# TILLAGE SYSTEM EFFECTS ON COTTON YIELD AND PROFITABILITY ON SILTY UPLAND SOILS.

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## Abstract

Tillage practices for cotton production were evaluated over a five-year period on a highly erosive wind transported soil in northern Mississippi (Tate County). A tillage study for cotton (*Gossypium hirsutum L.*) was established fol-lowing sod on a site with loess soils. The sod was tilled prior to establishment of treatments which included conventional (chisel, disk, bed, cultivate), ridge-till (remove ridge tops at planting, cultivate postemergence to rebuild ridges), no-tillage [wheat (*Triticum aestivum L.*) cover seeded following harvest, killed prior to planting], and minimum tillage (one pass with a mulch finisher prior to planting, cultivate postemergence). During the first year of the study, no-tillage cotton yields were lower compared to yields of cotton grown on conventional tilled soil. During years three to five, no-tillage crop yields were 19 to 43 percent greater than conventional tillage. Results of this study indicate viable no-tillage production systems for cotton can be developed for highly erosive loess soils in the Mid-South.

## Introduction

The Southern Mississippi Valley Silty Uplands, commonly referred to as the Brown Loam or Loess Belt, extends from Western Tennessee south through west Mississippi into Louisiana and borders the Mississippi Delta on the east. This belt of silty soils is divided into two local areas, the Thick Loess and Thin Loess and is actually the southern part of the great Loess Belt of the Central United States. The thick loess and thin loess areas combined comprise about 8 million acres in Mississippi, and depth of loess ranges from several feet on the western side to a few inches as it merges with the Coastal Plain on the east. The rest of this loess region located in the Midwest contains some of the most productive soils in the world. With the exception of the Delta, the loess soils are among the most productive soils in Mississippi. A combination of high fertility, good physical properties and favorable climate typify Mississippi loess soils which are capable of producing high yields of many crops, including cotton.

These soils while productive, are extremely susceptible to erosion once cleared for farming. Loess (silt) is easily eroded by raindrop impact and running water due to its weak cohesion. Mississippi's high rainfall and the steep slopes on which many of these soils occur also contribute to the severity of erosion. Current and past farming practices also contribute to the excessive erosion which is occurring on many farms today. Nearly all land in row crops on loess soils in Mississippi is being farmed using clean cultivation with few conservation measures.

Erosion is reducing the productivity of these soils, as well as resulting in other economic impacts. The large volume of sediment that washes from unprotected fields leads to water pollution, clogged stream channels, reduced water storage in reservoirs, and increased cost of maintaining roads, drainage systems, and navigable river systems including the Mississippi river. It appears that the adoption of conservation farming practices would do much to alleviate the above problems.

## Review of Literature

Much research has been devoted to developing cropping practices which reduce erosion. The value of no-tillage and reduced tillage for reducing erosion on Mississippi loess soils is seen in the data presented by McGregor et al. (1975), and by Mutchler and Greer (1984). These data, in general, show drastic reductions in soil erosion for conservation tillage practices, and in some cases yield increases were obtained. Similar results have been obtained on other soils in Mississippi with respect to reduced erosion (Hairston et al., 1984). The soil conserving attributes of conservation tillage have also been demonstrated on many other soils in various regions of the U.S. (Johnson et al., 1979; Laflen, 1978; Langdale et al., 1979; and Mannering et al., 1966).

The problem appears not to be a lack of research information but rather the lack of adoption of conservation practices by Mississippi farmers. Some of this reluctance may be because so little research information is available concerning relative net returns that may be expected from the adoption of some conservation practices relative to the conventional clean tillage production systems currently being used. This, understandably, is of no small concern to farmers. Some research has been done in Mississippi on prairie soils addressing this problem. Hairston et al. (1984) showed that conserva-tion production systems, while reducing erosion, did not produce net returns comparable to those of conventional tillage practices.

With this background, a research-demonstration project was jointly undertaken by the USDA-ARS and MAFES in

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erosive areas of the Brown Loam region to address the problem.

## Methods and Materials

The site for this study is located in the deep Loess soils belt in northern Mississippi. The soils included Memphis, Grenada, and Loring silt loams.

