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MULTI-YEAR EVALUATION OF NO-TILL, LOW-TILL AND CONVENTIONAL TILL COTTON IN LOUISIANA AND MISSISSIPPI

Greg Ferguson
Monsanto
Madison, MS
John Bradley
Monsanto
Memphis, TN

Abstract

Center of Excellence farms have been established in numerous locations across the United States to promote conservation tillage. In 1998 one of these sites was established on the Turner Brothers Farm near Mer Rouge, LA. Three tillage systems were initiated in cotton to evaluate the economic potential of conservation tillage. The three tillage systems were, conventional till, low till and no till. Another Center of Excellence site was established on Cato Farms near Yazoo City, MS. Similar tillage systems were initiated in cotton at this site. Production costs (excluding land rent) per acre were fairly similar between the sites. These ranged from a high of $457.18 at Mer Rouge and $440.10 at Yazoo City for the conventional till system to a low of $413.80 at Yazoo city and $430.98 at Mer Rouge for the no till system. The differences in production costs between the conventional till and no till systems were almost identical. There was a difference of $26.20 at Mer Rouge and $26.30 at Yazoo City. Yields at Mer Rouge averaged 37 pounds of lint more for the no till than for the conventional till. Profits for the no till at Mer Rouge averaged $135 per acre, and $83 for conventional till. The difference in production costs and yields resulted in a profit advantage for the no till system of $52 per acre. Results at Yazoo City were mixed. In 2001, results were very similar to Mer Rouge. However, in 2002, conventional till plots had a stand advantage of about 1 plant per foot, which was due to planting into dry soil in the no till and low till plots versus using a do-all in the conventional till systems. With the substantial difference in yield for 2002, profits averaged only $10 per acre more for conventional till. Break-even costs at Mer Rouge ranged from a low of $0.38 per pound with the no till systems in 2002 to a high of $0.83 per pound for the conventional till in 1998. At Yazoo City, break-even costs ranged from a low of $0.43 per pound in 2001 with the no till plots to a high of $0.46 per pound for the no till plots in 2002.

Introduction

Conservation tillage systems have been in place with varying degrees of success for many years, however, with the introduction of Roundup Ready crops the adoption of conservation tillage systems has been more rapid. Due to a lack of selective post emergence broadleaf herbicides in cotton, and traditional ideas about growing cotton, adoption of conservation tillage systems was slow. One of the reasons for initiating Center of Excellence farms was to show how Roundup Ready technology could be used to help growers move to a conservation tillage system, with that idea, Center of Excellence farms were started in many locations across the United States. In 1998, a Center of Excellence farm was started near Mer Rouge, Louisiana on the Turner Brothers Farm. Three tillage systems were initiated to show how conservation tillage could be useful to cotton growers. Those tillage systems included a conventional till system, which included some type of deep tillage in the fall followed by re-bedding, another re-bedding in the spring, followed by a bed conditioner prior to planting and at least 2 cultivations prior to harvest. The other main system was no till or as close to no till as possible. A third treatment was added, which was basically the no till system with fall tillage added which was called a low till system. With the successful implementation of the Mer Rouge site, an additional site near Yazoo City, Mississippi was added. This was started on Cato Farms with very similar tillage systems. After conducting the systems for several years the evidence has shown that conservation tillage systems are less expensive per acre to implement and result in equal or greater yields.

Materials and Methods

The Center of Excellence near Mer Rouge was established in 1998 on a field with a very uniform silt loam soil. Three tillage systems (Table 1.) basically consisting of No Till, Low Till and Conventional Till were established and replicated three times. Plot size was 32 rows 1998-2000) or 24 rows (2001-2002) wide by approximately 2000 ft in length. During the fall of 2000, the planting pattern was changed from an 8 x 40 inch row pattern to a 12 x 38 inch planting pattern. The plots were continued in 2001 and 2002. All tillage operations, spraying and harvesting was done with commercial equipment. Budgets for tillage operations were generated for both the 8 x 40 inch planting pattern and the 12 x 38 in planting pattern, and actual input costs were used. Profits were calculated using a lint price of $0.67 per pound for 1998 – 2000, $0.60 per pound for 2001 and $ 0.70 per pound for 2002 (lint prices were determined from the loan price of the cotton harvested in the plots and any additional government programs exclusively designated for cotton). Production costs and profits did not contain land rent, which averaged about $106 per acre.

