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Subsurface Placement Best In Reduced-Till

Kansas research show importance of nutrient management/hybrid selection in boosting crop yield

Summary: *Heavy residue cover can affect efficiency of surface applied nitrogen in conservation-till production systems. Research in Kansas has shown that placement of UAN is important in these systems. Best efficiency has been achieved with placement methods that put the UAN below surface residue. Placement of UAN in the soil away from the residue greatly reduces potential for nitrogen losses due to immobilization and volatilization. Heavy residue cover also results in cooler, wetter soils, particularly early in the growing season. Kansas research has shown that some short-season hybrids have responded to starter N-P applications when planted early in no-till production systems, even though residual soil fertility levels were high.*

Conservation-till production systems are used by an ever-increasing number of farmers across the United States. Conservation tillage is really a catch-all designation that includes any production system that strives to leave a protective residue cover on the soil surface. Examples include no-till, reduced-till, ridge-till, and others. The value of residue in protecting top soil from wind and water has been well documented.

On any soil that is highly erodible, December 31, 1994 was the date set for implementation of an approved farm conservation plan, in which residue cover is a major component. The efficiency of surface-applied nitrogen (N), for example, can be affected by such residue cover. Potential for immobilization (tie-up of N in decomposing residue) and volatilization is increased. Soils covered by a residue layer also tend to be cooler and wetter, particularly early in the growing season, which can affect N and phosphorus (P) needs. Mineralization release of N and other nutrients from organic matter will be slowed. P availability will also be affected.

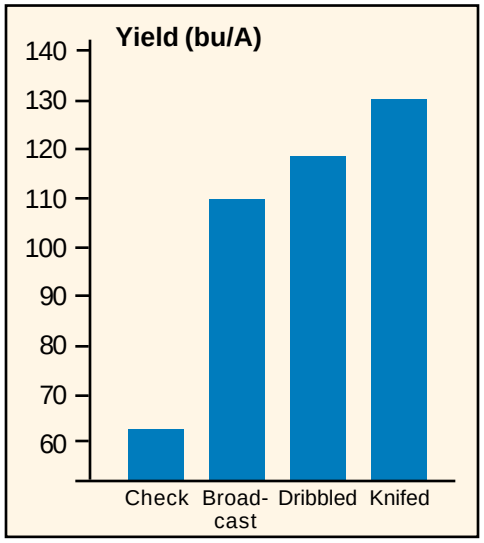

Figure 1. Effect of placement method on yield of no-till grain sorghum, North Agronomy Farm, Lamond et al., Kansas State University, four-year averages.

Subsurface band superior

Several years of research evaluating N rates and methods of application for UAN in continuous no-till production systems have been conducted in Kansas. Results of a four-year trial involving dryland continuous no-till grain sorghum are shown in Figure 1. N was applied in late May every year. An excellent response to N was noted and placement of UAN below the residue (knifed in 4 to 5 inches deep on 20-inch centers) was superior to surface broadcast application. Surface banding (dribble on 20-inch centers) performed better than broadcast but not as well as the knifed placement. Differences in N efficiency due to placement were noted in leaf N concentrations (sampled at boot stage) and in grain protein concentrations.

Research evaluating placement of UAN in dryland continuous no-till corn also has been ongoing. In the three-year study, N was applied in late April every year. Both placement methods that placed UAN below

