Dr. Gyles Randall and Jeffrey Vetsch

A Look At Starters, Row Cleaners And N Placement In No-Till

Minnesota researchers use study to determine effects of its components on no-till continuous corn and corn after soybeans.

Summary: *Starter fertilizer (10 gal/A 10-34-0) stimulated early plant growth, increased corn grain yields by 6 to 7 bu/A, and reduced grain moisture by about 1 percentage point for both continuous corn and corn after soybeans. Starter fertilizer did not increase grain N concentration. Row cleaners increased early plant growth of continuous corn but had no impact on any other corn production parameters. Continuous corn yields were increased 4 bu/A by row cleaners when averaged across N source and starter fertilizer. Corn yields following soybeans were increased 8 bu/A by starter fertilizer when row cleaners were not used and by only 3 bu/A by starter fertilizer when row cleaners were used. Corn yields following soybeans were 13 percent higher than for continuous corn.*

No-till corn production in northern portions of the Corn Belt has seriously challenged growers, often not being economically competitive with conventional or slightly reduced tillage systems. This is especially true on the highly productive but more poorly drained clay loam soils of northern Iowa and southern Minnesota where corn is grown on approximately 8 million acres. These soils are cold at planting and slow to warm. Slow root development retards early plant growth, delays silking, increases moisture at maturity and reduces yields. These effects occur most frequently with continuous corn, but are also noticeable when corn follows soybeans.

Three management options were considered to correct these problems or at least help to make no-till systems more competitive.

- Place fluid starter with seed to stimulate early root growth
- Clear residue from a 4- to 6-inch zone over the row with row cleaners to speed soil warming in seed zone and improve seed-to-soil contact for quicker emergence
- Place UAN within 2 to 3 inches of row to stimulate early plant growth.

Our primary objective was to determine the effects and interactions of starters, row cleaners and N placements on corn grain yield in continuous corn and corn following soybeans in no-till systems.

Continuous corn

Yield. Corn grain yield increased as high as 6 bu/A when starter fertilizer (10 gal/A 10-34-0) was used and as high as 9 bu/A when starter and row cleaners were used (Figure 1). Grain moisture percent was lowest when both starter and row cleaners were used.

Surface residue. Coverage was high throughout the season. Residue coverage averaged 98 and 87 percent on April 22 and May 20, respectively (data not shown). Residue coverage still averaged greater than 80 percent on July 2 and was greater than 65 percent on August 31 (Figure 2). Row cleaners had no effect on residue coverage on either July 2 or August 31.

Emergence. Corn emerged quickly in 1998 due to very warm temperatures in May. Soil temperature at the 2-inch depth on residue-free soil averaged 69.9°F for the month, almost 15°F warmer than in 1997. Corn began to emerge only 11 days after planting (10 days earlier than in 1997) and was completely emerged 8 days later (9 days earlier than in 1997). Row cleaners or starter fertilizer did not affect emergence under these warm conditions.

Plant height measured on June 19 increased significantly by 1.7 inches with UAN, 1.3 inches with row cleaners, and 4.5 inches with starter.

Grain moisture at harvest was reduced significantly (1.0 point) with the use of starter fertilizer but was not affected by row cleaners.

N concentration was not affected by starter fertilizer and row cleaners, but was reduced 0.15 percent N when UAN was broadcast on the soil surface compared to spoke-wheel injection.

Uptake. Starter fertilizer significantly increased grain N uptake by 6 lbs/A due largely to increased grain yield. Grain N uptake was 18 lbs/A less when UAN was broadcast on the soil surface, compared to spoke-wheel injection.

Corn after soybeans

Yield. The significant interaction between row cleaners and starter fertilizer (10 gal/A 10-34-0) was due to yields being increased 9 bu/A when row cleaners were not used and only 4 bu/A when they were used. Or looking at the data in another way, row cleaners had no effect on yield when used in combination with the starter fertilizer, but had a slight effect when used alone. In this very favorable year, continuous corn yields on the average were only 4 bu/A less than for corn after soybeans.