The Yazoo City site was established in 2001, and it was also put on a very uniform silt loam soil. Similar tillage systems to Mer Rouge were set up and replicated three times (Table 2.). These were set up on a 12 row by 38 inch planting pattern, with plot size being 24 rows wide by approximately 1000 feet long. All tillage operations, spraying and harvesting were accomplished with commercial equipment. For the tillage operations, budgets were generated for 12 x 38 inch row pattern and actual input costs were used. Profits were calculated using a lint price of $0.60 per pound in 2001 and $0.70 per pound in 2002 (lint prices were determined from the loan price of the cotton harvested in the plots and any additional government programs exclusively designated for cotton). Profits and production costs did not include land rent, which averaged about $90 per acre.

Results

For all years included in the study near Mer Rouge, production costs (Figure 1.) of the No Till systems were about $16 per acre less than the Low Till systems which were in turn were about $11 per acre lower than the Conventional Till systems. The difference between the No till and Conventional Till plots was $26.20 per acre. Most of this difference was due to the differences between the operations (tillage and harvesting) costs. While yields were variable from year to year (Figure 4.), for four of the five years, the No-Till of Low Till systems resulted in higher yields than the Conventional Till systems. Lower production costs and higher yields combined to show better profitability, by $56 per acre, with the No Till than with the Conventional Till system (Figure 3.). The five year cumulative profitability was better for the No Till and Low Till systems than the Conventional Till systems. Other parameters at Mer Rouge were also measured. In 2000, prior to switching to the 12 row by 38 inch planting pattern, soil samples were taken and analyzed for pH and organic matter content. Six-inch deep cores were taken and divided into 0-2, 2-4 and 4-6 inch samples. In the No Till system, overall pH was higher (Figure 5.), with a higher pH at the four and six inch sample depths. When the organic matter content was evaluated (Figure 6.), the No Till systems had consistently higher percentages than the Conventional Till systems. Overall results at Mer Rouge indicated that the No Till or Low Till systems resulted in better yields, lower production costs and higher profitability than the Conventional Till system.

The Yazoo City location had very similar production costs (Figure 2.) to the Mer Rouge site. The No Till systems resulted in the lowest production costs, which were about $14 per acre, lower than the Low Till systems which were about $13 per acre lower than the conventional Till. Surprisingly, the difference between the No Till and Conventional Till systems was $26.30, actually on $0.10 per acre more than the difference at Mer Rouge. Again, the majority of the difference was between the operations costs of the different tillage systems. After two years, yields at Yazoo City were variable. Yields in 2001 (Figure 7.) followed trends established at other locations, however, in 2002 the trend was reversed. This difference was largely due to the difference in stand between the tillage systems. When the Conventional Till systems were planted, a bed conditioner (do-all) was run through the plots. The Low Till and No Till systems did not get the bed conditioner. At planting, there was very little moisture for germination. Where the do-all was run, the planter could reach the moisture with ease, however, in the other plots only marginal moisture was available even at a planting depth of 1.5 inches. All of this led to a stand of about 3.5 plants per foot in the Conventional Till systems and an uneven 2.5 plants per foot in the other two tillage systems. This difference in stand led to a much more dramatic difference in yield than would normally be expected. Even though there was a rather large difference in yield trends from year to year, profit differences (Figure 8.) were not heavily skewed toward the 2002 Conventional Till systems. Due to the difference in overall yield, profit margins were higher at the Yazoo City location than at Mer Rouge.

Discussion

Overall results form both Center of Excellence locations show that production costs can be lowered by moving from a conventional or reduced tillage system to a no till system. As a whole, the no till systems have shown that equal or slightly better yields are attainable versus a conventional till type system. In some cases unexpected results can happen, such as the yield results with both locations in 2002. While yields were higher with Conventional Till systems in 2002 at Yazoo City, the opposite was true at Mer Rouge (Figure 9.). Due to soil crusting in the tilled plots at Mer Rouge, the stand had to be replanted. This resulted in delayed maturity, which in turn reduced yields, and also increased input costs with the additional seed cost. Both cases were included in the analysis since they were both considered “real world” problems associated with these different tillage systems. Simply planting earlier, or running a do-all over the No-Till and Low Till systems could have overcome the problem in Yazoo city. At Mer Rouge, the differences were largely due to organic matter content, and conditions were so wet after planting, that remediation with tillage wasn’t possible. These two cases show how important a good stand is to a profitable cotton crop.

