COST AND RETURNS TO NARROW-ROW COTTON PRODUCTION IN MISSISSIPPI

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Introduction

Narrow-row cotton production is perceived as an attractive production system to many Mississippi cotton producers. Producer 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 associated with 38- or 40-inch row spacings. Producers also have an interest in producing cotton in row spacings complementary with other row crops which are quite 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 narrow-row spacings as an alternative to conventional- row spacings.

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 yield. For the purposes of this study, narrow-row cotton was defined as cotton planted on rows 35 inches or less. Most of the narrow-row growers in Mississippi were identified and contacted. All but three agreed to participate. 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. It should be noted, however, 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. Cost of production could be reported to cooperating producers throughout the growing season. All production inputs were processed using the Mississippi State Budget Generator (Spurlock 1992).

After the 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, harvest 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 area, 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 was obtained. These factors dictated this type analysis.

Each input for every budget was compared with the standard published budgets of Mississippi State University (Lee et al., 1993). 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.

Only three cooperating producers grew both conventional-row and narrow row planted cotton. Comparisons of either costs or yields, however, would not have been valid on any of these farms. On these 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 on these farms but was not available for the conventional-row cotton on any of the three farms.

Farm Organization and Structure

This research was initiated in 1995 with emphasis on identifying differences in machinery complements and therefore fixed or ownership costs of farm machinery, and whether the use of narrow row cotton would alter the crop mix on these farms. Data were collected on these farms for this portion of the study by conducting indepth 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

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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, that is 6-row or 8-row equipment, is converted to 8- or 10-row narrow-row equipment, additional investment is required for the components of the tool to deal with 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 six percent reduction in performance rate due to narrower implement width associated with the change from 8-row conventional 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. Changes 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, that are generally the direct cost of maintenance and repair, and change in capital investment costs (fixed costs) were included and budgets rerun 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 indicate 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, and would result in an added return of 2 to 3 dollars per acre over conventional plantings for these regions. Four- and six-percent yield increases generally reflect yield increases observed in other studies on branch experiment stations in Mississippi in some years.

When cotton production profit is the only factor under consideration, a yield increase of at least 10 percent would be required to justify switching from conventional to narrow-row spacings. 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 Research and Extension Center indicates potentially economic increases in yield for narrow skip row plantings when compared with conventional skip-row patterns (Tupper, et al., 1994). Due to the limited number of observations, however, this work will not be reported in this paper. Additional work commencing 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, bedding with either disk bedders or middle busters was changed due to changes in performance rates where appropriate, that is for 8-row (conventional) to 10-row (narrow) and investment costs. This change, however, is relatively small.

Planting

Extensive information was obtained on planting, particularly seeding rates, and 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 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 for herbicides being used on a per acre basis in the 30-inch or 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 postdirect herbicide application than used for 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 costs 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 by Scott, Adams and Shaw (1994) indicated some small differences. They found a somewhat higher bollworm/tobacco budworm population in narrow-row cotton during mid-season. 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 conventional-row budgets (Lee et al., 1995). 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 used plant growth regulators. However, only four narrow-row producers reported rates of plant growth regulators above a total of 20 ounces per acre. Most narrow-row growers reported about one-third greater quantity of plant growth regulators used 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 reported. However, significant changes in costs of cotton harvesting for the two practices were observed. The fixed cost of harvesting equipment (4-row) was the same for narrow-row growers as for conventional growers. 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 paper. 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 in this paper, however, these costs may be essentially canceled out, particularly in the Hill areas of Mississippi when the number of tractors required is considered.

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 for a farm producing narrow row cotton. The principal second crop of narrow row producers was usually soybeans, which were planted either in the same row spacing as the cotton or in a narrow row spacing, particularly 14 to 24 inches. This may change if corn becomes a regular part of the crop mix. 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 principal crops grown in this area other than cotton are corn and soybeans. Yields and returns associated with 30-inch corn and soybean production is 30-inch production optimizes the yield returns from soybeans and corn according to cooperating farmers. Most farms in the Hill area plant from one-third to 40 percent of their cropland in cotton and the remainder in corn and soybeans. A farm from 600 to 1,000 acres would have had to have one additional tractor and one cultivator with postemergence applicators associated with it if cotton were 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 indicates that this tractor would cost $13.60 per hour to own and operate and that such a tractor would have to be used 1.262 hours per acre resulting in a tractor cost just associated with conventional-row planted 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 the increase in production costs. Therefore, the use of 30-inch row planted cotton on Hill farms would not add any meaningful costs to the farm cost per acre for cotton if the cotton crop were planted in 30-inch rows.

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, due to increased variable and fixed machinery costs and increased use of plant growth regulators.

Several high yielding producers in the study reported economically significant yield increases from narrow-row

cotton production when compared with conventional-row production, but this was not the norm for the majority of the growers in this study.

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

Five-row cotton harvesters used in narrow-row cotton production are more expensive than 30-inch 4-row machines, but some of this cost is negated when compared to 4-row conventional-row spacing machines.

Earliness has been promoted as one of the potential benefits of narrow-row cotton production. In 1992 and 1993, very little improvement in meaningful earliness, that is defoliation dates, was observed on most farms when compared with surrounding neighbors. However, almost all farms 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 not only in narrow-row cotton but in 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 38-40 cotton production regardless of farming region. The study clearly indicates the cost of production would have increased in a modest amount, principally due to increased harvest costs associated with the cotton picker. While popular literature reports that narrow row cotton production is more well suited for lower yielding cotton soils in the Cotton Belt, this was not found to be generally true in Mississippi. However, several producers who had a history of superior management skills in cotton who were growing cotton on highly productive soils obtained significant yield increases and improvement in net farm income after the shift to narrow row cotton production.

Funding

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References

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Table 1. Equipment prices, 1994.

	40-inch		30-inch	
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
	4-row		4-row	5-row
Cotton picker	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" = 240"	0
8 rows x 30" = 240"	0
8 rows x 40" = 320"	0
10 rows x 30" = 300"	-6%
10 rows x 32" = 320"	0

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

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

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

Item	40-inch rows 8-row	30-inch rows 10-row
Direct Expenses		
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
Repairs and	36.59	38.68
Interest on	12.66	13.45
Total Direct	401.20	411.66
Total Fixed	76.87	84.86
Total Specified	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		
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	42.29	55.13
Interest on	10.87	11.29
Total Direct	377.54	387.76
Total Fixed	87.11	98.06
Total Specified	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		
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	42.29	54.25
Interest on	10.87	11.29
Total Direct	377.54	385.76
Total Fixed	87.11	97.16
Total Specified	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[1] (soybeans and corn)

ASSUME:	
145 HP new tractor	$71,000
6-row 38- to 40-inch new	17,850
Total	$88,850
Need one tractor per 300-400 acres of cotton	
Tractor fixed cost per hour	$19.49
Hours per acre	1.262
Total	$17.16
1 cultivator + post applicator	$1.33
Total fixed machinery cost per acre	

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