The site had been used to produce cotton and other row crops in the past, but was in a mixed grass pasture for at least two years before the study was conducted. Areas for production plots were selected in the summer of 1987, and the blocks were sprayed with Roundup. The killed vegetation was burned after the top of the plants dried. Soil samples were taken and lime, P, and K applied, based on needs indicated by soil test results. The blocks were chisel plowed and disked that fall and wheat was drilled over the entire area to provide a winter cover crop. Individual plots were 18 feet wide and 40 feet long, which permitted six 36-inch wide rows per plot.

In April of 1988, all wheat was sprayed with Roundup and tillage treatments were initiated. The cultivar DES 119-triple treated (Orthene, Vitavax, and Captan)and acid delinted-was planted in each treatment. All plots were plant-ed the same day. Treatments #1 and #2 were planted on ridges, treatments #3 and #4 were planted on flat ground. Cotton was scouted and treated for insects as required. All treatments received a broadcast application of 350 lb./acre of 13-13-13 fertilizer containing boron at or near planting. All treat-ments received a sidedress application of ammonium nitrate at 45 lb./acre at about the four-leaf stage. All treatments except #3 utilized cultivation for weed control. All treatments employed postemerge herbicides, when neces-sary, to achieve good levels of weed control. Postemerge herbicides included Poast or Fusilade, Bladex, Caparol, or MSMA as needed. Yields were har-vested by hand, or mechanically when equipment was available. Stalks were shredded with a flail-type chopper as the final fall operation in all treatments.

### Treatment #1

**Conventional tillage:**
Tillage began in the spring with the minimum number of chiselings and diskings necessary to prepare the soil. Fertilizer and preplant herbicide (2.0 pints Prowl/acre) was broadcast applied and incorporated during soil preparation. Plots were hipped (bedded), harrowed, and planted in late April or early May. Preemergence applications of 3.0 pints Cotoran/acre (broadcast rate) were applied to an 18-inch band centered over each row. Cultivations and postemergence herbicide treatments were made as needed. Cultivation was such that at layby, the cotton was on a low ridge. Sidedress N was applied with a cultivation.

### Treatment #2

**Ridge-till:**
This treatment was planted with no primary tillage by knocking off the top of ridges (formed by cultivation the previous year) at planting with trash wippers mounted on a John Deere 7340 planter. A burndown herbicide (Roundup or Paraquat) was applied prior to planting. Fertilizer was applied on the surface and incorporated by subsequent cultivation. Ridges were reformed by cultivation. Herbicides (1.7 pints Dual plus 3.0 pints Cotoran/acre, broadcast rate) were applied to an 18-inch band over the row at planting. Cultivations and postemergence herbicide applications, when necessary, were applied to control weeds. Sidedress N was applied with a cultivation. Ridges were rebuilt with the last cultivation.

### Treatment #3

**No-till planted into wheat:**
Wheat was grown as a winter cover crop and killed with herbicides (1 quart Roundup plus surfactant or 1.5 pints Paraquat plus surfactant/acre) during early to mid-April. Cotton was planted about two weeks later as weather conditions permitted using a ripple coulter mounted on a John Deere planter. Fertilizer was broadcast at planting and at the four-leaf stage. Herbicides (2.0 pints Dual plus 3.0 pints Cotoran/acre) were broadcast applied preemergence. Directed sprays or over-the-top postemergence applications, when necessary, were used for weed control. Cultivations were made only when chemical weed control was unsatisfactory. Wheat was no-till drilled after cotton harvest followed by stalk shredding. Wheat and cotton was planted on flat ground in this treatment and the one which follows.

### Treatment #4

**Minimum seedbed preparation:**
A specialized conservation tillage implement was used in a once-over seedbed preparation. The implement was equipped with disks preceding field cultivator sweeps which are followed by smoothing fingers. Fertilizer and preemergence herbicide (2.0 pints Prowl/acre) was broadcast applied prior to tillage and incorporated with this operation. Preemergence application of 3.0 pints Cotoran/acre (broadcast rate) was applied to an 18-inch band over each row after planting. Cultivations and additional herbicides, when necessary, were used to control weeds. Cultivations were such that very low ridges were formed. Sidedress N was applied with a cultivation. This treatment sometimes required a contact herbicide application before tillage.

## Results

**Yield comparisons:**
Monthly and annual total rainfall amounts for all crop years are shown in Table 1. During the course of the study, rainfall amounts were both greater than and less than the long-term mean values for the area. Growing season rainfall (June-August) fluctuated widely.

