ADJUSTMENTS TO COTTON'S HIGH PRODUCTION COST BY MISSISSIPPI PRODUCERS

D.W. Parvin
Mississippi State University
Mississippi State, MS
F. T. Cooke
Delta Research and Extension Center
Mississippi State Mississippi
Stoneville, MS

Abstract

This paper discusses the adjustments Mississippi cotton farmers are making to the current problem of low cotton price and high cotton production cost. Whole-farm systems analysis is suggested as a means for organizing the quantity and variety of information available to cotton farmers to analyze alternative ways of attacking the problem.

Introduction

The Department of Agricultural Economics, Mississippi State University, releases estimates of the per acre cost of producing most of the state's agricultural enterprises on an annual basis. These estimates are generally referred to as budgets. The department's standard cotton budget, labeled "Solid cotton, sandy soil, 8-row equipment, Delta Area", for the 1999 season reports total direct expenses per acre of $454.16. Total fixed expenses per acre are estimated at $82.93. The department's estimate of total specified expenses, the sum of direct and fixed expenses, based on a yield of 825 pounds of lint per acre, is $537.09 per acre.

The cost items not addressed by the department's annual budget reports are land, management, and general farm overhead. This report assumes a land charge of $90.00 per acre. Management plus general farm overhead is set to $70.00 per acre for purposes of this paper. Hence, land, management, and general farm overhead total $160.00 per acre in this study.

The Mathematics

Selected abbreviations or symbols are defined as follows:

DC = direct expense or cost per acre
FC = fixed cost per acre
Y = yield (pounds of lint per acre)
P = price (dollars per pound of lint)
L = land cost per acre
M = management cost per acre
GFOH = general farm overhead cost per acre
Y*1.55 = pounds of seed per acre
PS = price of seed, ($0.05), dollars per pound
TC = total cost per acre
TR = total revenue per acre
BEY = break-even yield
BEP = break-even price

A portion of DC is proportional to Y. Most of the cost proportional to yield is associated with ginning. DC proportional to yield is estimated to sum to 10 cents per pound. For the standard budget yield of 825 pounds of lint per acre, the cost that is a function of yield totals $82.50 per acre. Hence, we write:

DC = $454.16 - $82.50 + $0.10 *Y;
DC = $371.66 + $.1Y.

To calculate BEP and BEY, we begin with the functional notation for TC equal TR:

TC = TR
C + FC + L + M + GFOH = Y * P + Y * 1.55 * PS
(371.66 + .1Y) + 82.93 + 160.00 = Y * P + Y * 1.55 * .05
614.59 + .1Y = Y (P + 0.0775)
614.59 = Y (P - .0225)
BEY = 614.59 ÷ (P - .0225)
BEP = (614.59 ÷ Y) + .0225

Table 1 reports BEY for selected prices. At current prices, most of Mississippi's cotton farms do not produce break-even yields.

Table 2 lists BEP for selected yields. Even at above average farm yields, current prices are well below break-even prices. In addition, Mississippi experienced a drought during the 1999 cotton production season and some producers are harvesting yields in the range of 450-550 pounds of lint per acre.

In 1999, Mississippi cotton growers with per acre cost of $697.09 per acre (assumed yield of 825 pounds of lint) and realized prices of $0.63 per pound of lint and $0.05 per pound of seed, will lose more than $100 on each acre. Many Mississippi cotton growers are currently in serious financial difficulty.

The 1975-1999 Period

Since 1975, the Department of Agricultural Economics at Mississippi State University has published cotton budgets on an annual basis. Table 3 reports direct and fixed costs per acre for 1975-1999, along with budgeted or expected yield,

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state average yield, gross domestic product, and deflated price and cost estimates. For the period 1975-1978 relative to the period 1995-1998, price (column 9, average price received by Mississippi cotton farmers) increased by 18%, while direct cost plus fixed cost (column 6) increased by 81%. During the same period deflated price (column 12) decreased by 51%, while deflated cost (column 13) decreased by 24%.

The relationship between deflated cost per pound (column 14) and deflated price (column 12) merits discussion. From 1975-1978 to 1995-1998, deflated cost per pound declined by 52% while deflated price declined by 51%. Some policy analysts may conclude that in real (deflated) terms, cotton growers have fared pretty well and should not be in financial difficulty. However, growers do not deal in deflated dollars. They settle their accounts each year in current dollars. If the balance is positive, they pay taxes in current dollars. Or, if the balance is negative, refinance the difference in current or undeflated dollars at current interest rates. Mississippi cotton growers are in financial difficulty and have been for several years. Clearly, they have not participated in the economic boom of the last decade, which saw gross domestic product increase by 23%, and the Dow Jones Industrial Average, which closed at 2,899.26 on July 2, 1990 and 11,326.04 on August 25,1999, increase by 291%.

