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Cost of Producing Narrow-Row Cotton in Mississippi

(A Case Study)

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Introduction

Narrow-row cotton is perceived as an attractive production system to many Mississippi cotton producers. The interest in narrow-row cotton is supported by popular information, which indicates that narrow-row cotton may result in increased yields, reduced cost of production, and thus greater profit than normally achieved with 38- or 40-inch row spacings. Producers also have an interest in growing cotton in row spacings complementary with other crops that are often grown in 30-inch rows.

The availability of spindle cotton harvesters suitable for harvesting narrow-row cotton has made it feasible for cotton growers to consider narrower than conventional row spacings as an alternative production system.

In certain areas of Mississippi, narrow-row spacings may contribute to acceptable practices more consistent with the conservation requirements of the 1985 Food Security Act. For these reasons, cost of production estimates are presented in this bulletin to provide farmers with sound information for decision-making.

Materials and Methods

Cost Studies

An attempt was made to locate all narrow-row cotton producers in Mississippi and solicit their cooperation in providing data on production practices, inputs, and yields. For the purposes of this study, narrow-row cotton was defined as cotton planted on rows spaced 35 inches or less. Through the help of the Mississippi Cooperative Extension Service, most of the narrow-row growers in Mississippi were identified and contacted. All but three agreed to participate in this study. Initially, 21 farms were identified in the Delta, 7 farms in the Brown Loam, and 3 farms in the Black Belt. Over the period of the study (1992 through 1994 crop years), these numbers have changed slightly, with usable data obtained from 18 farms in the Delta, 6 farms in the Brown

Loam and 5 farms in the Black Belt. (Data were obtained in 1992 and 1993 from one farm in the Coastal Prairie, but this farm went out of business in 1994.)

It should be also pointed out that while the majority of producers who agreed to participate in this study in 1992 continued to grow narrow-row cotton in 1994, a few producers quit growing cotton or switched back to conventional row spacings. In addition, four new producers started narrow-row cotton production during the course of the study.

Producers were asked to keep a detailed diary of all trips across the field and inputs over a typical field on their farm. These producers were contacted throughout the growing season, either by personal interview or telephone, so that the diaries could be kept current and cost estimates could be carried out through the growing season. Costs of production were reported to cooperating producers throughout the growing season. All production inputs were processed using the Mississippi State Budget Generator (*4*).

After production costs were estimated for each farm, costs were organized into the following categories: land preparation, planting, fertility, weed control, insect control, plant growth regulators, harvesting, and ginning. The analysis focused on individual inputs and trips over the field and the various components of the production process, i.e. seedbed preparation, planting, etc. There are many reasons for this. In the Delta, variability of productivity of soils for the different growers was great. Perhaps of greater importance, managerial skills varied greatly between producers. In the Brown Loam, not only soils varied but experience in cotton production varied greatly from grower to grower. The number of observations was also limited for each of the row spacings for which data were obtained. These factors dictated this type analysis.

Each input for every budget was compared with the standard published budgets of Mississippi State University (*1*). These published budgets are based on large samples of growers in each region. The samples were drawn and data collected by the Mississippi Agricultural Statistics Service, a part of the National Agricultural Statistics Service, USDA. This process allowed the development of a budget for narrow-row cotton production that could be directly compared with the average budgets for conventional-row cotton in each of the three regions under study. This report will be defined as a case study.

In the planning stages of this study, it had been assumed that some of the cooperating farms would be producing both narrow-row and conventional-row cotton so that yield comparisons could be made under similar management conditions. Only three cooperating producers, however, grew both conventional-row and narrow-row cotton. Comparisons of either costs or yields would not have been valid on any of these farms. On the three farms, the narrow-row cotton was produced on weaker, shallower soils with lower yield histories than the conventional-row cotton. In addition, some form of irrigation was available to some of the narrow-row cotton but not for the conventional-row cotton on any of the three farms.

On-Farm Variety Trials

In addition to the charge to estimate production costs for narrow-row cotton production in Mississippi, the authors were asked to conduct on-farm variety trials to attempt to identify those varieties that would give superior yields in the narrow-row planting pattern. Three farm cooperators in the narrow-row cost study agreed to plant variety trials on their farms. Because the authors had very little experience in variety trials, a learning process was required along with the assistance of state and federal cotton breeders at the Delta Research and Extension Center. These trials had to be designed to minimize inconvenience to the growers. On the advice of the cotton breeders, it was decided to test four varieties in six replications at each location. Varietal selection was left to the professional cotton breeders, who chose ones they judged might have the best potential in narrow-row planting patterns.