In the first year of the study (1988), crop yield with conventional tillage was greater than that of other tillage systems. All systems had been tilled the previous fall and all except the no-till plots were retilled prior to planting.

In 1989, the first insecticide application contained an unknown contaminant that damaged the crop plants and reduced productivity of all treatments. No yield data are presented for this growing season.

In 1990, June through August rainfall was less than 50 percent of normal, severely limiting yields of all treatments. During this growing season, yields of no-till and minimum tillage were greater than ridge tillage. Furthermore, no-tillage yield was greater than that of conventional. When compared to conventional, no-tillage crop yields were 19 percent higher.

Rainfall during June to August 1991 was 88 percent of normal and yields of all treatments were greater than for 1990. When compared to conventional, no-till crop yields were 43 percent greater, perhaps reflecting better water utilization for this treatment. The minimum tillage treatment yields were equal to conventional but greater than ridge tillage produced cotton.

June to August rainfall during 1992 was 163 percent of normal and all tillage treatments had the highest yields of any year of the study. During this year, the yield pattern was similar to 1990 with no-till being 21 percent greater than conventional and conventional yields being slightly greater than minimum and ridge tillage.

Conventional and ridge tilled treatments maintained the same generalized yield ranking with the ridge tillage treatment being slightly lower than conventional. Yields of both no-till and minimum till increased with time relative to the conventional treatment. The relationship of yield trends for the tillage treatments is shown in figure 1. From the data collected, no determin-ation can be made as to whether soil conditions for the tilled treatments deteriorated or no-till improved to cause the relative change in yields.

**Cost comparisons:**
To evaluate the profitability of the various tillage systems, enterprise budgets were developed for each of the treatments. Data collected for these budgets included sequence of operations, input requirements, and yield differences. Information from the enterprise budgets was used to determine input use, direct and fixed costs, and returns.

The first step in the analysis was to evaluate the production efficiencies for each the treatments. This was accomplished by constructing the enterprise budgets. Tables 3 - 6 present a summary of the costs and returns per acre for each of the four different tillage systems for years 1988, 90, 91, and 92.

**Direct, fixed, and total costs:**
Total direct costs for treatments 1,2, and 4 were comparable during each year of the study. Total direct costs were highest in treatment 3 (no-till) for all years. The single most important expense that contributes to this difference is herbicide costs. Another cost to consider here is the additional wheat seed cost. Fixed costs for all tillage systems did not vary widely. The average range in fixed costs was $11.31/acre. Total costs for no-till were also the highest each year.

**Seed:**
The same quantity of cotton seed per acre was utilized for each tillage system. However, the wheat planted in the no-till treatments increased direct expenses significantly. The additional cost from planting the wheat seed ranged from $9.00 to $15.60 per acre. Variance in this cost was due to different seeding rates and cost of seed.

**Herbicide:**
Treatment 3 (no-till) was cultivated postemergence in 1988 (only) to control nutsedge and perennial vines; all other treatments were cultivated at least twice each year. Perennial vine and nutsedge populations decreased each year and weed control was excellent in all systems during the last three years of the study. However, herbicide costs were substantially higher for these years in the no-till treatments. The same herbicides were used for all treatments, but the rates applied to the no-till treatments were significantly higher.

**Fertilizer:**
Fertilizer rates were the same for all tillage systems each year. A broadcast application of fertilizer was made for all treatments each spring before tillage operations. This consisted of an application of 13-13-13. Additional nitrogen was broadcast post emergence.

**Insecticide:**
Insects were scouted on weekly intervals and controlled by various insecticides as recommended by a crop consultant. Insect control was considered satisfactory and did not have an effect on crop productivity. There was no significant variation in insecticide applications among tillage systems.

**Custom & hauling expenses:**
Custom expenses included insect scouting, aerial insect and defoliant applications, and ginning. All of these expenses for each tillage system, with the exception of ginning,

remained approximately the same each year. Ginning charges and the associated hauling costs both varied based on yields. Therefore, these charges were highest in the no-till budgets for the last three years of the study.

**Other expenses:**
Expenses in this category include: operator labor, diesel fuel, and repairs and maintenance. These expenses were lower for the ridge and no-till treatments. Specific expenses that were lowest included: operator labor for tractors, diesel fuel for tractors, and repairs and maintenance for tractors. These expenses for minimum tillage were higher due to the increased horsepower requirements for the single-pass tillage equipment.

