Drs. R. E. Lamond and W. B. Gordon

NPK Starters Best N-Only Starters

Kansas researchers report combo produced superior corn yields even though soil P and K levels were high.

Summary: *With the interest in and importance of the use of starter fertilizers in conservation tillage production systems, research has been continued to evaluate higher rates of N in starters and different starter placements. The use in these studies of starters containing N, P, and K significantly increased corn yields compared to an N only program, even though soil P and K levels were high. Increasing N rates in direct seed-placed starter did not increase yields and significantly reduced plant population at both sites. Results confirm that higher N rates can be safely applied in starters when placed away from the seed (over the row or 2 x 2). The addition of 10 lbs/A of S in starter fertilizer significantly increased early-season corn growth and grain yield. With the cool, wet soil conditions encountered during early planting and the heavy residue cover in conservation tillage production systems, the use of starter fertilizers is a sound, efficient, and profitable management practice.*

Conservation tillage systems are characterized by at least a 30 percent residue cover at planting time. Some producers are interested in applying their total nutrient program at planting in order to reduce trips. University research over the past several years has emphasized the importance of starter fertilizers in conservation tillage crops.

Conservation tillage crops are subjected to several early-season stresses that limit the plant's ability to take up nutrients early in the season. Low soil temperature and soil compaction, combined with early planting dates for long-season hybrids, especially contribute to these stresses. They can be partially alleviated by use of starters even when soil test values for nutrients such as phosphorus (P) and potassium (K) are high. Research has also shown that manipulation of starter formulations in regard to concentrations of various nutrients can have substantial influence upon their effectiveness.

The concept of high nitrogen (N) starters has continued to develop over the past ten years. Research has clearly shown that yield advantages accrue from higher N:P_2O_5 ratios in starters than can be produced by normal manufacturing processes. The advantages of higher N concentrations include: 1) providing additional N supplies early in the growing season, 2) allowing additional flexibility in timing of supplemental N applications, 3) beneficial effects of soil P fixation reactions, and 4) enhanced P absorption even on high P-testing soils. University research has underscored the advantages in terms of higher crop yields.

Production of high N starters necessarily requires blending of nitrogen solutions (UAN) with other starter formulations. Since half the N in UAN is urea, banding higher concentrations of N close to the seed provides opportunity for the presence of free ammonia in proximity to the germinating seed. Crops are sensitive to free ammonia even on a very short-term basis and express that sensitivity in lowered seedling vigor and final stands.

Some observations have suggested the possibility of corn population decline with the banding of high N starters close to the seed row, despite the advantages these formulations have demonstrated. Grower interest in higher N rates placed beside the row at planting under adequate rainfall or irrigated conditions, combined with dryland producer

interest in applying all nutrients at planting in the Central Great Plains, points to the need for evaluation of techniques to avoid this germination effect and make it even more effective as a proven practice.

With all these ideas in mind, research evaluating starter management in conservation tillage production systems was continued in 2000 at our Manhattan and Scandia sites, applying high N rates in starters as well as different placements to reduce the risk of germination damage associated with higher N rates in starters.

Manhattan

Placement. The use of starter in either direct seed contact, dribbled over the row, or in a 2 x 2 placement increased yield (Figures 1 and 2).

N rate. Increasing N rates in the starter above 10 lbs/A did not increase yields further, and final plant populations were significantly reduced at the 40- and 50-lb/A rates of N when placed in the furrow. Starter N rates up to 50 lbs/A of N placed over the row and 120 lbs/A of N placed 2 x 2 had no effect on plant populations. These results suggest that when higher N rates in a starter are used, the starter should be placed over the row or 2 x 2.

Sulfur added. In the 2 x 2 study, inclusion of 10 lbs/A of sulfur (S) in the starter increased yields by 13 bu/A (Figure 2). In 1999, the addition of S in the starter increased yields by 22 bu/A. These results were somewhat unexpected as the soil is a productive silt loam with 3.1 percent organic matter. Apparently the cool, wet soil conditions encountered with early planting and heavy residue cover slowed S release from organic matter mineralization early in the growing season.

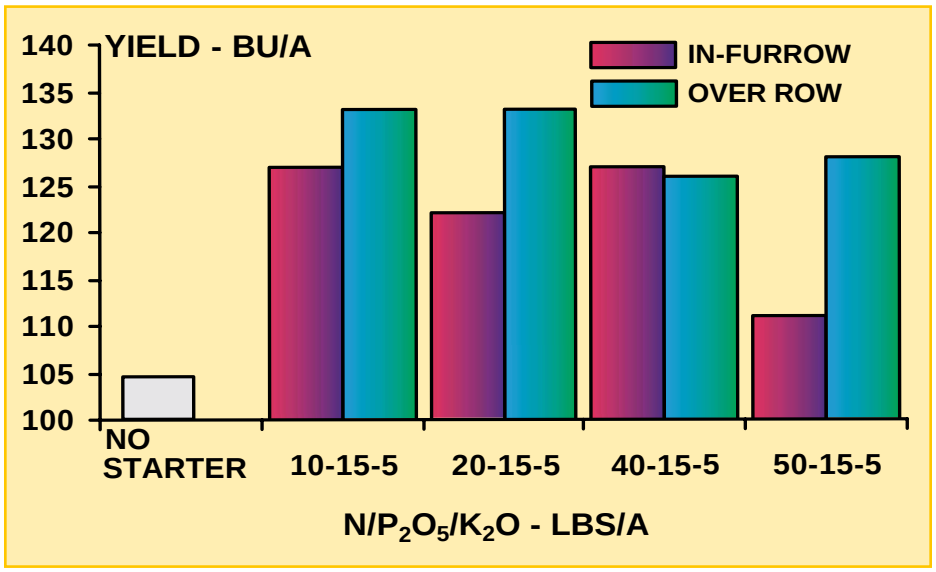

Figure 1. Corn yields comparing in-furrow and over row starter placement and different NPK formulations, Manhattan, Kansas, 2000.

