.386	3.30	0.206
20+20+6+0	2 x 0	UAN+7-21-7	3.62	0.383	3.46	0.211
20+20+6+0	2 x 2	UAN+7-21-7	3.82	0.385	3.14	0.224
20+20+10+10	2 x 0	APP+UAN+KTS+ATS	3.68	0.386	3.33	0.216
20+20+10+10	2 x 2	APP+UAN+KTS+ATS	3.74	0.406	3.43	0.224
20+40+10+10	2 x 0	APP+UAN+KTS+ATS	3.65	0.405	3.26	0.225
40+40+10+10	2 x 0	APP+UAN+KTS+ATS	3.83	0.402	3.00	0.221

conditions. The advent of earlier planting has also ushered in a renewed interest in starter (bandplaced) fertilizer. Subsequent questions have been raised regarding the inclusion of potassium (K) and sulfur (S) in the fluid starter as well as what constitutes optimal starter placement (in-row with seed versus bands two inches from the seed or bands dribbled on the soil's surface?).

To try to answer these questions, a study was developed and conducted in 2004 with the following objectives:

- Determine the effect of various combinations of NPKS rates as starter fertilizers for improving corn production and profitability on high P- and K-testing soils
- Evaluate placement positions for NPKS fluid starters for corn grown on high P- and K-testing soils
- Provide management guidelines to corn producers, crop advisors, and the fertilizer industry on fluid starter fertilizer rates and placements for reduced-till corn grown on high P- and K-testing soils.

Concentration

Concentrations of NPKS in the whole plant at the V6 stage were inconsistently affected by the NPKS treatments (Table 1). This was particularly true for N and K where statistically significant differences were found, but there was no clear rate or placement effect and no interaction between rate and placement. Whole plant P concentration was greatest (0.423%) when the starter P was placed in the seed furrow and least (0.386%) when placed on the soil's surface. Whole plant S concentration was not affected by any of the treatments. Concentrations of NPKS were similar between 2-inch x 0 and 2-inch x 2-inch placement positions.

Dry matter

Dry matter accumulation at V6 was greatly affected by the starter P treatments on this very high P-testing soil (Table 2). Dry matter was increased over the control by all starter treatments except the 20 + 20 + 6 + 0 treatment dribbled on the soil's surface. Largest plants were obtained with the 6 + 20 + 6 + 4 pop-up treatment. Starter fertilizer with sulfur (S) produced greater early plant growth than when S was omitted.

These early growth differences resulted in highly significant differences in NPKS uptake among treatments. In general, greatest NPKS uptake occurred with the 6 + 20 + 6 + 4 pop-up treatment and the 40 + 40 + 10 + 10 treatment dribbled on the surface. Placement position (2-inch x 0 vs. 2-inch x 2-inch) had no effect on NPKS uptake.

Table 2. Dry matter accumulation of NPKS in whole small corn plant (V6) at Waseca, 2004.

Rate/A	Placement	Sources	Yield lbs/A
0+0+0+0	None	None	134
6+20+6+4	Pop-up	APP+KTS	316
20+20+6+4	2 x 0	APP+UAN+KTS	200
20+20+6+4	2 x 2	APP+UAN+KTS	196
20+20+0+4	2 x 0	APP+UAN+KTS	182
20+20+0+4	2 x 2	APP+UAN+KTS	200
20+20+6+0	2 x 0	UAN+7-21-7	156
20+20+6+0	2 x 2	UAN+7-21-7	178
20+20+10+10	2 x 0	APP+UAN+KTS+ATS	218
20+20+10+10	2 x 2	APP+UAN+KTS+ATS	192
20+40+10+10	2 x 0	APP+UAN+KTS+ATS	228
40+40+10+10	2 x 0	APP+UAN+KTS+ATS	284

Table 3. Grain yield and grain moisture as influenced by NPKS rate, placement, and source at Waseca, 2004.