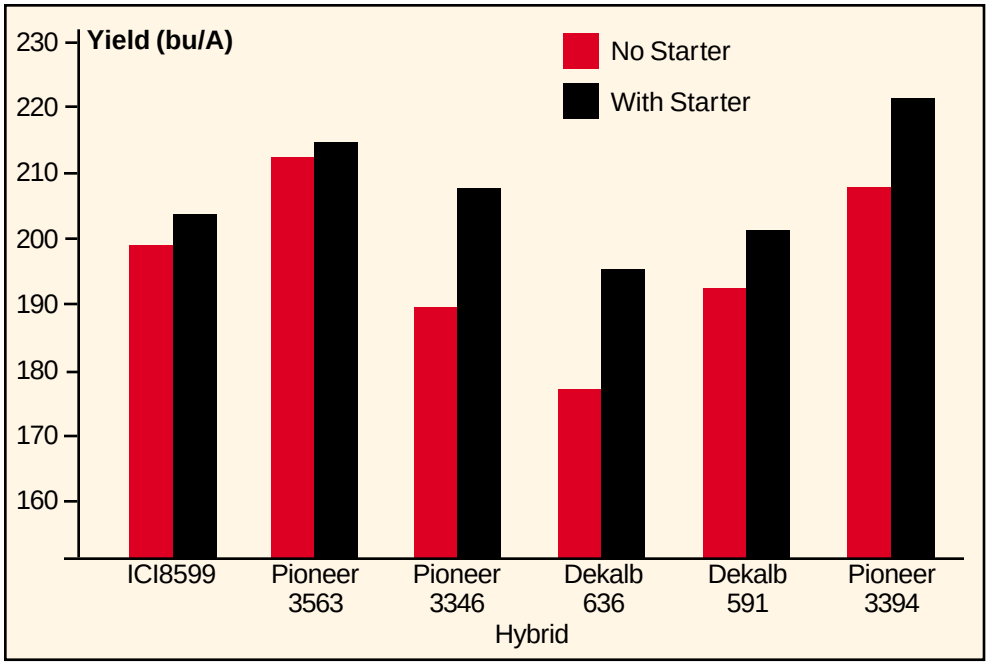

Figure 2. Hybrid and starter fertilizer effects on dryland, not-till corn, North Central Experiment Field, Lamond et al., Kansas State University, 1994.

the residue (knifed or point injection) produced yields superior to crops receiving broadcast treatments. The point injection system (spoke wheel) achieved a 1.5- to 2-inch depth with less residue disturbance than the knifed applicator.

Another study evaluating N rates, sources, placement, and timing on continuous ridge-till corn showed similar results with respect to N placement. Knifed UAN performed equal to NH3; however, broadcast UAN produced lower yields. There was no advantage to splitting UAN application (half knifed at preplant, half at sidedress) compared to knifing all at preplant. Soil was a Crete silt loam.

The bottom line in dealing with UAN in conservation-till is to place it in the soil below the residue to minimize any potential for volatilization and immobilization.

All hybrids not same

Production systems that leave a heavy residue cover on the soil result in cooler and wetter soils, particularly early in the growing season. A dryland corn production system that has gained considerable popularity in Kansas over the past several years involves planting early-maturing (85 to 105 days) corn hybrids from mid-March in southern Kansas to mid-April in northern Kansas. The idea is to get the crop through pollination before extremely hot, dry weather. When this production scheme is employed in no-till systems, there is a high risk of cool, wet soils interfering with N and P uptake of corn. Low soil temperatures result in slow plant growth due to slow root growth and reduced nutrient availability, even though the soil may have high residual fertility levels.

Figure 2 summarizes results of two years of work evaluating the effects of starter fertilizer on six corn hybrids ranging from 2530 to 2850 growing degree units. Study sites were dryland, no-till. Soil was a Crete silt loam that had a Bray 1 P level of 85 lbs/A (high range). Hybrids were grown without or with starter fertilizer (30 lbs/A of N and 30 lbs/A of phosphate) as UAN and APP (10-34-0). Application was two inches to the side and two inches below the seed at planting. N was balanced at 180 lbs/A on all treatments as knifed UAN just after planting. Corn was planted on April 26, 1993 and April 19, 1994.

Even though this is just two years of data, results suggest that responses to starter fertilizer can be very economical even on high P soils--at least with some hybrids when corn is planted early in a high-residue production system. This work will be continued and expanded to look at grain sorghum hybrids.

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