Surface residue. Coverage was high throughout the season. Residue coverage averaged 92 and 78 percent on April 22 and May 20, respectively (data not shown). Residue coverage still averaged greater than 50 percent on July 2 and greater than 40 percent on August 31 (Figure 3). Placement method of UAN did not affect residue coverage.

Emergence. Corn emergence started 11 days after planting and was complete 4 days later. There was a very slight positive effect of row cleaners on emergence 2 and 3 days after emergence started (Figure 4).

Plant height was not affected by row cleaners, but was 5.1 inches taller when starter fertilizer was used. Plant height for corn after soybeans was about 6 inches taller than it was for continuous corn.

Grain moisture at harvest was reduced significantly (1.1 points) with the use of starter fertilizer but was not affected by row cleaners.

N concentration was reduced by the use of starter fertilizer. However, the small differences were considered to have little practical effect. Unlike continuous corn, grain N concentration was not reduced by broadcast application of UAN.

Uptake. Grain N uptake was not affected by row cleaners or starter fertilizer. When starter fertilizer was used

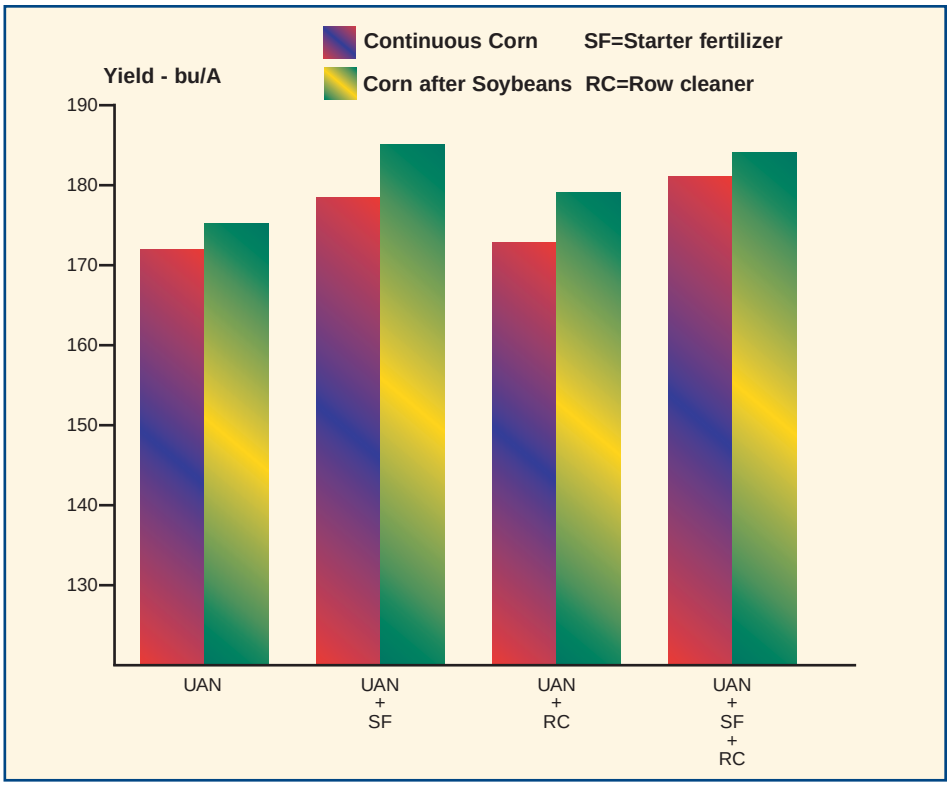

Figure 1. Corn grain yield as affected by row cleaners, starter fertilizer, and crop rotation, Randall, et al., University of Minnesota, 1998.

