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Sorghum Yields Similar In Placement Trials

Researchers postulate soil moisture level may affect crop response in surface vs. subsurface comparison trials.

Summary: *Although there were no consistent differences in sorghum yields or N-P uptake between surface and subsoil applications in this no-till study on sorghum (1986-87; 1989), we opted in our recommendations for one of the subsurface systems (coulter-nozzle) based on its adaptability and the potential that subsurface applications have for higher fertilizer-use efficiencies. Adequate rainfall was available. Had the trials been curried out under moisture stress conditions, greater differences in yield responses might have been observed. The study was conducted on a Houston Black clay at Temple, Texas. Fluid fertilizers were used in all applications.*

Conservation farming systems are designed to conserve resources, including the minimization of soil loss by water erosion. Appropriate tillage practices are combined with crop residue cover maintenance to protect soil surfaces from raindrop impact as well as enhance water infiltration.

Surface banding of plant nutrients, especially N, may be as effective as subsurface placement if rainfall is adequate. While surface broadcasting of fertilizers may result in the least disruption of residue cover and soil, a number of studies have demonstrated that subsurface banding is the most consistent approach to increased fertilizer-use efficiency in conservation tillage. This practice minimizes contact of nutrients with surface residues (zone of greatest microbial immobilization) and places fertilizer in a soil zone more consistently moist.

Initial phases of our work involved the design of an experimental fertilizer applicator and the performance

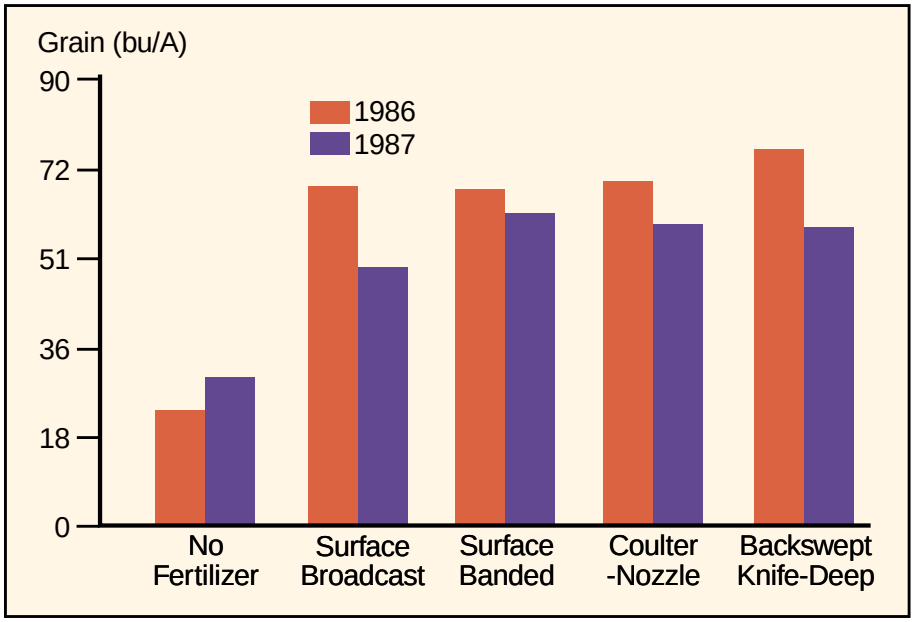

Figure 1. Grain yield response to surface vs. subsuface applications on sorghum, Chichester and Morrison, USDA-ARS, Temple, TX, 1986-87.

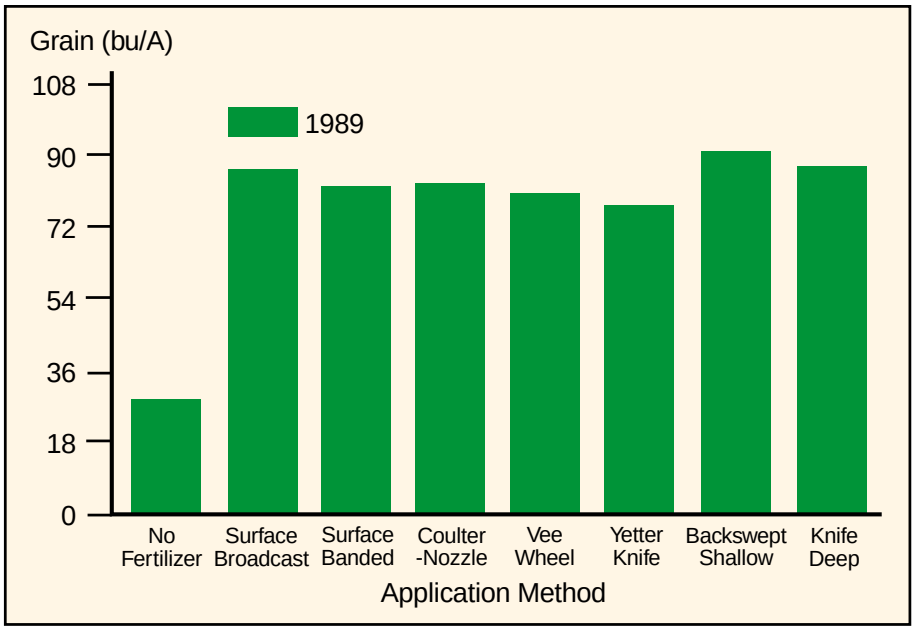

Figure 2. Grain yield response to surface vs. subsuface applications on sorghum, Chichester and Morrison, USDA-ARS, Temple, TX, 1989.

evaluation of various applicator tools. Applications were with solution-type fertilizers because they are most commonly used by farmers in central Texas.