In consultation with cooperating farmers, it was decided that the test would be planted the entire length of relatively small cotton fields so one complete round with a harvester could be made. This would minimize non-picking time and dead-heading from one end of the field back around to the place where the cotton could be weighed. Plot size varied from slightly more than one acre to more than 1 ½ acres. In general, from 0.6 to nearly one acre was harvested from each plot. Individual plot sizes varied because of varying row lengths within the field.

A key element in these trials was the availability of a cotton boll buggy equipped with load cells for weighing each plot. This boll buggy was provided by the Mississippi Cooperative Extension Service. Each plot was picked and the cotton dumped into the boll buggy, weighed, then dumped either on the farmer's trailer or module builder. Plots in the North Delta and South Delta were always the last cotton planted so each farmer could complete the planting of his main crop without the slowdown associated with planting plots and emptying hoppers between each variety.

The trial in the Brown Loam was planted early in the planting season because the farmer's cotton fields were widely scattered throughout the county. Harvesting of the two trials in the Delta were always after the farmer had completed his first harvest. The trial in the Brown Loam, however, was picked usually from 10 to 14 days after harvest was initiated. Harvest dates would have some impact on the measured yields from these studies. The later harvest date in the Delta would have a tendency to result in higher yields for the latest maturing cotton since some lint loss could be expected for the early maturing varieties.

Farm Organization and Structure

This study was initiated in 1995, with emphasis on identifying differences in machinery complements and therefore fixed or ownership costs of farm machinery, and to determine whether the use of narrow-row cotton would alter the crop mix on these farms. Data were collected for this portion of the study by conducting in-depth interviews with narrow-row growers who had participated in the cost component of this research.

Results

Cost Studies

The initial emphasis in this study was to identify different levels of inputs between conventional and narrow-row cotton. As the study progressed, however, it became clear that perhaps a more important difference in production costs was associated with machinery costs and performance rates. Table 1 presents the differences in costs between 6-row and 8-row conventional equipment and between 8-row conventional equipment and 10-row narrow-row equipment. The difference in cost between 4-row conventional, and 4-row and 5-row narrow-row harvesters is also presented.

Tables 2 and 3 present the percent change in width, thus the resulting change in performance rates (time required to cover one acre) associated with these tools. Obviously, when near same width equipment (ie., 6-row or 8-row equipment) is converted to 8- or 10-row narrow-row equipment, additional investment is required for the components needed to adapt the tool to the additional number of rows. As shown in Table 2, there is no change in performance rate between 6-row conventional and 8-row narrow-row equipment. However, there is a 6% reduction in performance rate due to less width when we move from 8- to 10-row 30-inch rows. Some growers in the Delta region used 32-inch row spacings, and when these conversions were made there was no difference in total width, thus no change in performance rate.

Change in performance rate, that is, time required to cover an acre, is reflected where appropriate. However, these changes are relatively small except in the case of the cotton harvester itself. These changes in machinery costs, generally the direct cost of maintenance and repair, and change in capital investment costs (fixed costs), were included and budgets re-run for narrow-row cotton. Tables 4, 5, and 6 present comparative budgets for 40- and 30-inch cotton for the Delta, Brown Loam, and Black Belt farming regions of Mississippi.

The 5-year average reported in the cost of production estimates of Mississippi State University indicates an average yield of 825 pounds of lint for the Delta region, 680 pounds of lint for the Brown Loam, and 520 pounds of lint for the Black Belt growing region. A 4% yield increase attributable to narrow-row cotton production would only be sufficient to cover increased costs as indicated in Tables 1, 2, and 3 in the Delta region. A 6% yield increase would be sufficient to cover costs in the Black Belt and Brown Loam. A 6% increase in yield would result in an added return of $2 to $3 per acre over conventional plantings. Four- and six-percent yield increases generally reflect yield increases observed in other studies on branch experiment stations in Mississippi in some years. Realistically, for most producers, switching from conventional to narrow-row spacings in cotton

would require an increased yield of at least 10% to be profitable. However in the Brown Loam and Black Belt areas of Mississippi, where soybeans and corn are the usual other crops produced on farms, such a switch may be economically desirable so that all machinery could be used in all crops. This would, of course, reduce capital investment in farm machinery on such farms.

Narrow-row skip-row plantings occurred on three of the farms in this study, one in the Brown Loam and two in the Delta. These three farms reported the highest yields and returns above specified expenses of any farmers in the study. Small plot research conducted at the Delta Branch Experiment Station indicates potentially economic increases in yield for narrow skip-row plantings when compared with conventional skip-row patterns (*5*). Because of the limited number of observations, however, this work will not be reported in this bulletin. Additional work that began in 1995, both of an agronomic and economic nature, will continue to investigate skip-row planting patterns for narrow-row cotton production.

