# COMPARISON OF TILLAGE METHODS FOR COTTON FOLLOWING FESCUE SOD IN CROPLAND

Joseph R. Johnson[1] and Keith McGregor[2]

## INTRODUCTION

The current acres enrolled in the Conservation Reserve Program (CRP) in the Brown Loam soil resource area in North Mississippi probably had already become an economic risk to the soybean producers before the CRP contracts. CRP is a contract program between USDA and producers to take fields with highly erodible land out of production for 10 years. Declining soybean prices and land productivity through the late 70's and early 80's caused soybean producers to abandon many of the fields before entering the CRP contracts. By far, most of the CRP acres of the Brown Loam was once pasture land brought into soybean production in the early and mid-seventies.

Cotton again has become the dominate crop of the Brown Loam soil area. Soybean acreage declined 70% during the decade of the 80's. The soybean acreage in the hill section continues to decline (USDA Statistical Reporting Service, 1981-82; 1991).. Brown Loam soil is of the ideal texture and structure for cotton production. Even though the hill land is considered droughty in the summer. cotton still can be very productive and return a favorable profit on the hills.

If considerable strength in cotton commodity prices were possible by the time CRP contracts expire, some of the land could return to cotton production. This, however, is speculative. The Agricultural Stabilization Conservation Service (ASCS) classified these fields as cropland. A Soil Conservation Service (SCS) farm plan will be necessary to bring the land back into production to avoid violating the Sodbuster Provision of the Food Security Act of 1985 Farm Bill. Type of cropping system allowed will depend on the Conservation Compliance Standards. The SCS has not determined if the compliance standards will be equal to the tolerance level (T) or 2T. On the average, 50% of the land per field is not classified as highly erodible (HE). Therefore, on a per field basis it could be possible to exceed the erosion standards on the HE portion of land and still be in compliance within the field. Consequently, the choice of tillage practices a producer uses in a field can be much broader than just what applies to the HE land.

With these factors in mind, research was started to evaluate the tillage procedures for handling CRP land going into cotton. The objective of this study was to evaluate the effects of alternative tillage practices and procedures (described in Methods and Materials) on cotton yields during the first year of cotton production following sod.

## METHODS AND MATERIALS

Research described in this report supports and complements broader cooperative studies between the North Mississippi Branch of MAFES and the National Sedimentation Laboratory (USDA-ARS) that evaluate effects on runoff and erosion of returning idle upland watersheds (similar to CRP land) to row crop production. Those studies include runoff and sediment yield measurements on a 4.4-acre watershed before and after implementation of conservation tillage treatments (contoured, no-till planted cotton rows and 20-foot wide grassed buffer strips) following fescue sod extablished in 1986. Soils on the watershed are a mixture of Memphis, Loring, and Providence silt loams. The Providence soil has a fragipan which is sometimes very shallow. This tillage study site was adjacent to the watershed, contained similar soils, and was treated in the same manner as the watershed prior to the beginning of this study.

The experimental design is a randomized complete block with five replications. Fragipan depth was measured at eight locations within each replication and was within 2 in in each replication. Tillage treatments were: (1) fall hipped and spring rehipped; (2) no-till; (3) conventional tillage (disk-chisel, disk, hip); (4) no-till with two cultivations; (5) spring 2X hipped. Two postemergence cultivations were made on all treatments except the (2) no-till treatment.

Roundup (2.0 lb ai/ac) was sprayed as a burndown treatment in October of 1992 over the entire study area before any fall tillage. A second Roundup (1.0 lb ai/ac) spray was made in the spring of 1993 on the no-till planted plots. Dual

[1] MAFES. North Mississippi Branch Sta , Holly Springs, MS
[2] USDA ARS. National Sedimentatino Lab. Oxford, MS

(0.5 lb ailac) and Cotoran (.75 lb ai/ac) were broadcast sprayed immediately after planting. The cotton was planted on April 29, 1993. Measurements for plant height, canopy cover, residue cover, and percent weeds were made on May 26, July 7, Aug. 11, and Sept. 14. The cultivations were made using a no-till cultivator on June 3 and July 2. An early post directed spray was made on June 14 using MSMA (1.5 lb ailac) and Cotoran 10.75 lb ai/ac) + Probe 10.67 lb ai/ac). A layby treatment was made on July 9 using Bladex 10.5 lb ai/ac) plus a 1% surfactant on vlv. Insecticide treatments were sprayed starting in early June with pinhead square for bollweevil and continuing throughout the growing season as needed according to scouting reports made by personnel on the station. Cotton was defoliated on October 1 using Def 11.2 lb ailac) + Prep 1.03 lb ailac) and machine harvested on October 22. After shredding stalks with a rotary cutter, residue cover was made using a transect line. A second residue cover will be made in May, 1994 after the second year's planting.

## RESULTS AND DISCUSSION

The conventional tilled system produced well-structured mellow beds for planting. The fall hipped beds were rough, cloddy, and uneven at planting. These beds had large air pockets. The sod rolled when it was hipped and the beds were inverted sod rolls on top of sod. The rehipping of the fall beds in the spring covered the cloddy surface with loose soil but didn't help in the overall bed structure. On the other hand, spring hipping resulted in beds that tilled easier and improved the bed structure. The rehipping of the spring beds, however, did make for a well developed seedbed. The no-till plots were planted flat into killed sod.

