Cotton And Corn Rotation Under Reduced Tillage Management: Impacts On Soil Properties, Weed Control, And Yield

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Historically, cotton has been grown in monoculture under conventional tillage system in the lower Mississippi Delta region. Profit margins in cotton production have declined in recent years due to high production costs, low commodity prices, and stagnant yields. There is a need to find profitable crop production systems that increase crop yields without greatly increasing production costs. There has been a renewed interest in producing cotton in a rotation system to overcome chemical and biological factors associated with a yield plateau that occur in cotton monoculture. When crops are rotated, the change in herbicides and practices may often improve control of problem weeds, soil properties, and crop yields. Reduced tillage system minimize input cost due to fewer tillage operations. Transgenic crops resistant to glyphosate introduced during the past decade have provided farmers flexibility to manage weeds and freedom to choose a rotational crop for the following year without restrictions. This study examines cotton and corn production in a rotation under a reduced tillage system. The specific objectives of this study were to compare soil properties, weed control, yields, and net return from continuous and rotated cotton-corn production systems. Weed control and yields from glyphosate-resistant (GR) and non-GR cultivars were measured and compared over the 6-yr period. An important aspect of this research was to determine whether rotation of cotton with corn would increase crop yields and profit under reduced tillage systems in the lower Mississippi River alluvial flood plain region.

A 6-yr rotation study was conducted from 2000 to 2005 on a Dundee silt loam at Stoneville, MS. There were four rotation systems (continuous cotton, continuous corn, cotton-corn, and corn-cotton) for each conventional and GR cultivar arranged in a randomized complete block design with four replications. Each treatment consisted of eight rows spaced 40-inch apart and 150-feet long. After the fall of 2000, the experimental area received no tillage operations except the beds were conditioned: re-hipped after harvest and flattened before planting. Glyphosate-based program in GR cultivars and non-glyphosate-based program in conventional cultivars were used for weed control. Crops were irrigated on an as-needed basis each year.

Soil organic matter in surface 5-cm soil at planting was higher in corn grown continuously and in rotation compared to continuous cotton system. Overall, soil pH and other fertility parameters were similar in all rotation systems. Control of ten dominant weed species (grass and broadleaf) in cotton and corn was >93%, regardless of herbicide program and weed control was sufficient to support cotton and corn production. Control of browntop millet and hyssop spurge slightly reduced (83 to 85%) in rotated non-GR cotton after 6 years. Control of yellow nutsedge (55%) was reduced in continuous non-GR cotton; this apparent weed species shift toward yellow nutsedge was mitigated by breaking the cotton monocrop with corn. Plant populations of both conventional and GR cotton rotated with corn were similar to that of continuous cotton suggesting cotton stand establishment was not affected by corn residues from the previous year. Cotton yield increased every year following rotation with corn by 10 to 32% in the conventional cultivar and by 14 to 19% in the GR cultivar compared to continuous cotton. Similarly, corn yield increased by 5 to 13% in the conventional cultivar and by 1 to11% in the GR cultivar when rotated with cotton. These results indicate that a rotational system can increase yield in both cotton and corn over a mono-cropping system without increasing production costs. This 6-yr study under reduced tillage demonstrated that a switch to cotton-corn rotation system is agronomically feasible, economically beneficial, and potentially sustainable option for farmers in the lower Mississippi Delta region.