Land Preparation and Fertility

As most land preparation (disking, chisel plowing, subsoiling) is done on a broadcast basis, narrow-row cotton production affected none of the costs associated with these practices. However, cost of bedding with either disk bedders or middle busters was changed because of changes in performance rates for 8- to 10-row and investment costs. This change, however, was relatively small.

Planting

Extensive information was obtained on planting, particularly seeding rates, and on the use of in-furrow systemic insecticides and fungicides. Total quantities of seed were usually adjusted by narrow-row growers to reflect the same seeding rate as they would use on 40-inch rows. The same procedures were used for systemic insecticides and fungicides. Farmers indicated that while this meant a lower quantity of materials per foot of row, adjustments were made purely to keep costs as they had been with conventional row spacings. Most farmers felt that this lower rate per foot of row had little or no effect on the usefulness of in-furrow treatments.

Weed Control

Weed control practices reflected a considerable amount of adjustment through the period of the study as farmers gained more experience with the effectiveness of herbicides in narrow-row cotton. Preplant broadcast materials were used at the same rate as in conventional row spacings. However, most of the narrow-row growers reported that for banded materials, preemergence herbicides, and postemergence herbicides, band width was reduced as they gained experience with narrow-row production. This was found to be acceptable in the narrow-row cotton because the canopy closes more rapidly. Adjustments in band widths resulted in nearly identical rates of herbicides being used on a per-acre basis in the 30-inch and 40-inch rows. However, weed control was further enhanced by this rapid closing of the canopy to the point where most producers in all regions reported one less cultivation and postdirected herbicide application than needed for the conventional row spacings reported in the Mississippi budget estimates. This resulted in a reduction in both fixed and variable machinery costs, herbicide quantities, and labor.

Insect Control

Insect control costs among cooperating narrow-row growers in each region varied greatly. But, insect control cost also varied greatly in conventional row spacings from farm to farm. It was not possible to identify any significant change in the cost of insect control between 30- and 40-inch cotton production. It should be pointed out, however, that the effects of row spacing on cotton pest populations and yield were addressed by Scott, Adams, and Shaw (*3*), who found a somewhat higher heliothis population in narrow-row cotton during midseason. This higher population was assumed to be associated with the more rapidly closing canopy and thus poorer penetration of insecticides.

Plant Growth Regulators

The number of applications and quantities of plant growth regulators was discernably higher on all narrow-row farms than is reported in the budgets for conventional row spacings. The conventional-row budgets reflect the fact that a number of growers do not use plant growth regulators. All narrow-row growers included in this study use plant growth regulators. However, only four narrow-row producers reported using rates of plant growth regulators totaling more than 20 ounces per acre. Most narrow-row growers reported using about one-third greater quantity of plant growth regulators than is reported in the budgets for conventional cotton production.

Harvesting

There was no meaningful difference between defoliation practices for conventional and narrow-row growers in each of the three regions. However, significant changes in costs of cotton harvesting for the two practices were observed. In the case of 4-row narrow-row cotton, the cost was the same as for a 4-row conventional harvester. The performance rate due to difference in width of area harvested was dramatically reduced for 30-inch cotton. This resulted in a 25% reduction in performance rates and thus an increase in both fixed and variable costs and labor costs for the harvester. Five-row 40-inch harvesters were included in this study only in the Delta. No 5-row machines were used by the cooperating growers in the Brown Loam or Black Belt.

Total Specified Costs

Tables 4, 5, and 6 present costs associated with each of the categories of production presented in this bulletin. These costs were $18.46 greater for 30-inch cotton in the Delta, $21.17 greater for 30-inch cotton in the Brown Loam, and $18.27 greater for narrow-row production in the Black Belt of Mississippi. These data clearly indicate that on a per-acre basis increased machinery costs result in slightly higher production costs for narrow row cotton in Mississippi. As will be pointed out later, however, these costs may be essentially canceled out, particularly in the hill areas of Mississippi, when the number of tractors required is considered.

On-Farm Variety Trials

Only one test could be planted in 1992 because of a late start on the project and a wet planting season. Tests were conducted at three locations -- North Delta, South Delta, and Central Brown Loam -- in 1993 and 1994. The data for each variety in each location for each year will not be presented in this paper because they contribute nothing to the understanding of costs or economics of narrow-row cotton production. These data indicated that row spacings had no meaningful effect on the desirability of one cotton variety versus another in narrow-row plantings. The ranking of the varieties in these tests tended to correspond closely with variety trials grown throughout the state in conventional row spacings.