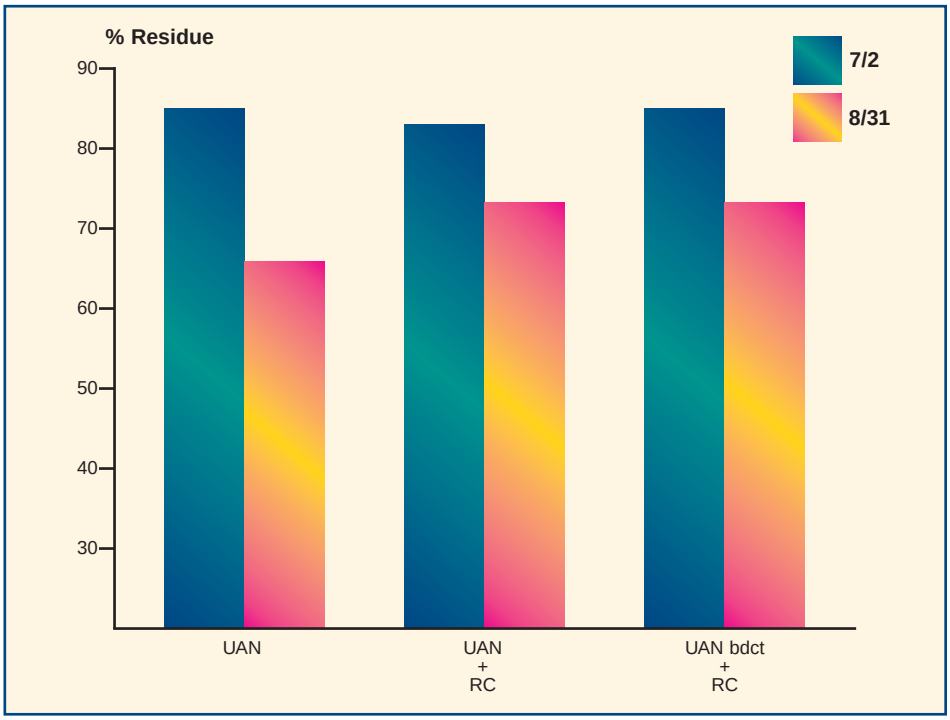

Figure 2. Surface residue coverage as influenced by row cleaners and method of N application in continuous corn, Randall, et al., University of Minnesota, 1998.

alone uptake was greater than when it interacted with row cleaners, where it had no effect.

Procedure

Soil. Experiments were conducted on a tile-drained Nicollet-Webster clay loam soil complex located at the Southern Experiment Station, Waseca, Minnesota.

Plots. Tile lines were spaced 75 feet apart and all corn rows were perpendicular to the tile lines. Continuous corn plots were located on the same plots as in 1997, and stalks were not chopped. Corn also followed soybeans that had been no-till drilled in 1997. Each plot was 10 feet wide (4- to 30-inch rows) by 120 feet long. No plots were cultivated.

> *"Starter fertilizer stimulated early plant growth and increased corn grain yields by 6 to 7 bu/A."*

Design. Experimental design was a 2^3 factorial with complete randomization within each of the four replicates.

Planting. Pioneer 36F30 was planted on May 1 at a population of 33,000 seeds/A. Fluid 10-34-0 was applied with the seed at the rate of 10 gal/A on half of the plots. Additional P was not applied because soil tests taken in July of 1997 found Bray P_1 was 22 and 26 ppm and exchangeable K was 166 and 167 ppm for the continuous corn and corn/soybean rotation sites, respectively.

Pesticides. Corn rootworm was controlled in continuous corn with an application of the insecticide FORCE. Weeds were controlled with a preemergence application of HARNESS plus HORNET.

Thinning. Plots were thinned to a uniform plant population of 31,400 plants/A after stand counts were taken on June 19.

