EFFECTS OF METHOD OF APPLICATION METHOD AND COMPOSITION OF STARTER FERTILIZER ON IRRIGATED CORN

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Summary
Field studies were conducted at the North Central Kansas Experiment Field, located near Scandia, on a Crete silt loam soil. The study consisted of four methods of starter fertilizer application (in-furrow with the seed, 2 inches to the side and 2 inches below the seed at planting, dribble on the soil surface 2 inches to the side of the seed, and banded over the row on the soil surface) and five starter fertilizer combinations. The starters consisted of combinations that included either 5, 15, 30, 45, or 60 lbs/A N with 15 lbs/A P_2O_5 and 5 lbs/A K_2O. A no-starter check plot also was included in the experiment. Additional treatments included 2x2 starter with and without potassium. Dribble application of 30-30-5 starter fertilizer applied 2 inches to the side of the row also was compared to dribble directly over the row. Nitrogen was balanced so that all plots received 220 lbs/A N, regardless of starter treatment. Starter fertilizer combinations were made using liquid 10-34-0 ammonium polyphosphate, 28% UAN, and potassium thiosulfate (KTS). When starter fertilizer was applied in-furrow with the seed, plant populations were reduced by over 8,400 plants/A compared with the no starter check. Corn yield was 33 bu/A lower when starter fertilizer was applied in-furrow than when applied 2x2. Dribble application of starter fertilizer in a surface band 2 inches to the side of the seed row resulted in yields equal to 2x2 applied starter. Grain yield and V-6 dry matter were lower in the starter treatments that only included 5 or 15 lbs N/A. Other treatments were added in order to determine if K was responsible for any of the additional yield seen with the starter fertilizers or if N and P were the only elements necessary. Starters that included K improved yields (three-year average) by 12 bu/A.

Introduction
Use of conservation tillage including ridge-tillage has increased greatly in recent years because of its effectiveness in conserving soil and water. In a ridge-tillage system, tillage at planting time is confined to a narrow strip on top of the ridge. The large amount of residue left on the soil surface can interfere with nutrient availability and crop uptake. Liquid starter fertilizer applications have proven effective in enhancing nutrient uptake, even on soils that are not low in available nutrients. Many producers favor in-furrow or surface starter applications because of the low initial cost of planter-mounted equipment and problems associated with knives and coulters in high-residue environments. However, injury can be severe when fertilizer containing N and K is placed in contact with seed. Surface applications may not be effective in high residue situations. The objective of this research was to determine corn response to starter combinations using 4 different application methods.

Procedures
Irrigated ridge-tilled experiments were conducted at the North Central Kansas Experiment Field on a Crete silt loam soil. Analysis by the KSU Soil Testing Laboratory showed that initial soil pH was 6.2; organic matter content was 2.4%; and Bray-1 P and exchangeable K in the top 6 inches of soil were 40 and 420 ppm, respectively. The study consisted of four methods of starter fertilizer application methods (in-furrow with the seed, 2 inches to the side and 2 inches below the seed at planting, dribble in a narrow band on the soil surface 2 inches to the side of the seed row, and banded over the row on the soil surface).

In the row-banded treatment, fertilizer was sprayed on the soil surface in a 8 inch band centered on the seed row immediately after planting. Starter consisted of combinations that included either 5, 15, 30, 45, or 60 lbs N/A with 15 lbs P_2O_5/A and 5 lbs K_2O/A. A no-starter check also was included. Nitrogen as 28% UAN was balanced so all plots received 220 lbs/A, regardless of starter treatment. Additional treatments consisted of 2x2 placed starter with and without K. Dribbling starter fertilizer (30-30-5 rate) to the side of the row also was compared to the same starter rate dribbled directly over the row. Starter fertilizer combinations were made using liquid 10-34-0 ammonium polyphosphate, 28% UAN, and KTS.

Results

When starter fertilizer was applied in-furrow with the seed, plant populations were reduced by over 8,400 plants/A when compared with the no starter check (Table 1). Corn yield was 33 bu/A lower when starter fertilizer was applied in-furrow with the seed than when applied 2 inches beside and 2 inches below the seed. Dribble application of starter fertilizer in a narrow surface band 2 inches to the side of the seed row resulted in yields equal to the 2x2 applied starter. The band over the row treatment resulted in yields greater than the in-furrow treatment but less than the 2x2 or surface band treatments. Grain yield and V-6 dry matter accumulation was lower in the starter treatment that only included 5 or 15 lbs N/A. Addition of K to the starter mix increase three-year average grain yields by 12 bu/A (Table 2). When averaged over the three years of the experiment, there were no differences in 2x2 placement and dribble on the soil surface.

Table 1. Starter application method and composition effects on corn grain yield, plant population and V6-stage dry whole plant dry matter, North Central Kansas Experiment Field, Scandia, 2002.

Application method	Starter	Yield, 2002	Yield, 2000-2002	Population	V-6 Dry Matter
	lbs/A	bu/A	bu/A	plants/A	lbs/A
	Check 0-0-0	175.2	164.4	31,425	385
In-furrow	5-15-5	188.6	172.0	24,822	392
	15-15-5	188.2	177.2	24,710	401
	30-15-5	184.5	174.4	22,754	390
	45-15-5	180.2	171.0	21,650	388
	60-15-5	170.0	162.8	21,122	345
2x2	5-15-5	202.0	193.9	31,422	452
	15-15-5	208.0	196.9	31,368	598
	30-15-5	222.2	215.7	31,480	708
	45-15-5	223.5	214.9	31,422	710
	60-15-5	222.0	214.3	31,458	711
Dribble 2x	5-15-5	200.6	189.8	31,452	445
	15-15-5	205.8	197.8	31,325	571
	30-15-5	218.0	211.9	31,388	700
	45-15-5	220.0	212.5	31,399	709
	60-15-5	221.0	212.7	31,410	710
Row band	5-15-5	195.8	179.4	31,408	448
	15-15-5	198.5	180.2	31,397	586
	30-15-5	212.2	191.5	31,429	678
	45-15-5	212.1	194.6	31,451	688
	60-15-5	213.6	200.6	31,422	689
Method Means					
In-furrow		182.3	171.1	23,012	383
2x2		215.5	206.2	31,430	636
Dribble 2x		213.0	204.9	31,395	627
Row band		206.4	190.1	31,421	617
LSD (0.05)		12.0		791	20
Starter Means					
5-15-5		196.8	183.8	29,776	434
15-15-5		200.1	188.0	29,700	539
30-15-5		209.4	199.1	29,263	619
45-15-5		208.9	198.2	28,981	624
60-15-5		206.2	197.6	28,853	613
LSD (0.05)		10.0		NS	22

Table 2. Starter fertilizer composition effects on corn grain yield, Scandia, KS.

Starter				2000	2001	2002	Average
	lbs/A			----------bu/A----------			
	N	P_20_5	K				
1.	15	30	5	170	180	172	174
2.	30	30	0	178	190	186	185
3.	30	15	0	178	192	185	185
4.	30	30	5	190	206	196	197

Means were compared using orthogonal contrasts. Treatment 4 was significantly greater than treatment 2 at the 0.01 level of significance.