Farm Organization and Structure

Information obtained from cooperating farms in the Delta area of Mississippi indicated that narrow-row cotton production had no meaningful effect on the crop mix or the machinery complement. The principal reason for this was that the narrow-row producers' principal second crop was usually soybeans, which were planted either in the same row spacing as the cotton or in a narrow-row spacing (14 to 24 inches). In the hill areas of Mississippi, however, it was found that 30-inch row spacings were complementary in their impact on machinery investments because the two other principal crops grown are corn and soybeans. Yields and returns associated with 30-inch corn and soybean production indicate that 30-inch production optimizes the yield returns from both crops, according to cooperating farmers. Most farmers in the hill area plant from 33 to 40% of their cropland in cotton and the remainder in corn and soybeans. A farm from 600 to 1,000 acres would have to have one additional tractor and one cultivator with postemergence applicators associated with it if cotton was produced in 38-to 40-inch rows.

Table 7 presents the 1996 investment costs in 145-horsepower tractor and a 6-row cultivator with

postemergence applicators. Data obtained from the published production costs for 1996 indicate that this tractor would cost $13.60 per hour to own and operate and would have to be used 1.262 hours per acre, resulting in a tractor cost associated only with conventional-row cotton of $17.16 per acre. The cultivator with postemergence attachment using the same analysis would add $1.33 per acre to costs. This would result in a $19.49 increased machinery cost for cotton production on farms in this size range, which would effectively cancel additional yield returns; therefore, planting cotton in 30-inch rows on hill farms would not add significantly to the farm cost per acre.

Discussion

This study clearly indicates that production costs for narrow-row cotton are slightly greater than for conventional row spacings. Significant reductions in weed control costs were observed in narrow-row planting patterns. These savings were more than offset, however, by increased variable and fixed machinery costs and increased use of plant growth regulators.

For most cotton farmers in Mississippi, the decision to plant cotton in a narrow-row pattern can only be justified where there are significant acreages of other crops on a farm grown in narrow-row patterns.

It should be pointed out that several of the high-yielding producers reported economically significant yield increases from narrow-row cotton production when compared with conventional row spacing, but they were an exception to the norm in this study.

As previously pointed out, yield responses on poorly drained, lower yielding, and marginal cotton soils were very disappointing. One of the principal reasons for this could be that the beds for narrow-row cotton production are much smaller and lower than beds in conventional row spacings. These lower beds, when associated with poor drainage, may be a factor in the extremely poor yields in narrow-row cotton on the clay soils.

Five-row cotton harvesters used in narrow-row cotton production are somewhat more costly than four-row machines, but much of the cost associated with performance rates is negated when five-row machines are compared with four-row machines for conventional row spacings.

Earliness has been touted as one of the great benefits of narrow-row cotton production. In 1992 and 1993, very little improvement in meaningful earliness (ie., defoliation dates) was observed on most farms when compared with neighboring farms. However, almost all producers included in the narrow-row study were able to initiate defoliation and harvest from one to two weeks earlier for the 1994 crop. Factors affecting earliness need to be intensively researched in both narrow-row cotton and conventional-row cotton. It is clear that all factors associated with earliness are not yet understood.

Conclusions

Narrow-row cotton yields were reported by farmers to be very similar or slightly higher than for conventional 38- to 40-inch cotton regardless of farming region. The study clearly indicates the cost of production increased modestly, principally due to increased harvest costs. While popular literature reports that narrow-row cotton production is more suited for lower yielding soils in the Cotton Belt, this was not found to be true in Mississippi. Several producers who had a history of superior management skills in cotton and who were growing cotton on highly productive soils were obtaining significant yield increases as well as improvement in net farm income after the shift to narrow-row cotton production.

The skip-row planting of narrow row cotton is currently being investigated intensely at the Delta Branch Experiment Station at Stoneville, to determine if these planting patterns will result in meaningful increases in net farm income.

References

(*1*)Cotton 1994 Planning Budgets. 1993. Agri. Economics Report 58, December 1993.

(*2*)Cotton 1996 Planning Budgets. 1995. MAFES Agri. Economics Report 71, December 1995.

(*3*)Scott, W.P., D.A. Adams, and R. Shaw. 1994. The Effects of Row Spacings on Cotton Pest Populations and Yield. Proceedings, 1994 Beltwide Cotton Conferences, Cotton Insect Research and Control Conference, p. 910-911.

(*4*)Spurlock, Stan R., and David H. Laughlin. 1993. Mississippi State Budget Generator User's Guide Version 3.0, Agri. Econ. Tech. Pub. No. 88, July 1992.

