OFF-FARM COSTS OF MOVING COTTON IN THE 1969/70 MARKETING SEASON

U.S. DEPARTMENT OF AGRICULTURE•ECONOMIC RESEARCH SERVICE

ABSTRACT

This study examines costs of and charges for moving raw cotton from the farm to the textile mill. Costs and charges, by marketing function beginning with ginning, are estimated separately for the four geographic regions encompassing the Cotton Belt for the 1969/70 marketing season.

Brief consideration is given to possibilities of reducing costs of marketing cotton, against the background of cost estimates developed. Areas investigated are adoption of new machinery and/or technology, structural changes, and research activity.

Key Words: Cotton, costs, charges, marketing, technology, structure, research.

PREFACE

This study will serve as background information for a larger study of cotton's current and prospective economic position. Current marketing cost levels and possible means of reducing these levels are two areas of major concern in the larger study in that they relate directly to cotton's competitive position in the fibers market.

The authors gratefully acknowledge supporting efforts by numerous colleagues, especially their willingness to make available relevant materials before their publication elsewhere. We give credit for all these materials in the selected references section.

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SUMMARY

Estimated average total costs for moving one bale of raw cotton through the gin and subsequent marketing functions in the 1969/70 marketing season were $31.69 in the Southeast, $38.99 in the Midsouth, $44 in the Southwest, and $49.02 in the West. These costs are on a "per bale marketed" basis and exclude costs of moving seed cotton from the farm to the gin. Estimates of charges made per bale were $29.10, $40.84, $38.61, and $46.40 for the Southeast, Midsouth, Southwest, and West, respectively.

Substantial savings in marketing appear possible through automatic seed cotton unloading and bale packaging--ranging from about 3 to 7 percent of total ginning cost, depending on gin size. Consolidation of smaller gins into larger plants and combining of ginning and warehousing functions appear to offer considerable potential savings. Review of published literature revealed that savings of up to $5 per bale could be realized from central ginning, although several serious related problems were cited. Group action designed to combine two or more of the marketing functions appears to be worthy of further study. Promising areas of additional research on cutting off-farm costs include studies to reduce ginning costs, investigation of the possibilities for vertical integration, systems studies designed to seek out least-cost flow patterns for cotton, and research on further development and use of automated fiber-testing facilities.

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INTRODUCTION

Pressures from fibers which compete with cotton are mounting and consequently both farm production and off-farm costs have received considerable attention in the search for areas in which efficiencies might be gained, resulting in reduced prices to users of raw cotton or increased producer returns. A recent study of the costs of moving cotton from the West Texas producing area to domestic and foreign mills found the total cost to be well in excess of $60 per bale (15). 1/ While costs of moving cotton from some other areas are not expected to be this high, they are substantial--and excessive, by popular consent. The level of off-farm costs, which generally exceed those of our major foreign competitors, put us at a disadvantage in the world market.

Purpose of Study

The primary purpose of this study was to develop recent, realistic estimates of off-farm costs of moving cotton, by specific marketing function and by four geographic regions. 2/ We knew that costs vary considerably among these regions and thus should be considered separately for each.

Individual attention was given various functions involved in moving cotton from the farm to the mill door. These are:

- Seed cotton storage and assembly
- Ginning
- Receiving at compresses and warehouses
- Storage
- Compression
- Break-out and shipping
- Transportation
- Financing
- All other functions 3/

1/ Underscored numbers in parentheses refer to items in Selected References, page 23 .

2/ The four regions are:
Southeastern: Alabama, Georgia, Florida, North Carolina, and South Carolina
Midsouth: Arkansas, Louisiana, Mississippi, Missouri, and Tennessee
Southwestern: Oklahoma and Texas
Western: Arizona, California, and New Mexico

3/ This category represents such costs as buying and selling commissions; legal, audit, and overhead cost of marketing agencies; and classing and grading fees.