We selected both backswept applicator knives and a coulter-nozzle applicator that minimized residue and soil disturbance. Vertical distribution was unknown for fertilizer applied with the coulter-nozzle applicator in a narrow soil slot.

Objective of this research was to test the effectiveness of new shallow sub-surface applicators (as well as existing tools) against surface applicators. Resulting nutrient uptake and yield were measured to determine the effectiveness of each placement system.

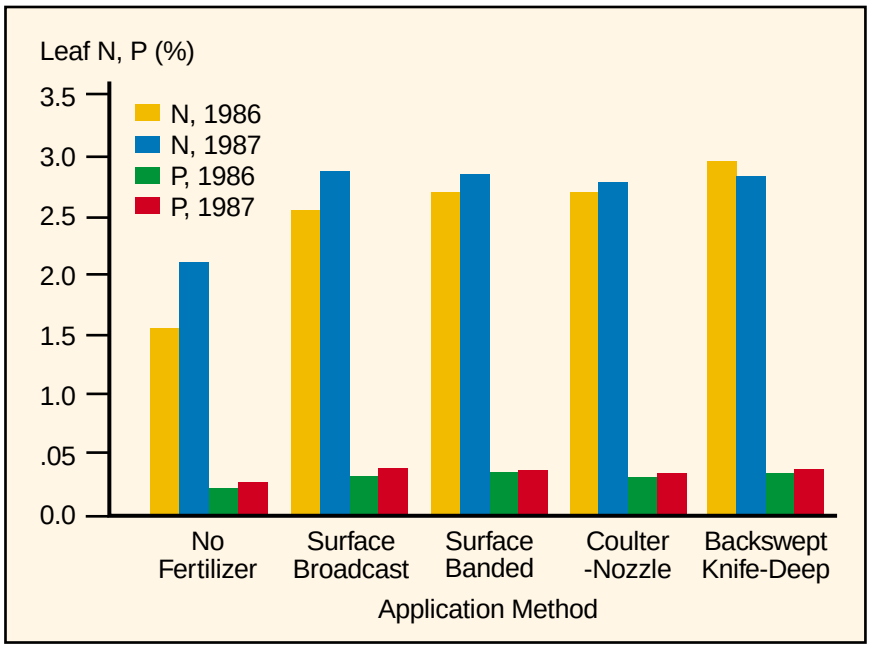

Figure 3. NP uptake response to surface vs. subsuface applications on sorghum, Chichester and Morrison, USDA-ARS, Temple, TX, 1986-87.

Rainfall possible factor

Agronomic responses to six fertilizer applicator treatments were not significantly different within each year. For grain yield, the only differences were between the control and those receiving N and P (Figures 1 and 2). Similarly, plant uptake of N and P showed little or no differences in response to fertilizer application method (Figure 3). One exception was increased uptake of N in 1986 from deeper placement with the backswept knife (Figure 3). Another was lower P uptake with the coulter-nozzle treatment than for the three other application treatments in 1987 (Figure 3). A third was lower N uptake in surface applications when compared to five subsurface placements in 1989. When grain yield data were analyzed in terms of N-use efficiency, there were no differences within each year. similar to the above discussion of yield.

Lack of differences in plant response among treatments in this study may reflect the adequacy of rainfall that is usual during the early spring season when these tests were run. Other workers have shown that differences in surface and subsurface placement, especially N. may he compensated under conditions where surface-applied fertilizer moved into the soil with infiltrating rainfall and/or where plant roots were not water stressed in shallow soil layers. Had the trials been carried out under moisture stress conditions, greater differences in yield response might have been observed.

The resulting 68 percent increase in soil slot width (made by thickening coulter blade from 0.153 to 0.257 inch) suggests there may have been a trend for the N to be distributed deeper in the wider slot.

Criteria

Placement system. Our choice of subsurface application over simpler surface application is based on previous studies, as cited earlier in this text, not on the results of this three-year study.

Implements. The backswept knife, thin Yetter knife, and Vee wheel did not produce plant responses different from those to coulter-nozzle applications at the same depth. What tipped us toward the coulter-nozzle were: 1) preferential reduced soil and residue disturbance, and 2) least sensitivity to high soil moisture adhesion.

Methodology

Crop. Grain sorghum was grown in rotation with winter wheat and corn. Fertilizer treatments were made into wheat stubble after nine months of chemical fallow.

Plots. No-till plots were configured in 61-inch-wide-raised beds between permanent-controlled traffic lanes on 80-inch spacings.

Treatments. Fertilizer treatments included 1) control, 2) surface broad-cast, 3) surface band, 4) coulter-nozzle, 5) backswept knife, 6) Yetter knife, and 7) Vee-wheel.

Fertilizers. Solution-type fertilizers were mixes of 32% VAN solution and APP (10-34-0) solution.

Application rates were 135 and 26 lbs/A of N and P_2O_5, respectively in 1986 and 1987, and 70 and 28 lbs/A of N and P_2O_5, respectively in 1989.

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