TILLAGE SYSTEMS FOR THE TENNESSEE VALLEY: COTTON YIELD AND SOIL WATER USE

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Abstract

Conservation tillage that utilizes large amounts of organic residues would be beneficial to the low organic matter soils of the Tennessee Valley of northern Alabama. Maintaining competitive yields of conservation tillage cotton (*Gossypium hirsutum L.*) is required for adoption of these systems on the highly erodible soils of the region which have been continuously cropped to cotton. In the fall of 1995, a study was implemented at the Alabama Agricultural Experiment Station's Tennessee Valley Substation at Belle Mina on a Decatur silt loam (clayey, kaolinitic, thermic, Rhodic Paleudults) to develop a practical conservation tillage system that results in competitive cotton yields. The experimental design is a randomized complete block of four replications. Treatments included factorial combinations of fall ridging (with and without) and deep tillage (none, in-row subsoiling, paratilling); as well as spring strip tillage and conventional tillage. All plots, except conventional tillage, were established with a cover crop of rye (*Secale cereale* L.) which averaged 5400 and 3600 lb/A dry matter in 1995 and 1996, respectively . Cotton, 'DPL 51' and 'DPL NuCOTN 35^{B}' was planted in 1995 and 1996, respectively, on 40-inch rows. Soil volumetric water content was determined twice a week (0-16 in. depth) from the in-row, and trafficked and nontrafficked row middle positions using time domain reflctometry. Cotton performance was evaluated by percent open bolls and yield. Soil penetrometer readings were taken after planting to evaluate soil strength as affected by tillage practice.

In both 1995 and 1996, deep tillage (either subsoiling or paratilling) resulted in greater soil water depletion (an indication of improved rooting) compared to conventional tillage. Soil water depletion was greatest under paratilling with ridging. In both years, paratilling and subsoiling eliminated soil compaction below 10 inches in the profile compared to conventional tillage and the no-tillage control (flat plant without deep tillage). In 1995 ridge tillage resulted in greater seed cotton yields than flat planting (1579 lb/A vs. 1404 lb/A) and was equivalent to conventional tillage (1509 lb/A). In 1996, flat planting with deep tillage and fall ridging without deep tillage resulted in greater yields (3890 lb/A and 3740 lb/A, respectively) than conventional tillage (3130 lb/A), however, fall ridging with deep tillage did not result in greater yields (3230 lb/A). The reduction in yield with ridging in combination with deep tillage was due to the additive effect of both practices on delaying maturity (as measured by percent open bolls). In summary, conservation tillage with high levels of cover crop residue yielded as well or better than conventional tillage both years. Both ridge tillage and deep tillage had a positive effect on soil water extraction and yield. Although further study is needed to evaluate a wider range of environmental conditions, fall ridging and deep tillage appear to be promising conservation tillage practices for the Tennessee Valley.

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