Table 1. Mer Rouge Tillage Systems and Operations.

1. No Till
   - 1998: no tillage
   - 1999: no tillage
   - 2000: no tillage - (fall-change from 8 x 40”rows – 12 x 38” rows disk 2x, field cultivator, subsoil, bed 2x)
   - 2001: do-all, furrow plow
   - 2002: furrow plow
2. Low Till
   - 1998: rip/buster, do-all 2x, cultivate, furrow plow
   - 1999: paratill, furrow plow
   - 2000: paratill, furrow plow - (fall-change from 8 x 40”rows – 12 x 38” rows disk 2x, field cultivator, subsoil, bed 2x)
   - 2001: do-all, furrow plow, paratill, bed
   - 2002: furrow plow, paratill, bed
3. Conventional Till
   - 1998: rip/buster, bed 3x, do-all 2x, cultivate 2x, furrow plow
   - 1999: subsoil, disk, field cultivator, bed 3X, do-all, cultivate 2x, furrow plow
   - 2000: disk 3x, field cultivator, bed, do-all, cultivate 3x- (fall-change from 8 x 40”rows – 12 x 38” rows disk 2x, field cultivator, subsoil, bed 2x)
   - 2001: do-all, furrow plow 2x, paratill, bed
   - 2002: bed, do-all, furrow plow 2x, paratill, bed

Table 2. Yazoo City Tillage Systems and Operations.

1. No Till
   - 2001: rip/bed, do-all, furrow plow
   - 2002: bed, roller
2. Low Till
   - 2001: rip/bed, do-all, furrow plow, paratill, bed
   - 2002: bed, roller, paratill
3. Conventional Till
   - 2001: rip/bed, do-all, cultivate 2x, paratill, bed
   - 2002: bed, do-all, cultivate 2x, paratill, bed

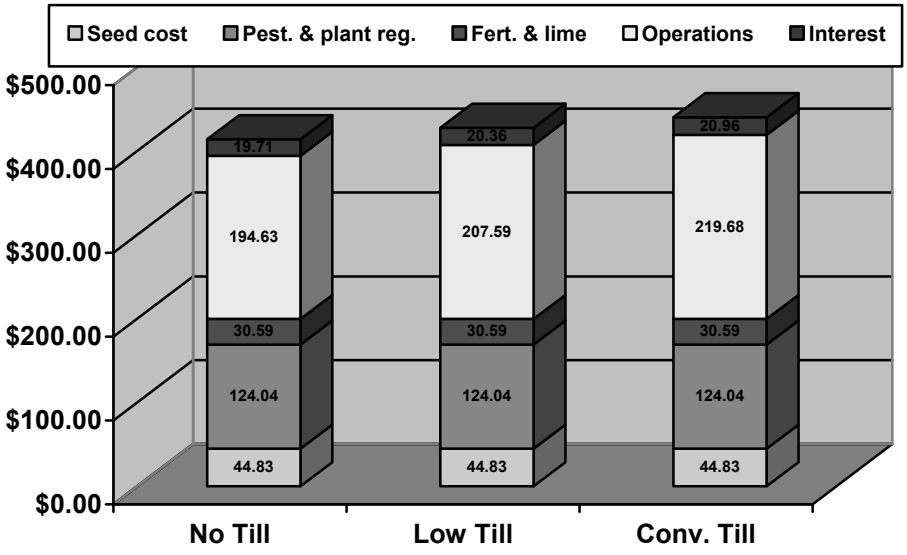

Figure 1. Mer Rouge Production Costs - Dollars per Acre -1998-2002.