Dr. Randall is professor and Vetsch is assistant scientist at the Southern Experiment Station in Waseca, MN. ❑

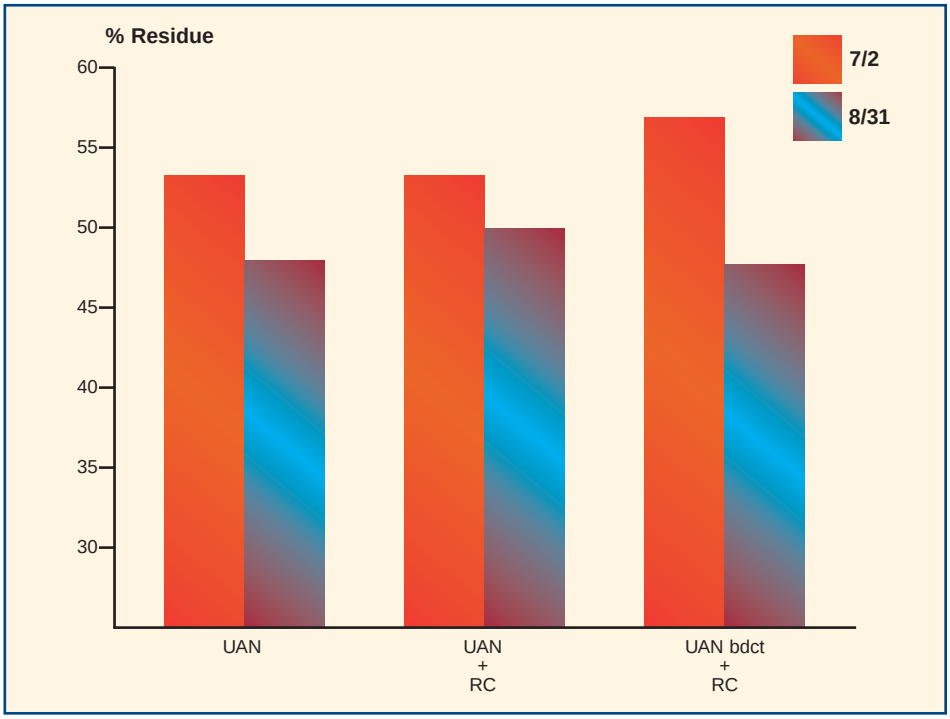

Figure 3. Surface residue coverage as influenced by row cleaners and method of N application in corn-soybean rotation, Randall, et al., University of Minnesota, 1998.

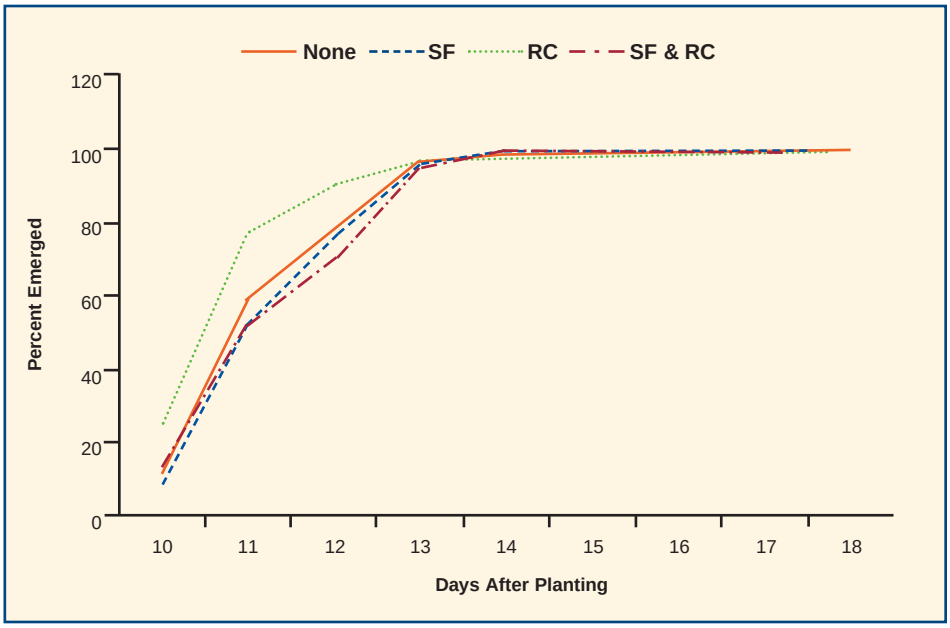

Figure 4. Emergence rate of corn following soybeans as influenced by row cleaners and starter fertilizer, Randall, et al., University of Minnesota, 1998.