The Components of Cost

Historically Mississippi cotton growers have attempted to optimize the difference between **revenue** and **cost** by maximizing yield. Currently break-even yields and expected yields are not close. Additionally break-even prices and expected prices are not close. Producers are price takers in both the input market and the output market. Current producer adjustments seem to be in the general area of cost reduction by reducing the level or amount of inputs since yield increasing opportunities appear limited. The tendency is to emphasize or concentrate on cotton direct cost per acre. But the other crops produced on the cotton farm should also be examined, especially for ways they can interact with cotton to reduce its cost and/or increase yield (reduce cost per pound). In addition, the other component of cost, especially fixed cost and general farm overhead, should be carefully examined. A dollar saved in other areas is just as valuable as a reduction of a dollar in direct cost.

Many of Mississippi's cotton producers will grow cotton differently (cheaper per acre with the expectation that yield can be maintained reducing cost per pound) in the year 2000 than they have in the past years. Some began in 1999. And, a few, with lower yielding cotton soils, began several years ago.

Direct Cost

Direct expenses include such items as seed, fertilizer, herbicides, insecticides, growth regulators, defoliants, other chemicals, labor, fuel, custom operations, and interest on operating capital. Also included are the estimated costs of repairs and maintenance for all machinery, including towed equipment and self-propelled power equipment. Direct expenses vary directly with the number of acres cropped.

Fixed Cost

Fixed expenses include such items as depreciation and interest on investments associated with the production process. These costs, at the farm level, do not vary as a function of the number of acres produced. Theoretically they are incurred even if the farm fails to produce a single acre. In the cotton budgets, fixed expenses are related to tractors, pickers, high clearance sprayers, and towed equipment. Many economists and most computerized budget generators (which calculate fixed cost on a per acre basis) tend to view fixed costs as noncash costs (assume 100% equity in equipment). However, if the grower is leasing equipment and/or making annual payments on purchased equipment, the distinction between direct cost and fixed cost becomes rather arbitrary. Generally, it is better to view (and to attempt to reduce) fixed cost as a single item on a whole farm basis.

General Farm Overhead Cost

Overhead expenses are associated with operating the farm business and reflect expenses that while significant, are not necessarily specific to any particular enterprise. Examples of farm overhead costs include tax services, record keeping, utilities, maintenance of farm buildings, maintenance of turn rows and drainage ditches, insurance, and property taxes. Other overhead charges include legal fees, farm organization and membership dues, marketing services and computer services.

General farm overhead includes a fixed, as well as a direct cost component. It also includes the fixed costs associated with tractor and equipment associated with farmstead maintenance, maintenance of turn rows, drainage construction and maintenance. In addition, the costs for the operation of the farm shop and general use of pickup trucks are included.

General farm overhead expenses probably are increasing at a faster rate than other cost categories. For example, in 1998 the Department of Agricultural Economics and Agribusiness, Louisiana State University, estimated direct general farm overhead cost at $55.03 per acre. The fixed component was estimated at $9.29 per acre, a total of $64.32 per acre. In 1999 their estimates were increased to $57.40 and $12.77 for a total of $70.17 per acre, an increase of 9.1% in a single year.

Land Cost

In general, the procedure employed in this study was to assign a charge to land equal to the average net cash rent represented by the rental market in the Delta area of Mississippi. Land cost can be viewed as an opportunity cost for land, since landowners should receive a return to the land in production equivalent to what could be received by renting the land out of production. In this study, a land charge of $90.00 per acre is utilized. Some cotton land rents for more. Rented land planted to cotton that rents for less is comprised largely of type II or III cotton soils.

Management Cost

For purposes of this paper, management cost is defined as the cost of hired management and is included with general farm overhead. Hence, the difference between total revenue and total cost (as defined) is returns to owner/operator management and risk. Owner/operators that draw a salary and/or charge the farming business for living expenses should include these costs. In such cases, the residual between total cost and total revenue could be viewed as returns to risk.

Economic Model

The economic principles are quite clear. In simplest terms, when output price falls relative to input prices, producers should adjust by reducing the level (amount) of inputs (reduce cost). Similarly, when selected input prices increase relative to output price, growers should adjust by lowering the amount of the specific inputs with relative price increases (reduce cost). Most of Mississippi's cotton producers will grow their cotton differently in the year 2000 than they did in earlier years. In addition, they will operate their farms differently. Changes will not be restricted to the cotton acreage. Cotton growers are employing whole farm system techniques to improve the profitability of the farm business.

Inherent in the economic model being employed, is the implication that with reduced inputs, yield will decline. This is because the economic model is based on physical relationships between the level of inputs and the level of yield and assumes constant technology. However, if the shock that causes the need to reduce inputs, such as a declining output price or increasing prices of inputs, is accompanied by the introduction of new technology, the adjustments may not result in a reduction in yield.