## Summary and Conclusions

An improved moisture regime with no-till is likely an important factor in increased yields for no-till during the last three years of this study. When yields are calculated on a percentage basis, the greatest difference between no-till and conventional tillage treatments was during a moderately dry year (1991, 43%). During the year with above average rainfall, no-till yield was 21 percent greater than that of conventional tillage. This yield pattern fits one that might be expected with a treatment that conserves rainfall through increased infiltration and/or reduced evaporation. The crop root system in the untilled system may have a deeper water extraction pattern due to better access to deeper soil via more macropores and improved soil structure.

Despite having the highest total cost among all the tillage systems, no-till treatments also had the highest net returns for the last three years of the study. A summary of the net returns for all tillage systems is found in table 7. As indicated earlier in table 2, the no-till cotton yielded more lint per acre than the other tillage systems for years 3 through 5. These higher yields were more than able to offset the increases in herbicide and seed costs.

The significant increase in cotton yields produced with no-till relative to conventional tillage indicate management systems for no-till cotton can be developed, and that no-till cotton may be a viable option for some highly erosive upland soils in the mid-south. This would be important to mid-south U.S. cotton growers because this practice allows a higher value crop to be produced on highly erosive soils without the usual soil losses associated with cotton production.

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Table 1. Monthly rainfall amounts, Nelson Farm, Mississippi, 1988-1992.

| MONTH | 1988 | 1989 | 1990 | 1991 | 1992 | NORMAL |
|---|---|---|---|---|---|---|
| | MM | MM | MM | MM | MM | MM |
| JAN. | 50 | 154 | 122 | 54 | 59 | 123 |
| FEB. | 74 | 180 | 322 | 237 | 73 | 121 |
| MAR. | 120 | 140 | 187 | 137 | 221 | 141 |
| APR. | 115 | 32 | 148 | 402 | 51 | 139 |
| MAY. | 18 | 93 | 207 | 165 | 23 | 140 |
| JUN. | 1 | 341 | 53 | 85 | 168 | 91 |
| JUL. | 363 | 219 | 62 | 59 | 121 | 90 |
| AUG. | 7 | 75 | 6 | 81 | 130 | 76 |
| SEP. | 132 | 130 | 43 | 37 | 52 | 94 |
| OCT. | 30 | 31 | 140 | 119 | 66 | 58 |
| NOV. | 175 | 106 | 99 | 204 | 96 | 122 |
| DEC. | 162 | 74 | 343 | 170 | 111 | 132 |
| TOTAL | 1247 | 1575 | 1732 | 1750 | 1171 | 1327 |

Table 2. Comparison of seed cotton yields, Nelson farm, 6-36" rows, conventional, ridge, no, and minimum tillage, Mississippi, 988, 90, 91,92.

| YEAR | CONVENTIONAL | RIDGE | NO-TILL | MINIMUM |
|---|---|---|---|---|
| | (lbs.) | (lbs.) | (lbs.) | (lbs.) |
| 1988 | 1830 | 1560 | 1560 | 1430 |
| 1990 | 1125 | 825 | 1335 | 1130 |
| 1991 | 1540 | 1460 | 2200 | 1740 |
| 1992 | 2480 | 2275 | 3000 | 2425 |
| Average | 1744 | 1530 | 2024 | 1681 |

Note: All 1989 cotton treatments were damaged by a contamination in the first insecticide application during July 1989.

Table 3. Comparison of cost and returns per acre, Nelson Farm, cotton, 6-36" rows, conventional, ridge, no, and minimum tillage, Upper thick loess, Mississippi, 1988.