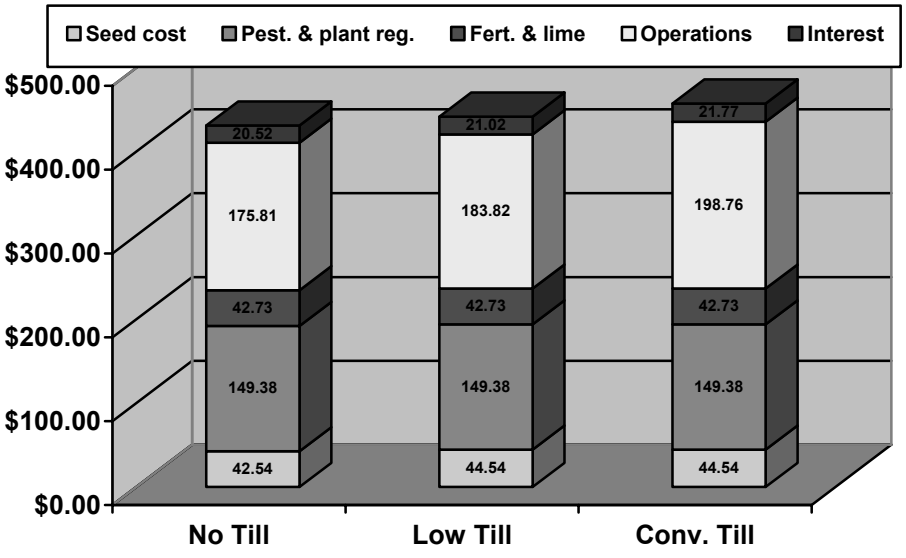

Figure 2. Yazoo City Production Costs - Dollars per Acre -1998-2002.

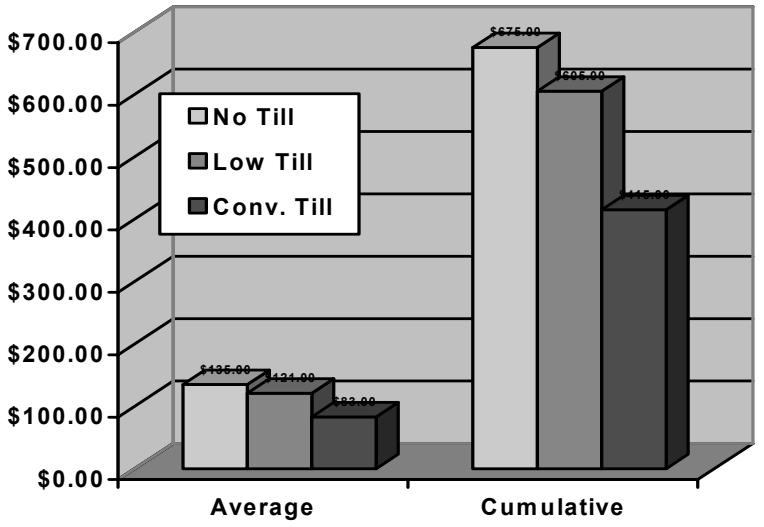

Figure 3. Mer Rouge, LA -Profit Per Acre 1889-2002.

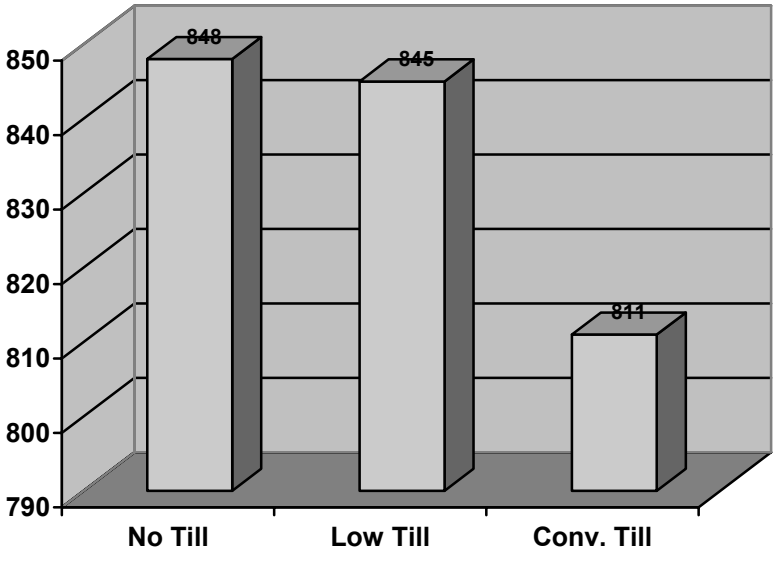

Figure 4. Mer Rouge, LA – Average Yield Per Acre 1998-2002.