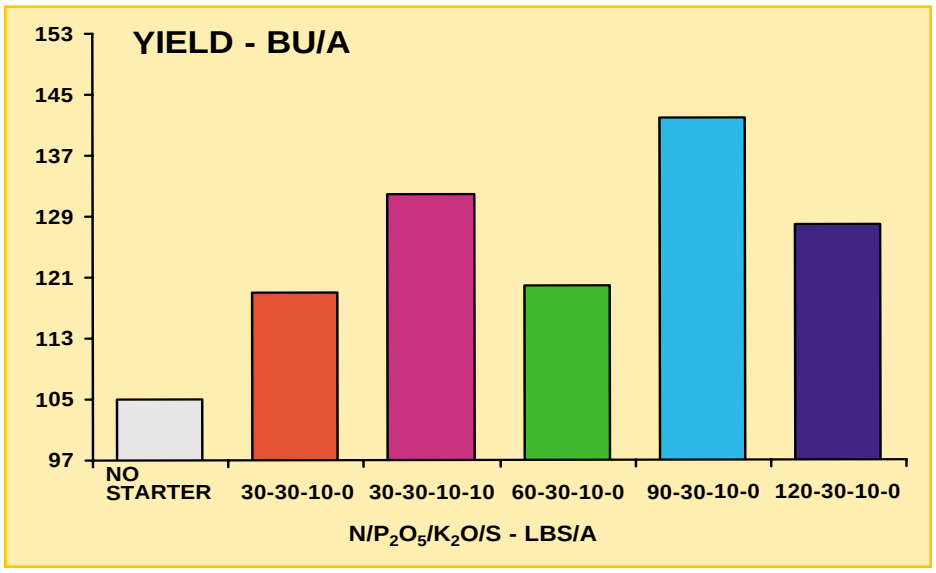

Figure 2. Corn yield response to different N rates and the addition of sulfur (S) to NPK formulations, using 2 x 2 placement, Manhattan, Kansas, 2000.

Scandia

Placement. When starter was applied in-furrow with the seed, plant populations were reduced by over 7,500 plants/A when compared with the other application methods. Corn yield averaged 34 bu/A lower when starter was applied in-furrow with the seed

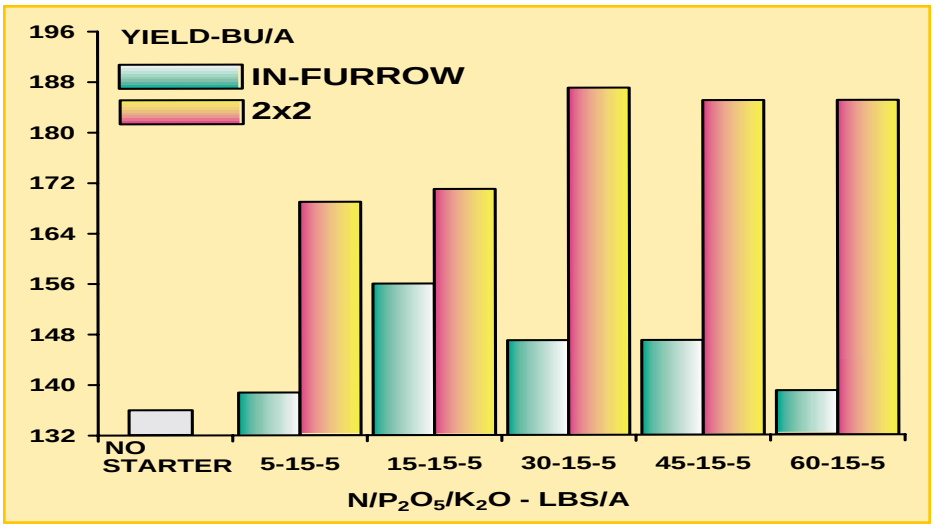

Figure 3. Corn yield response to in-furrow and 2 x 2 placement of starters using different NPK formulations, Scandia, Kansas, 2000.

than when applied 2 inches beside and 2 inches below the seed (Figure 3). Dribble application of starter in a narrow surface band 2 inches to the side of the seed row resulted in yields equal to the 2 x 2 applied starter. In this year, surface band application was equal to sub-surface starter placement. The band-over-the-row treatment resulted in yields greater than the in-furrow treatment but less than the 2 x 2 or surface band treatments.

N rate. Grain yield and V-6 dry matter accumulation was lower in the starter treatment that included only 5 lbs/A of N.

Methodology

Location. Studies were conducted at the North Agronomy Farm at Manhattan, Kansas (dryland) and the North Central Experiment Field at Scandia, Kansas (irrigated).

Placement. At Manhattan on continuous no-till corn, placements included: in-furrow, over the row (surface band), and 2 x 2 (2 inches below and 2 inches to the side of the seed); at Scandia on irrigated no-till corn, placements included: in-furrow, 2 x 2, over the row, and surface band 2 inches to the side of the row.

N rate. Total N was balanced on all treatments at 150 lbs/A (Manhattan) and 220 lbs/A (Scandia).

Fertilizers. P and K were included in all starters. Starters were formulated with UAN, 7-21-7 (Manhattan), 10-34-0 and potassium thiosulfate (Scandia), and ammonium thiosulfate (Manhattan).

Planting. Corn was planted on April 7 at Manhattan, while at Scandia it was planted on April 12.

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