| ITEM | CONV. | RIDGE | NO-TILL | MINIMUM |
|---|---|---|---|---|
| INCOME | | | | |
| Cotton Lint (lbs.) | 718 | 612 | 612 | 561 |
| Cotton Seed (lbs.) | 1112 | 948 | 948 | 869 |
| TOTALINCOME($) | 456.98 | 389.52 | 389.52 | 357.06 |
| DIRECT EXPENSES ($) | | | | |
| CUSTOM | | | | |
| Insect scouting | 4.00 | 4.00 | 4.00 | 4.00 |
| App Ins by Air | 20.00 | 20.00 | 20.00 | 20.00 |
| App. Defoliant/Air | 2.75 | 2.75 | 2.75 | 2.75 |
| HARVEST AID | | | | |
| Gramoxone | | 11.20 | 11.20 | 11.20 |
| Def | 2.98 | 2.98 | 2.98 | 2.98 |
| Dropp | 14.11 | 14.11 | 14.11 | 14.11 |
| FERTILIZER | | | | |
| Fert 13-13-13 | 33.04 | 33.04 | 33.04 | 33.04 |
| Nitrogen 32% | 16.16 | 16.16 | 16.16 | 16.16 |
| HERBICIDE | | | | |
| Prowl | 5.40 | | | 5.40 |
| Cotoran 4L | 16.44 | 16.44 | 16.44 | 16.44 |
| Dual 8E | | 11.80 | 11.80 | |
| INSECTICIDE | | | | |
| Lorsban | 4.09 | 4.09 | 4.09 | 4.09 |
| Bidrin 1.56 | 1.56 | 1.56 | 1.56 | |
| Methyl Par. | 17.33 | 17.33 | 17.33 | 17.33 |
| Cymbush | 5.12 | 5.12 | 5.12 | 5.12 |
| Orthene SP | 5.36 | 5.36 | 5.36 | 5.36 |
| HAUL | | | | |
| Haul Cotton | 14.36 | 12.24 | 12.24 | 11.22 |
| SEED/PLANTS | | | | |
| Cotton Seed | 8.51 | 8.51 | 8.51 | 8.51 |
| Wheat Seed | | | 9.60 | |
| OPERATOR LABOR | | | | |
| Implements | 1.24 | 1.24 | 1.24 | 1.24 |
| Tractors | 10.51 | 9.53 | 9.73 | 11.79 |
| Self-propelled | 6.84 | 6.84 | 6.84 | 6.84 |
| DIESEL FUEL | | | | |
| Tractors | 6.59 | 5.78 | 5.89 | 7.06 |
| Self-propelled | 2.12 | 2.12 | 2.12 | 2.12 |
| REPAIR & MAINTEN. | | | | |
| Implements | 4.02 | 2.49 | 3.11 | 4.33 |
| Tractors | 4.77 | 4.25 | 4.34 | 5.23 |
| Self-propelled | 19.39 | 19.39 | 19.39 | 19.39 |
| INTEREST ON OP.CAP. | 7.72 | 8.30 | 8.35 | 8.33 |
| TOT. DIRECT EXPENSES ($) | 291.85 | 295.59 | 306.26 | 290.48 |
| RET. ABOVE DIRECT EXP. ($) | 165.13 | 93.93 | 83.26 | 66.58 |
| FIXED EXPENSES ($) | | | | |
| Implements | 38.45 | 38.45 | 38.45 | 38.45 |
| TOTAL FIXED EXP. ($) | 60.08 | 55.33 | 56.68 | 61.51 |
| TOTAL EXPENSES ($) | 351.93 | 350.92 | 362.94 | 351.98 |
| RET. ABOVE TOTAL EXP. ($) | 105.05 | 38.60 | 26.58 | 5.08 |

Table 4. Comparison of cost and returns per acre, Nelson Farm, cotton, 6-36" rows, conventional, ridge, no, and minimum tillage, Upper thick loess, Mississippi, 1990.

