CONSERVATION TILLAGE SYSTEMS AND RESEARCH IN TEXAS

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Abstract

Cotton is an important economic crop in southern central and southern plains of northwest Texas. However, maintenance or expansion of current acreages of this crop is dependant upon reduction of production costs. Conservation tillage in many areas can be influential in development of profitable systems that can also meet conservation compliance. Such systems can also be beneficial economically and otherwise even on non-highly erodible soils.

The purpose of these studies was to evaluate influence of long-term tillage practices on nitrogen requirements, cotton yields and economic returns.

Experiments were conducted on two South Texas soils, an Orelia sandy clay loam (*Typic Ochraqualf*, Experiment I) and a Victoria clay (*Udic Pellustert* Experiment II). Tillage treatments on the Orelia soil included conventional (CT), minimum till (MT), minimum till + in-row chisel (MT+Ch) and no-till (NT). The MT included a total of five tillage trips with tillage depth maintained at three inches. The MT+Ch was identical to MT with the addition of in-row chisel at 16 inch-depth. The chisel replaced the root plow used in the MT treatment. The CT system involved tillage to a maximum depth of six inches with yearly tillage operations totaling nine to eleven depending upon seasonal precipitation. Specific operations in the CT system included shredding and disking stalk after harvest, plowing out stubble in old plant rows with sweeps, rebuilding raised beds; row middle and beds were cultivated with sweeps during fall and winter to control weeds. The MT system included shredding and disking stalks after harvest following by root plowing plant stubble and forming low profile beds in one operation; glyphosate and dicamba + 2, 4-D were sprayed to control winter and fall weeds; NT included shredding stalks, spraying regrowth with dicamba + 2, 4-D, fall and winter weeds were controlled with paraquat and glyphosate as needed. No tillage was performed either preplant or post-plant in this system with the exception of the minimal soil disturbance in knifing fertilizer and vee seed placement operations. All tillage treatments were tested at 60 N and $30P_20_5$ lb/A fertilization rates.

Field study No. II in South Texas was conducted on a Victoria clay located at the Texas A&M University Research Farm at Corpus Christi over a 10-year period. The sixteen treatments included the same four tillage systems described for Experiment I each evaluated at fertilizer nitrogen rates of 0, 20, 40 and 60 lb N/A. Fertilizer phosphorus (P) was applied at 40 lb P_20_5/A to all treatments receiving N. As was the case for Experiment I, treatments were arranged in a randomized complete block design with four replications. All fertilizer was preplant band applied in a 4x4 placement. Row width for both experiments was 38 inches. Short-season cotton cultivars were used in both experiments.

The second conservation tillage project was located on the Southern Plains at Lamesa, Texas. Both dryland and irrigated experiments were conducted on an Amarillo fine sandy loam (*Paleustalf*) soil. The cropping systems being evaluated both under dryland and irrigation included MT cotton in which stalks were shredded, the old rows relisted to incorporate a preplant herbicide and cultivated as needed for weed control. Also included was terminated rye-cotton system in which rye was planted into cotton stalks following harvest and chemically terminated two-four weeks prior to cotton planting. Cotton was then seeded into the standing wheat residue. Under dyland no fertilizer was applied while 140-0-0 was applied to the irrigated test. Cotton planting dates were June 3 for dryland and May 2 for the irrigated test. Harvest dates were November 1 and October 16-18 for the dryland and irrigated testing, respectively.

Yield results from the long-term tillage studies in South Texas showed response to conservation tillage was variable with seasonal precipitation and soil type. On lighter textured Orelia sandy clay loam with below average precipitation, NT and MT cotton produced higher yields (5, 18%, respectively) than conventionally tilled cotton. With average and above average precipitation lint yields from both MT and MT+Ch equalled or exceeded yields from CT cotton.

Lint yields averaged for the 10-year study on the Victoria clay showed seven and eight percent increases (42, 52 lb lint/A) over CT, respectively, for MT and MT+Ch treatments. Cotton grown in the NT system produced slightly lower yields (-3%, -21 lb/A) compared to CT cotton. With above average precipitation, cotton in the MT and NT systems produced 1090 and 1114 lb lint/A with 40 lb N/A, respectively. Chiseling in the stubble row following harvest at a depth of 16 inches actually reduced yields by 124 lb/A. Higher N rates failed to increased lint yields. In seasons with below average precipitation, yields were reduced to approximately 52 and 59 percent of those with above-average precipitation for MT and NT, respectively. With CT lint yields were reduced to 48 percent under the same precipitation pattern. Preliminary economic analyses (based on 10 years data on Victoria) indicates substantial

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increase in net profit using the MT system when tillage depth is maintained at three inches or less.

Results of the Southern Plains experiments under dryland showed lint yields can range from 0 to 315 lb/A in droughty seasons. The zero yield was realized under CT because insufficient soil moisture was present at planting to establish a stand while with MT the good stand of cotton produced 315 lb lint/A compared to 39 lb lint/A in the terminated rye cover system. Five year averages showed highest yields and net returns were produced with the MT system. Dryland yields averaged 354 lb lint/A with the MT system which was 77 percent higher than yields with the CT system (199 lb lint/A). Average net returns for the MT system were $393/A compared to an average of $2/A for the CT system.

With irrigation, lint yields ranged from 966 to 1265 lb/A with terminated rye cover conservation tillage system producing the highest yields and net returns over the five year period. Compared to the CT system, MT averaged 13 percent higher yields and 25 percent higher net returns.