Types of Adjustments

Perhaps the most rational initial adjustments is simply to ease back on all inputs. Most growers opted for this approach in 1999. The more radical or complex adjustments such as shifts from solid to skip-row or to ultra narrow row cotton (UNRC) production systems and/or no-till systems require considerable study.

It is very unlikely that adjustments will result in one new system of cotton production emerging for all Mississippi growers. Production systems could differ by soil types. But producer attitudes related to dramatic reductions in the farm labor force, leased equipment, and custom farming (especially custom cotton harvest), will be important. Additionally, the portion of the farm that is irrigated, the percent equity in land and equipment, the number of years remaining on current land leases, and level of management will be factors of major importance on selected farms. Initially, most adjustments will tend to be driven by efforts to reduce direct cost, but many of the adjustments (with proper planning) can have a positive impact on fixed costs and general farm overhead.

Ultra Narrow Row

Ultra narrow row cotton production systems are based on stripper harvest and cotton generally planted in 7.5, 10.0, or 15.0 inch row widths. Often the system is based on genetically modified varieties. UNRC is typically planted flat, with or without deep tillage and pre-emergence chemicals. UNRC is often produced no-till, especially in the non-Delta area of Mississippi and on the heavier soils in the Delta.

A disadvantage of this system is the large amount of seed required, this is especially troublesome when some of the more expensive genetically modified varieties are employed. Rebates to UNRC growers, where the per acre technology fee is based on pounds of seeds planted per acre, will be important. Another disadvantage lies in the perceived discount associated with stripper cotton. The advantages lie in reduced labor, power, and equipment requirements per acre. Problems may exist with current harvesting and ginning technology. In the author's opinion, these problems, if real, will be quickly and easily solved if UNRC acreage increases significantly.

No-Till

A few of Mississippi's growers have been employing this technology for several years. As with UNRC, some producers have attempted this approach and have discontinued its use. With this technology, the soil is undisturbed except when absolutely necessary, such as extreme rutting associated with wet harvesting conditions. This system employs the standard spindle picker. In general this system reduces fixed costs on a percentage basis much more than direct costs. In addition, labor, power, and equipment requirements are reduced relative to conventional production systems. Most of the farms utilizing these systems employ genetically modified varieties on a percentage of the acreage but some growers rely entirely on conventional

varieties. Typically no-till cotton farmers produce all of their crops by employing no-till technology.

Skip-Row

These systems have fewer linear feet of row per acre than solid planted cotton. With full-skip planting patterns, materials applied "down the row" are 66.67% of solid and on narrow-skip they are 81.63% of solid. In additional, there are two other important distinctions. The yield reduction should be considerably less than the reduction in linear feet of row (88-96% of solid on a land acre basis). Harvesting costs (approximately $85 per acre with solid cotton) are reduced.

Limited Seedbed/Chemical Tillage

These systems are built around chemical cultivation after emergence and maintenance of old seedbeds. In these systems, down the row deep tillage seems to be replacing subsoiling at a 45 degree angle to the row. These systems may or may not employ genetically modified varieties and preplant herbicides. Like UNRC and no-till systems, this approach reduces labor and items correlated with labor, such as tractors, towed equipment, fuel, and repairs.

A Problem

Much of the difficulty we are currently experiencing between the research community and the farming community is associated with our lack of ability to communicate. Our basic enterprise budgets are on a per acre basis. These budgets are useful for many purposes. But behind these budgets are numerous assumptions, which makes them less than desirable for whole-farm systems analysis.

As long as the grower simply wants to maximize the profitability of a particular enterprise, per acre budgets are satisfactory. With current persistent negative margins, a systems or holistic approach to the entire farm firm must be undertaken and the per acre budgets are only a starting point.

Modern agriculture is extremely sophisticated. The successful farmer must know and use highly technical information from a wide variety of specialized disciplines. He or she is required to take the various research produced components or recommended practices and fit them together into a complex production system for each enterprise on the farm. And, the enterprise production systems must be integrated into a more complete whole-farm system.

Modern agricultural research is being conducted by highly trained researchers specializing not only within one discipline, but often specializing in one or two problem areas within that discipline. Such work has and will continue to be beneficial at both the basic and applied levels. Our current problem of less than satisfactory profitability on cotton farms is probably of sufficient difficulty that a single discipline is inadequate to investigate possible solutions. Information from many disciplines will probably be required. Such research will require the combined effort of a team of researchers from several disciplines.

Modern farm management decisions and problems must be defined and researched within the context of their relationships to the organization of the entire farm business. The key to the successful operation of a modern commercial farm lies in a comprehensive and systematic approach to prior planning. There appears to be no short-cut to this stage of management.

