COTTON GROWTH AND DEVELOPMENT UNDER DIFFERENT TILLAGE SYSTEMS

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INTERPRETIVE SUMMARY

Interest in conservation tillage systems has grown because of the need to reduce production costs and improve soil productivity. Cotton *(Gossypium hirsutum* L) yield response to conservation tillage has been variable. Stand establishment problems have been implicated, but lower populations have not always resulted in lower yields. Analysis of crop growth and development can provide insight into differences between various treatment inputs that affect yield. Such analyses would lead to a better understanding of how conservation tillage systems improve or impair cotton productivity.

Shoot growth analyses [crop growth rates (CGR), leaf area indices (LAI), net assimilation rate, and fruiting from numbers and weights] and root growth determination (root length density or soil moisture extraction) were conducted in 1991, 1992, and 1994 on a Gigger silt loam soil for three tillage systems initiated in 1987. These systems were conventional, ridge tillage, and no tillage. Each system included four cover crops; native vegetation, winter wheat, hairy vetch, and crimson clover. The cover crops did not produce consistent interactive effects with tillage and were therefore pooled.

An important component in crop production research is knowing when treatment differences first begin to occur in the crop. In this study, treatment differences in CGR and LAI occurred prior to the appearance of flower buds and were maintained through early bloom. The no-till system produced plants that reached exponential growth sooner and at a higher rate than the ridge-till system each year of the study. Conventional tillage was similar to no till in two of three years, but less in 1991. The increased CGR was due to greater LAI development. The greater LAI and CGR resulted in numerically to significantly greater early flower bud production and earlier and greater boll set or individual boll weights. All of these factors related to final yield. Lint yield averaged over the 3 years of this study were 944 lb/A for no till, 899 lb/A for conventional tillage, and 795 lb/A for ridge tillage. Differences between tillage systems could not be attributed to plant population. Root length density and soil moisture extraction for the ridge till system often lagged behind that of the other two systems, but this was not consistent. Soil impedance data taken in 1993 indicated the ridge till system had the greatest soil impedance at 0-6 inches in the soil profile. A loss of soil structure, organic matter, and soil aggregation in the planting zone by the ridge till process may have contributed to compaction or a loss of nutrients resulting in slower crop development for that system. The slower growth and development began very early and persisted through the beginning portion of reproductive development of the crop. The no-till system had the greatest pre bloom CGR and lint yields, indicating this was the conservation tillage system with the greatest production potential for this soil type.