Rate/A	Placement	Sources	Yield bu/A	Moisture %
0+0+0+0	None	None	181.7	27.3
6+20+6+4	Pop-up	APP+KTS	198.8	22.7
20+20+6+4	2 x 0	APP+UAN+KTS	198.9	24.1
20+20+6+4	2 x 2	APP+UAN+KTS	195.6	24.6
20+20+0+4	2 x 0	APP+UAN+KTS	197.4	25.0
20+20+0+4	2 x 2	APP+UAN+KTS	198.5	27.0
20+20+6+0	2 x 0	UAN+7-21-7	186.8	28.1
20+20+6+0	2 x 2	UAN+7-21-7	196.2	26.7
20+20+10+10	2 x 0	APP+UAN+KTS+ATS	210.2	24.3
20+20+10+10	2 x 2	APP+UAN+KTS+ATS	202.4	25.1
20+40+10+10	2 x 0	APP+UAN+KTS+ATS	200.8	25.3
40+40+10+10	2 x 0	APP+UAN+KTS+ATS	202.4	23.6

Grain yield

Grain yield was increased on this very high P-testing soil over the no-starter control by all starter treatments except the 20+ 20 + 6 + 0 treatment dribbled on the soil's surface (Table 3). A 17.1 bu/A response was obtained with the 6 + 20 + 6 + 4 pop-up treatment.

No other starter treatment significantly increased yield over the pop-up treatment. Grain yield was increased (P = 10% level) by the 20 + 20 + 10 + 10 treatment over the 20 + 20 + 6 + 0 treatment when averaged across placement positions. Placement position did not affect grain yield.

Grain moisture

Grain moisture at harvest was affected significantly by starter fertilizer (Table 3). Grain moisture was highest (27.3%) for the no-starter control and lowest (22.7%) for the 6 + 20 + 6 + 4 pop-up treatment. This 4.6-point advantage for the pop-up starter fertilizer can translate into a substantial saving in drying costs. Currently, drying costs about $0.03/point or 14 cents/bu in this case, which, assuming 190 bu/A, is a savings of $26.60/A. Grain moisture was higher (27.4%) when S was omitted (20 + 20 + 6 + 0) compared to including S in 20 + 20 + 6 + 4 (24.3%) or 20 + 20 + 10 + 10 (24.7%) when averaged across starter treatment rates. Placement position had no affect on grain moisture.

Plant population

Initial plant population was not affected by any of the starter fertilizer treatments, indicating no phytotoxicity for the starter rates or placements under the wetter conditions immediately following planting. Placement of a 4-lb/A S rate in the furrow with the seed may be a concern, however, if drier conditions occurred. Although final plant populations were statistically different among the 12 treatments, the range from 32,400 to 33,100 plants/A and the CV (0.7%) were very small.

Conclusions

Plant growth. In this cool spring when wet conditions prevailed after planting, a significant plant growth response was recorded for all but one of the starter fertilizer treatments on this very high P-testing soil. Greatest growth (138% larger than the control) was obtained with the 6 + 20 + 6 + 4 pop-up treatment.

Concentrations of NPKS were not greatly different among any of the treatments at the V6 stage. However, uptake of NPKS was greatly affected by starter fertilizer due to the large effect of starter fertilizer on early growth.

Yield. Corn grain yields increased an average of 17 bu/A (5 to 29 bu/A) by the starter fertilizer treatments over the no-starter control (182 bu/A). None of the higher rate NPKS treatments increased yield significantly over the 6 + 20 + 6 + 4 pop-up treatment (199 bu/A). Yield tended to be consistently greater when S was included in the starter treatment. The wet and cool conditions may have limited mineralization of S from the organic matter and, combined with very high yields, resulted in the response to S. Grain yields were not different between the surface dribble (2-inch x 0) and injected (2-inch by 2-inch) placements.

Grain moisture at harvest was significantly reduced by some of the starter fertilizer treatments, especially the pop-up treatment. These reductions in grain moisture due to starter fertilizer could reduce drying costs by up to $27/A and should be strongly considered when making decisions regarding whether to use starter fertilizer — even on soils testing 28 ppm P (very high) based on this single year of data.

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