Plant residue at four weeks after planting averaged 80% higher for the no-till cotton than for the tilled cotton (Table 1). After the cultivations, the no-till plots without cultivations continued to average above 80% residue whereas the cultivated no-till cotton dropped below 40% residue. The sweep action of the cultivator covered more of the residue and exposed more soil in the no-till cotton than was realized by the eye.

Abundance of rainfall and water logged conditions the first four weeks after planting resulted in poor rooting systems in the no-till planted cotton. From personal observation, the rooting system of the cotton on the raised beds at six weeks after planting was superior to that of the cotton planted no-till on flat ground. The exposure of no-till plants to stress due to excess water produced a poor rooting system. The weather then turned hot and dry resulting in drought stress for the plants especially the no-till with the poor rooting system.

Plant population was statistically significant (P.05) for the no-till planted cotton versus the tilled plots (Table 2). Yet, the average population of all tillage practices ranged from 40,000 to 50,000 plants per acre, which are ideal plant population rates for North Mississippi Brown Loam soils IMcCarty, et al, 1990). Three weeks after emergence there was no difference in plant height in the tillage plots (Table 3). At eight weeks after emergence a big difference was observed in plant height. Preplant tilled cotton averaged 22 inches in height compared to 17 inches for cotton with no preplant tillage.

**Table 1. Seasonal residue in cotton plot with different tillage practices.**

| Tillage Practices | May 26 | July 7 | Aug. 11 | Sept. 14 |
|---|---|---|---|---|
| | Percent ground cover | | | |
| Fall Hipped | 6 | 6 | 7 | 44 |
| No-Till | 97 | 95 | 95 | 84 |
| Conventional Till | 6 | 2 | 3 | 55 |
| No-Till + Cult. | 94 | 36 | 31 | 56 |
| Spring Hipped | 16 | 14 | 14 | 54 |

**Table 2. Plant population of cotton within different tillage practices at three weeks after emergence.**

| | TILLAGE PRACTICE | |
|---|---|---|
| | Preplant Tillage | No Preplant Tillage |
| Plant population/acre | 50,666 | 43.499 |
| LSD (0.5) | 6,248 | |

Table 3. Seasonal growth and development in plant height and canopy closure of cotton plants grown using different tillage practices.

| | PLANT HEIGHT (IN) | | | | CANOPY COVER (%) | | | |
|---|---|---|---|---|---|---|---|---|
| Tillaae Practices | Mav 26 | July 7 | Aua. 11 | Sept. 14 | May 26 | July 7 | Aug. 11 | Sept. 14 |
| Full Hipped | 2 | 21 | 27 | 30 | 4 | 41 | 64 | 59 |
| No-Till | 2 | 16 | 29 | 33 | 3 | 32 | 59 | 59 |
| Conventional Till | 2 | 22 | 31 | 36 | 4 | 45 | 76 | 76 |
| No-Till + Cult. | 2 | 17 | 28 | 34 | 3 | 32 | 59 | 61 |
| Spring-Hipped | 2 | 23 | 31 | 34 | 3 | 46 | 75 | 74 |

Table 4. Seasonal weed population/50 ft of row in cotton grown using different tillage practices.

| Tillaae Practices | May 26 | July 7 | Aug. 11 | Sept. 14 |
|---|---|---|---|---|
| | | (%) | | |
| Fall Hipped | 0 | 2 | 2 | 3 |
| No-Till | 0 | 2 | 8 | 14 |
| Conventional Till | 0 | 1 | 1 | 2 |
| No-Till + Cult. | 0 | 1 | 9 | 15 |
| Spring Hipped | 0 | 1 | 1 | 2 |

Table 5. Seed cotton yield of cotton grown using different practices.

| TILLAGE PRACTICES | SEED COTTON YIELD |
|---|---|
| | lb/ac |
| Fall hipped | 1594 |
| No-till | 1540 |
| Conventional till | 1793 |
| No-till + cultivation | 1355 |
| Spring hipped | 1824 |
| LSD .05 | 320 |

Cultivation was made on June 3 and July 2 in all cotton with preplant tillage and in the designated no-till plot. Cultivation at these growth stages did not appear to have any beneficial effect on the plant growth and development- certainly not any that could be measured in terms of height or canopy. The cotton in the fall-hipped plots grew similar to the other tilled plots until about eight weeks after emergence. From that point until maturity there was very little growth in plant height for the fall hipped cotton. This lack of plant growth was probably a result of the structure of the seedbed, which dried out rapidly.

Closure of plant canopy closely followed the same pattern as plant height for the different tillage systems. The spring hipped cotton and the conventional tilled cotton had a higher percentage of canopy closure after August 11 than the fall hipped, no-tilled plus cultivate, and no-till cotton. Cultivation of the no-till cotton after plants were four and eight weeks old did not have any effect on plant canopy closure.

Weed population was higher in the no-till and no-till plus cultivate at 12 and 17 weeks after emergence than in the plots that had preplant tillage (Table 4). The plots with no preplant tillage had shorter plants with less canopy cover at eight weeks after planting thereby allowing more light on the row, which enhanced weed seed germination.

Yields were significantly lower (P.05) for the no-till plus cultivate plots (Table 5). Yields were more of a reflection of available soil moisture and rooting system than any other factor.

## CONCLUSION

The no-till planted plots had a significantly lower plant population. However, the population of the no-till plots were within the recommended range. Plant height and canopy closure were the highest for the conventional tilled plots. Residue as ground cover decreased as tillage increased. Yields were significantly lower for the no-till plus cultivate plots.

## REFERENCES

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