| ITEM | CONV. | RIDGE | NO-TILL | MINIMUM |
|---|---|---|---|---|
| INCOME | | | | |
| Cotton Lint (lbs.) | 441 | 323 | 523 | 443 |
| Cotton Seed (lbs.) | 684 | 584 | 812 | 687 |
| TOTAL INCOME ($) | 278.73 | 207.47 | 330.59 | 279.99 |
| DIRECT EXPENSES ($) | | | | |
| CUSTOM | | | | |
| Insect scouting | 4.00 | 4.00 | 4.00 | 4.00 |
| App Ins by Air | 14.00 | 12.00 | 12.00 | 12.00 |
| Gin | 35.28 | 25.84 | 41.84 | 35.44 |
| FERTILIZER | | | | |
| Fert 13-13-13 | 34.93 | 34.93 | 34.93 | 34.93 |
| Nitrogen 32% | 12.19 | 12.19 | 12.19 | 12.19 |
| HERBICIDE | | | | |
| Roundup | | | 18.29 | |
| 2,4-D Amine | | | 1.35 | |
| Prowl 5.90 | | | 5.90 | |
| Cotoran 4L | 17.00 | 17.00 | 17.00 | 17.00 |
| Zorial 80% | 15.53 | | | 15.53 |
| Dual 8E | | 9.53 | 9.53 | |
| Cotoran +MSMA | 2.25 | | 7.50 | 2.25 |
| Lorox 4.14 | 4.14 | 4.14 | 4.14 | |
| MSMA + surfactant | 1.62 | 1.62 | 1.62 | 1.62 |
| Bladex 1.57 | | 4.70 | 1.57 | |
| Gramoxone | | 10.07 | 10.07 | |
| INSECTICIDE | | | | |
| Temik 15% | 11.89 | 11.89 | 11.89 | 11.89 |
| Di-Syston | | | .54 | |
| Methyl Par. | 3.11 | 3.11 | 3.11 | 3.11 |
| Cymbush | 24.23 | 19.82 | 15.42 | 19.82 |
| Orthene SP | 11.48 | 10.72 | 10.72 | 11.48 |
| HAUL | | | | |
| Haul Cotton | 8.82 | 6.46 | 10.46 | 8.86 |
| SEED/PLANTS | | | | |
| Cotton Seed | 14.20 | 14.20 | 14.20 | 14.20 |
| Wheat Seed | | | 15.60 | |
| OPERATOR LABOR | | | | |
| Tractors | 16.27 | 9.99 | 12.62 | 12.10 |
| Self-propelled | 6.84 | 6.84 | 6.84 | 6.84 |
| DIESEL FUEL | | | | |
| Tractors | 12.76 | 7.72 | 9.34 | 9.39 |
| Self-propelled | 2.72 | 2.72 | 2.72 | 2.72 |
| REPAIR & MAINTEN. | | | | |
| Implements | 7.01 | 3.19 | 3.93 | 5.26 |
| Tractors | 7.91 | 4.85 | 6.12 | 5.88 |
| Self-propelled | 21.31 | 21.31 | 21.31 | 21.31 |
| INTEREST ON OP.CAP. | 13.40 | 11.36 | 15.82 | 12.54 |
| TOT. DIRECT EXPENSES ($) | 310.36 | 265.50 | 339.80 | 291.97 |
| RET. ABOVE DIRECT EXP. ($) | (31.63) | (58.03) | (9.21) | (11.98) |
| FIXED EXPENSES ($) | | | | |
| Implements | 15.01 | 7.00 | 8.58 | 11.32 |
| Tractors | 22.24 | 13.45 | 16.21 | 16.35 |
| Self-propelled | 44.55 | 44.55 | 44.55 | 44.55 |
| TOTAL FIXED EXP. ($) | 81.80 | 65.00 | 69.34 | 72.22 |
| TOTAL EXPENSES ($) | 392.16 | 330.50 | 409.14 | 364.19 |
| RET. ABOVE TOTAL EXP. ($) | (113.43) | (123.03) | (78.55) | (84.20) |

Table 5. Comparison of cost and returns per acre, Nelson Farm, cotton, 6-36" rows, conventional, ridge, no, and minimum tillage, Upper thick loess, Mississippi, 1991.