(*5*)Tupper, Gordon R., Fred T. Cooke, Jr., M. Wayne Ebelhar, and H.C. Pringle III. 1994. Effect on Row Spacing, Planting Pattern, and Varieties on Cotton Yield and Returns. MAFES/MSU Journal Article No. 8686.

Table 1. Equipment prices, 1994.

	40-inch spacing		30-inch spacing	
Equipment	**6-row**	**8-row**	**8-row**	**10-row**
Bedder	6,150	7,575	7,250	8,800
Planter	13,600	17,095	16,180	20,470
Cultivator	8,830	10,598	9,800	11,850
Cotton picker	4-row		4-row	5-row
	168,888		168,888	189,575

Table 2. Change in performance rates by row width -- bedders, planter and cultivator.

Equipment size	Percent Change
6 rows x 40 inches = 240 inches	0
8 rows x 30 inches = 240 inches	0
8 rows x 40 inches = 320 inches	0
10 rows x 30 inches = 300 inches	-6%
10 rows x 32 inches = 320 inches	0

Table 3. Change in performance rates, by row widths -- cotton pickers.

Size	Percent change
4 rows x 40 inches = 160 inches	0
4 rows x 30 inches = 120 inches	-25%
5 rows x 30 inches = 150 inches	-6%

Table 4. Specified cost of production, 30- and 40-inch row spacings, solid cotton, Delta Area of Mississippi, 1995.

	40-inch rows	30-inch rows

Item	8-row	10-row
Direct Expenses	----------$/acre----------	
Custom	86.25	86.25
Harvest Aid	21.26	21.26
Fertilizer	53.42	53.42
Fungicide	11.37	11.37
Herbicide	41.09	35.01
Insecticide	63.78	66.73
Haul	3.30	3.30
Seed/plants	11.55	11.55
Growth regulator	9.49	18.98
Operator labor	18.15	19.13
Hand labor	5.63	5.63
Unallocated labor	14.52	14.52
Diesel fuel	12.14	12.38
Repair and maintenance	36.59	38.68
Interest on operating capital	12.66	13.45
Total Direct Expenses	401.20	411.66
Total Fixed Expenses	76.87	84.86
Total Specified Expenses	478.07	496.53
Difference	18.46	

Table 5. Specified cost of production, 30- and 40-inch row spacings, solid cotton, Brown Loam of Mississippi, 1995.

Item	40-inch rows 8-row	30-inch rows 10-row
Direct Expenses	----------$/acre----------	
Custom	76.90	76.90
Harvest Aid	21.26	21.26
Fertilizer	55.18	55.18
Herbicide	32.30	28.43
Insecticide	42.56	42.56
Haul	13.60	13.60
Seed/plants	11.55	11.55
Growth regulator	9.49	12.78
Operator labor	24.65	22.83
Hand labor	5.63	5.63
Unallocated labor	19.72	19.72
Diesel fuel	11.54	10.90
Repair and maintenance	42.29	55.13
Interest on operating capital	10.87	11.29

Total Direct Expenses	377.54	387.76
Total Fixed Expenses	87.11	98.06
Total Specified Expenses	464.65	485.82
Difference	21.17	

Table 6. Specified cost of production, 30- and 40-inch row spacings, solid cotton, Black Belt of Mississippi, 1995.

Item	40-inch rows 8-row	30-inch rows 10-row
Direct Expenses	---------$/acre---------	
Custom	76.90	76.90
Harvest Aid	21.26	21.26
Fertilizer	55.18	55.18
Herbicide	32.30	28.43
Insecticide	42.56	42.56
Haul	13.60	13.60
Seed/Plants	11.55	11.55
Growth regulator	9.49	11.66
Operator labor	24.65	22.83
Hand labor	5.63	5.63
Unallocated labor	19.72	19.72
Diesel fuel	11.54	10.90
Repair and maintenance	42.29	54.25
Interest on operating capital	10.87	11.29
Total Direct Expenses	377.54	385.76
Total Fixed Expenses	87.11	97.16
Total Specified Expenses	464.65	482.92
Difference	18.27	

Table 7. Added cost of having 38- to 40-inch cotton on a farm growing other crops in 30-inch rows (soybeans and corn)[1].

ASSUME:	
145 HP new tractor	$71,000.00
6 row 38- to 40-inch new cultivator and pest applicator	$17,850.00
Total	$88,850.00
Need one tractor per 300-400 acres of cotton.	
Tractor fixed cost per hour	$13.60
Hours per acre	1.262
Total	$17.16 per acre
1 cultivator + post applicator cost per acre	$1.33
Total fixed machinery cost per acre	$19.49

[1]Cotton 1996 Planning Budgets. Agri. Economics Report 71, December 1995.