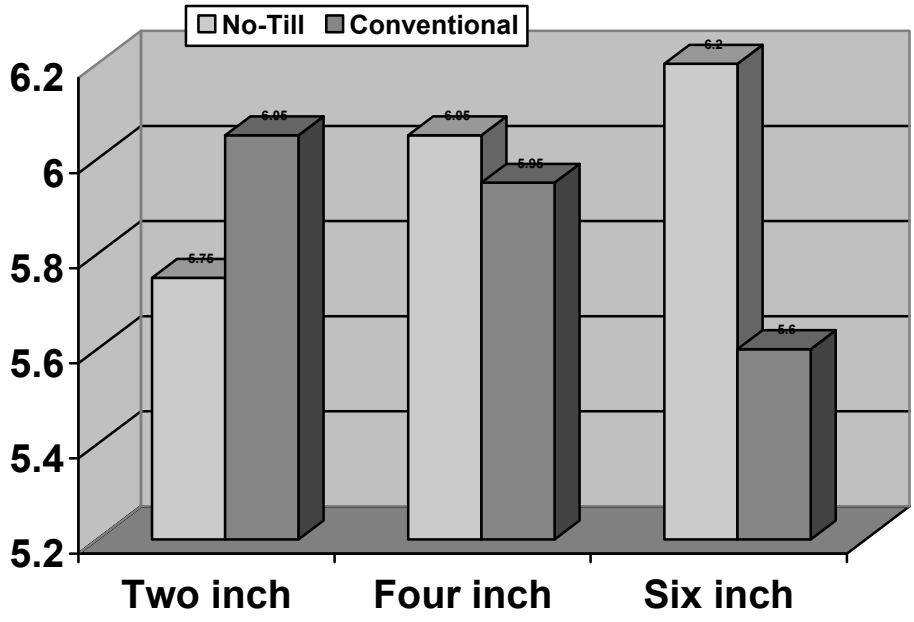

Figure 5. Mer Rouge, LA - pH Taken in 2000.

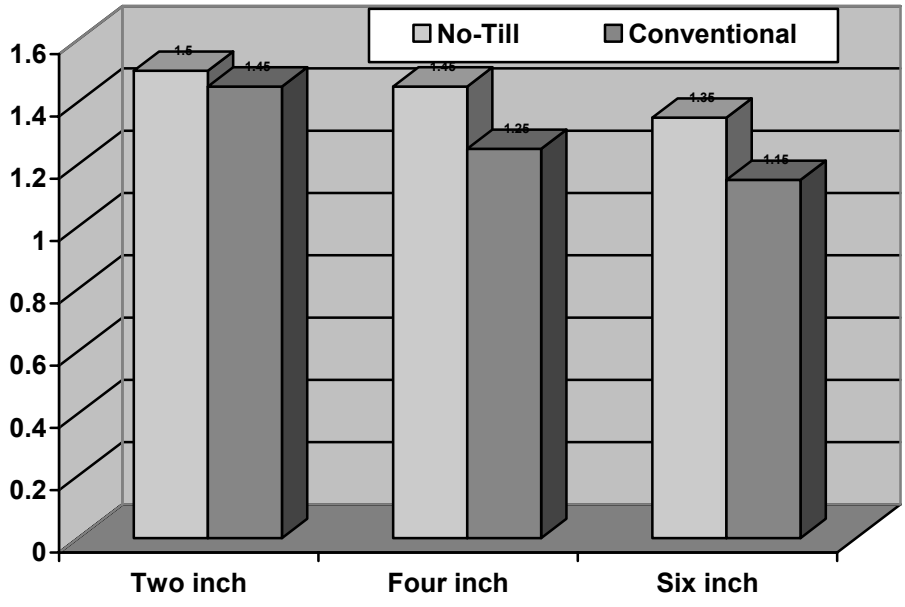

Figure 6. Mer Rouge, LA – Organic Matter % Taken in 2000.