| ITEM | CONV. | RIDGE | NO-TILL | MINIMUM |
|---|---|---|---|---|
| INCOME | | | | |
| Cotton Lint (lbs.) | 603 | 572 | 862 | 682 |
| Cotton Seed (lbs.) | 937 | 888 | 1338 | 1058 |
| TOTAL INCOME ($) | 393.25 | 373.00 | 562.10 | 444.70 |
| DIRECT EXPENSES ($) | | | | |
| CUSTOM | | | | |
| Insect scouting | 4.00 | 4.00 | 4.00 | 4.00 |
| App Ins by Air | 6.00 | 6.00 | 6.00 | 6.00 |
| Gin | 48.24 | 45.76 | 68.96 | 54.56 |
| FERTILIZER | | | | |
| Fert 13-13-13 | 29.73 | 29.73 | 29.73 | 29.73 |
| Nitrogen 32% | 12.27 | 12.27 | 12.27 | 12.27 |
| HERBICIDE | | | | |
| Roundup | | | | 17.69 |
| Prowl | 6.58 | | | 6.58 |
| Cotoran 4L | 8.98 | 8.98 | 17.96 | 8.98 |
| Zorial 80% | 6.34 | 6.34 | 12.69 | 6.34 |
| Dual 8E | | 5.03 | | 10.07 |
| MSMA + surfactant | | | 1.75 | 5.30 |
| Bladex | 1.61 | 1.61 | 5.35 | 1.61 |
| Gramoxone | | 3.24 | | 6.48 |
| INSECTICIDE | | | | |
| Guthion | 4.76 | 4.76 | 4.76 | 4.76 |
| Cymbush | 13.24 | 13.24 | 13.24 | 13.24 |
| Karate | 6.26 | 6.26 | 6.26 | 6.26 |
| HAUL | | | | |
| Haul Cotton | 12.06 | 11.44 | 17.24 | 13.64 |
| SEED/PLANTS | | | | |
| Cotton Seed | 7.53 | 7.53 | 7.53 | 7.53 |
| Wheat Seed | | | | 9.00 |
| OPERATOR LABOR | | | | |
| Tractors | 13.57 | 8.78 | 9.18 | 9.29 |
| Self-propelled | 7.48 | 7.48 | 7.48 | 7.48 |
| DIESEL FUEL | | | | |
| Tractors | 8.75 | 5.72 | 5.65 | 5.94 |
| Self-propelled | 2.48 | 2.48 | 2.48 | 2.48 |
| REPAIR & MAINTEN. | | | | |
| Implements | 5.32 | 3.34 | 3.77 | 3.52 |
| Tractors | 6.44 | 4.18 | 4.28 | 4.39 |
| Self-propelled | 21.38 | 21.38 | 21.38 | 21.38 |
| INTEREST ON OP.CAP. | 8.97 | 8.41 | 11.70 | 8.43 |
| TOT. DIRECT EXPENSES ($) | 241.99 | 230.16 | 324.53 | 238.41 |
| RET. ABOVE DIRECT EXP. ($) | 151.26 | 142.84 | 237.57 | 206.29 |
| FIXED EXPENSES ($) | | | | |
| Implements | 11.36 | 7.05 | 8.06 | 7.36 |
| Tractors | 17.87 | 11.72 | 11.29 | 12.09 |
| Self-propelled | 44.68 | 44.68 | 44.68 | 44.68 |
| TOTAL FIXED EXP. ($) | 73.91 | 63.45 | 64.03 | 64.13 |
| TOTAL EXPENSES ($) | 315.90 | 293.61 | 388.56 | 302.54 |
| RET. ABOVE TOTAL EXP. ($) | 77.37 | 79.39 | 173.54 | 142.16 |

Table 6. Comparison of cost and returns per acre, Nelson Farm, cotton, 6-36" rows, conventional, ridge, no, and minimum tillage, Upper thick loess, Mississippi, 1992.