Whole-farm systems analysis is not easy. It is hard work, but will make the farmer (owner/operator) more productive. In conclusion one might say that the whole-farm systems approach simply means that one is doing a thorough and comprehensive job of attacking the problem (the current lack of satisfactory level of profitability). The successful operation of any kind of business requires that business management possess a considerable amount of knowledge concerning the activities in which they are engaged. Rather than being simply a "way of life", farming is also a business. In fact, farming is a much more complicated and imprecise business than most people suspect.

Table 1. Breakeven Yield, Selected Prices, Cotton, Mississippi, 1998.

Price $/lb. of lint	**Breakeven Yield** lbs. of lint/acre
0.50	1287
0.55	1165
0.60	1064
0.65	979
0.70	907
0.75	845
0.80	790

Price of cottonseed = $0.05 per pound

Table 2. Breakeven Price, Selected Yields, Cotton, Mississippi, 1998.

Yield Lbs. of lint/ acre	**Breakeven Price** $/Lb. of lint
500	1.2517
600	1.0468
700	0.9005
800	0.7907
900	0.7054
1000	0.6371
1100	0.5812
1200	0.5347

Table 3. Expected (Budgeted) and State Average (Actual) Yield, Cost, Price, Gross Domestic Product, Deflated Price and Cost, Cotton Mississippi, 1975-1999.

	Budgeted	Actual	Direct	Fixed	Sum	Budgeted Cost Per	Actual Cost Per					Actual Deflated
Year	Yield (in pounds)		Cost (in dollars)			Pound	Pound	Price	GDP Index	Deflated Price	Deflated Total Cost	Cost/LB
1975	700	454	227.11	47.80	274.91	37.66	60.55	52.50	1.0000	52.50	274.91	60.55
1976	700	376	213.42	49.42	262.84	36.01	69.90	61.50	1.0584	58.11	248.34	66.05
1977	700	581	219.13	53.43	272.56	37.34	46.91	52.50	1.1269	46.59	241.87	41.63
1978	700	561	234.08	61.33	295.41	40.47	52.66	60.00	1.2091	49.62	244.32	43.55
1979	700	657	260.36	71.08	331.44	45.40	50.45	63.50	1.3122	48.39	252.58	38.44
1980	700	488	290.27	75.38	365.65	52.24	74.93	76.40	1.4334	53.30	255.09	52.27
1981	700	626	300.78	91.57	392.35	56.05	62.68	58.40	1.5683	37.24	250.18	39.96
1982	700	853	331.68	110.00	441.68	63.10	51.78	60.00	1.6671	35.99	264.94	31.06
1983	700	640	323.79	102.44	426.23	60.89	66.60	66.20	1.7382	38.09	245.21	38.31
1984	700	767	320.40	95.45	415.85	59.41	54.22	56.00	1.8038	31.05	230.54	30.06
1985	700	764	310.23	92.66	402.89	57.56	52.73	55.90	1.8658	29.96	215.93	28.26
1986	700	571	310.62	93.23	403.85	57.69	70.73	50.90	1.9145	26.59	210.94	36.94
1987	700	829	300.87	87.06	387.93	55.42	46.79	63.60	1.9734	32.23	196.58	23.71
1988	750	736	318.18	87.55	405.73	54.10	55.13	53.70	2.0454	26.25	198.36	26.95
1989	750	732	329.09	84.20	413.29	55.11	56.46	62.90	2.1316	29.51	193.89	26.49
1990	750	728	334.53	88.53	423.06	56.41	58.11	65.40	2.2238	29.41	190.24	26.13
1991	750	888	355.33	85.78	441.11	58.81	49.67	55.20	2.3122	23.87	190.78	21.48
1992	750	761	371.48	86.19	457.67	61.02	60.14	52.60	2.3759	22.14	192.63	25.31
1993	750	572	363.89	75.82	439.71	58.63	76.87	57.50	2.4386	23.58	180.31	31.52
1994	825	806	401.21	76.87	478.08	57.95	59.32	71.70	2.4968	28.72	191.48	23.76
1995	825	622	407.95	84.11	492.06	59.64	79.11	73.40	2.5543	28.74	192.64	30.97
1996	825	819	394.30	77.30	471.60	57.16	57.58	68.00	2.6023	26.13	181.22	22.13
1997	825	901	422.04	67.44	489.48	59.33	54.33	65.20	2.6507	24.60	184.66	20.50
1998	825	740	467.98	79.13	547.11	66.32	73.93	60.90*	2.6776	22.77	204.33	27.61
1999	825	N/A	454.16	82.93	537.09	65.10	N/A	N/A	2.7322	N/A	196.58	N/A

*Preliminary, estimated from available monthly data