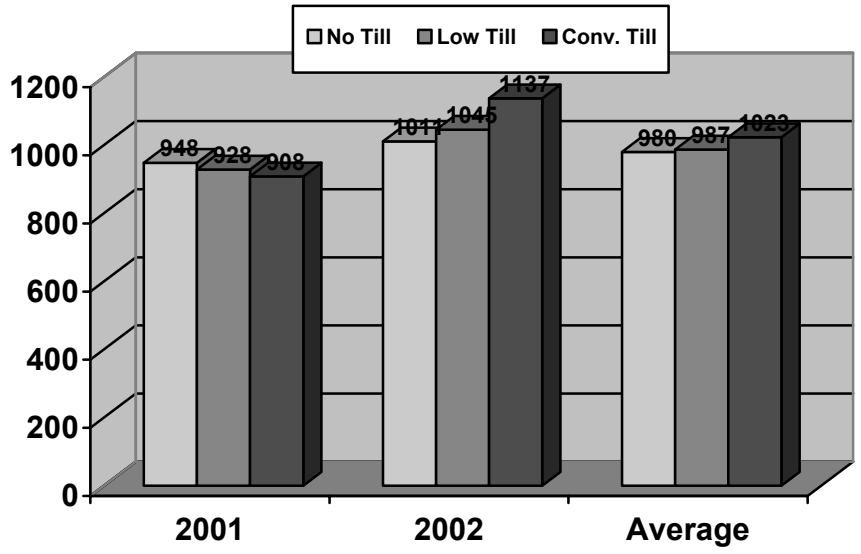

Figure 7. Yazoo City, MS -Yield Per Acre 2001-2002.

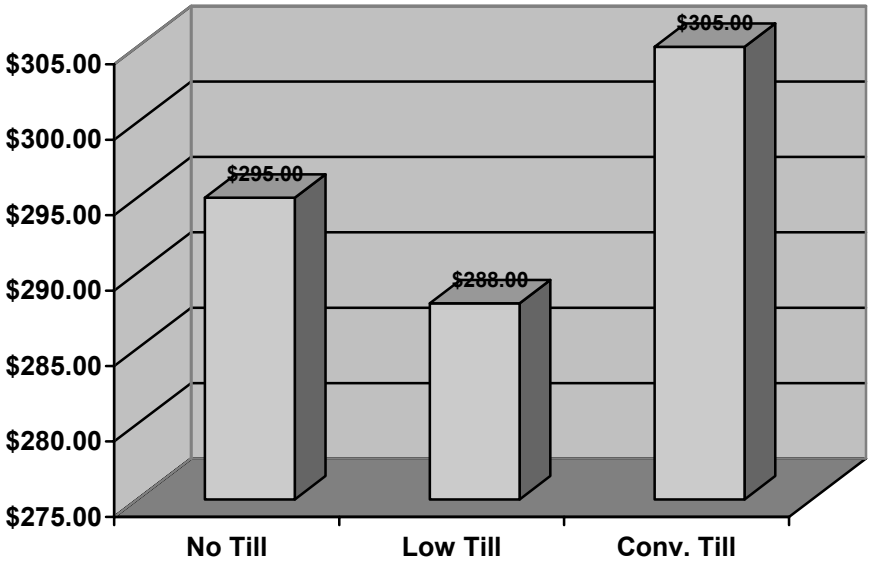

Figure 8. Yazoo City, MS - Profits Per Acre 2001-2002.

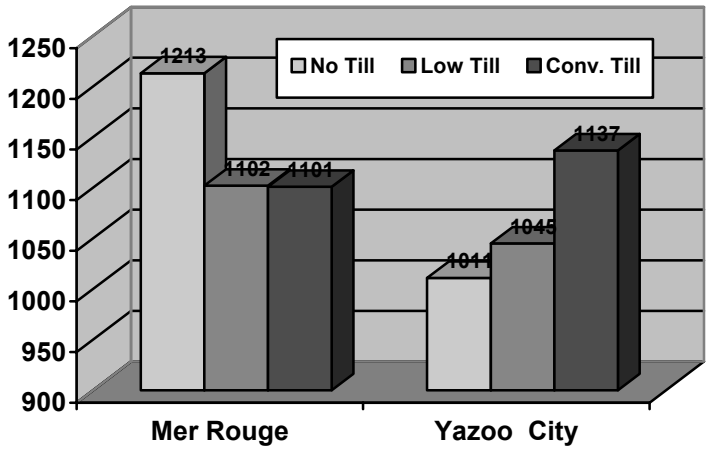

Figure 9. Yield Per Acre 2002.