| ITEM | CONV. | RIDGE | NO-TILL | MINIMUM |
|---|---|---|---|---|
| INCOME | | | | |
| Cotton Lint (lbs.) | 968 | 887 | 1170 | 945 |
| Cotton Seed (lbs.) | 1512 | 1388 | 1830 | 1470 |
| TOTAL INCOME ($) | 631.60 | 578.85 | 763.50 | 616.35 |
| DIRECT EXPENSES ($) | | | | |
| CUSTOM | | | | |
| Insect scouting | 4.00 | 4.00 | 4.00 | 4.00 |
| Gin | 77.44 | 70.96 | 93.60 | 75.60 |
| HARVEST AID | | | | |
| Def | 8.15 | 8.15 | 8.15 | 8.15 |
| Gramoxone | .77 | .77 | .77 | .77 |
| FERTILIZER | | | | |
| Fert 13-13-13 | 34.44 | 34.44 | 34.44 | 34.44 |
| Nitrogen 32% | 12.63 | 12.63 | 12.63 | 12.63 |
| FUNGICIDE | | | | |
| Terraclor Super X | 14.40 | 14.40 | 14.40 | 14.40 |
| Fungicide | 13.68 | 13.68 | 13.68 | 13.68 |
| HERBICIDE | | | | |
| Roundup | | 15.51 | | 15.51 |
| Cotoran 4L | 6.26 | 6.26 | 12.53 | 6.26 |
| Zorial 80% | 6.60 | 6.60 | 13.19 | 6.60 |
| Dual 8E | 5.59 | 5.59 | 11.18 | 5.59 |
| MSMA + surfactant | 2.71 | 2.71 | 5.42 | 2.71 |
| Bladex 2.83 | 2.83 | 5.65 | 2.83 | |
| Gramoxone | | 2.85 | 2.85 | 2.85 |
| Fusilade 2000 | 4.47 | 4.47 | 2.24 | 2.24 |
| Probe | 11.61 | 11.61 | 23.21 | 11.61 |
| INSECTICIDE | | | | |
| Temik 15% | 10.33 | 10.33 | 10.33 | 10.33 |
| Guthion | 18.29 | 18.29 | 18.29 | 18.29 |
| Larvin | 3.59 | 1.80 | 3.59 | 3.59 |
| Asana | 25.68 | 48.22 | 25.68 | 25.68 |
| Methyl Parathion | 4.01 | 4.01 | 4.01 | 4.01 |
| HAUL | | | | |
| Haul Cotton | 19.36 | 17.74 | 23.40 | 18.90 |
| SEED/PLANTS | | | | |
| Cotton Seed | 11.72 | 11.72 | 11.72 | 11.72 |
| Wheat Seed | | | | 11.55 |
| OPERATOR LABOR | | | | |
| Implements | 1.35 | 1.35 | 1.35 | 1.35 |
| Tractors | 13.06 | 8.90 | 6.47 | 8.11 |
| Self-propelled | 10.54 | 10.83 | 11.05 | 10.49 |
| DIESEL FUEL | | | | |
| Tractors | 8.29 | 5.64 | 3.90 | 5.12 |
| Self-propelled | 3.18 | 3.26 | 3.32 | 3.17 |
| REPAIR & MAINTEN. | | | | |
| Implements | 6.25 | 4.26 | 4.32 | 4.01 |
| Tractors | 6.60 | 4.50 | 3.13 | 4.08 |
| Self-propelled | 28.50 | 29.01 | 29.42 | 28.40 |
| INTEREST ON OP.CAP. | 12.33 | 13.62 | 14.42 | 11.79 |
| TOT. DIRECT EXPENSES ($) | 388.66 | 411.38 | 459.84 | 373.40 |
| RET. ABOVE DIRECT EXP. ($) | 242.94 | 167.47 | 303.66 | 242.95 |
| FIXED EXPENSES ($) | | | | |
| Implements | 13.21 | 9.39 | 9.71 | 8.89 |
| Tractors | 17.91 | 12.19 | 8.05 | 11.02 |
| Self-propelled | 54.43 | 55.31 | 56.01 | 54.26 |
| TOTAL FIXED EXP. ($) | 85.55 | 76.89 | 73.77 | 74.17 |
| TOTAL EXPENSES ($) | 474.21 | 488.27 | 533.61 | 447.57 |
| RET. ABOVE TOTAL EXP. ($) | 157.39 | 90.58 | 229.89 | 168.78 |

Table 7. Comparison of net returns, Nelson farm, cotton, 6-36" rows, conventional, ridge, no, and minimum tillage, Mississippi, 1988, 90, 91, 92.

| YEAR | CONV. | RIDGE | NO-TILL | MINIMUM |
|---|---|---|---|---|
| 1988 | $105.05 | $38.60 | $26.58 | $5.08 |
| 1990 | ($113.43) | ($123.03) | ($78.55) | ($84.20) |
| 1991 | $77.35 | $79.39 | $173.54 | $142.16 |
| 1992 | $157.39 | $90.58 | $229.89 | $168.78 |
| Average | $56.59 | $21.39 | $87.86 | $57.95 |

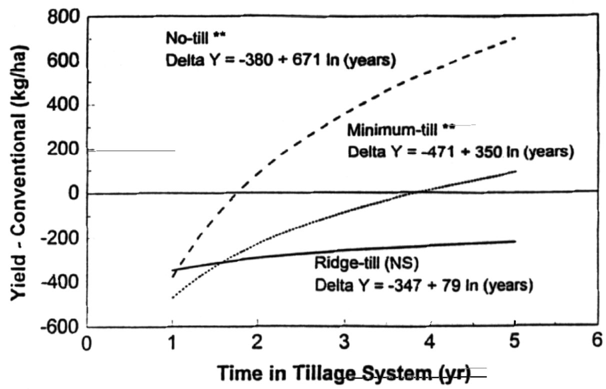


Figure 1. Yield relationship of conventional U.S. no-till, minimum-till and ridge-till tillage systems.
Source: Triplett, et al.