In addition to this largely descriptive objective of the study, we had a secondary, largely analytical purpose: to provide general insights into possibilities for reducing present levels of off-farm costs, thus reducing the spread between mill price and turn row value. This involved areas in which additional cost-cutting research or adoption of new technology might be particularly effective. The time limitation under which the study was conducted permitted only limited investigations here.

Method of Study

The essential method employed was to assemble various published data on costs of moving cotton, update and supplement these data where necessary, and draw upon these cost estimates and relevant experience in suggesting fruitful areas of research or promising cost-reducing technology.

The basic time period is the 1969/70 marketing season--a recent period and one for which many of the desired estimates of cost are available. Various methods of updating were used in cases where data were not available for 1969/70.

In studying costs of moving cotton, a conceptual problem arose concerning the appropriate kind of data--that is, charges or actual cost of performing the service. Ideally, one would like to look at both and use the actual cost of performing a given service to evaluate efficiency, but examine charges to determine whether they are reasonable approximations of actual costs. As an example of this conceptual problem, cases are encountered frequently in which ginning charges are lower than best available estimates of actual costs of performing the services. This situation may arise because some other element of the owner's overall enterprise is bearing a part of the ginning cost. Or perhaps the owner is covering variable costs and perhaps a part of fixed costs and chooses to operate on that basis rather than close the gin.

To resolve the dilemma posed above, we developed estimates of both the cost and the charges for each marketing function.

Various sources of information used in the study are listed in Selected References at the end of this report. A primary reference was the recent study of handling cotton conducted at Texas Tech University (15). Also, many of our own studies (Fibers and Grains Branch, Marketing Economics Division, ERS) provided valuable data and will be cited individually. Published reports by USDA's Farmer Cooperative Service provided insights into alternative methods of handling cotton. Various data were also provided by the National Cotton Council, the Cotton Economic Research Committee of Texas, the Texas Transportation Institute, and the Foreign Agricultural Service, USDA.

ESTIMATES OF OFF-FARM COSTS AND CHARGES

Various assumptions, data sources, and supplementary information were necessary in developing the estimates of off-farm costs. These are discussed in some detail by marketing function. The sources of information used in the development of each estimate are documented.

Seed Cotton Assembly and Storage

There is some question as to whether the costs of seed cotton assembly and storage--functions usually performed by the producer--fall in the off-farm category. Also, insufficient data precluded development of reliable estimates of these costs by geographic region. However, because assembly and storage are properly within the marketing stream and their costs are considerable, we gave some attention to costs of these functions. We did not attempt to distinguish between charges and costs.

The Texas Tech study indicated, on the basis of considerable data, that the assembly cost in West Texas averages $3.99 per bale and the storage cost, $4.33 per bale (15). The results of that study--which assumed average 5-mile, one-way haul distance from farm to gin, $1.40 hourly wage rate, a three-bale average trailer load, 15 bales hauled or stored per trailer per year, and 60 percent of trailer costs allocated to storage (based on survey results)--were as follows:

Activity	Cost per bale
Assembly:	
Labor	$0.77
Pick-up truck	0.33
Trailer	2.89
Total assembly	3.99
Temporary storage	4.33
Total	$8.32

Among geographic regions, labor would be expected to vary considerably, but the overriding factor influencing cost--bales handled per trailer--is somewhat independent of region. Table 1 shows results of a recent ERS study indicating how this factor affects assembly costs in the Western area (10).

Using assumptions made in the Texas Tech study, only about three trips would be made per six-bale trailer (they assumed each trailer handled 15 bales) over an average distance of 5 miles one way. According to table 1, this would result in a cost of assembly (actually assembly and storage, under the assumptions made) of close to $10 per bale--not greatly different from the Texas Tech estimate.

Regional Estimates

Estimated costs of and charges for ginning and succeeding functions are tabulated for the study regions in tables 2 through 5. These estimates reflect the estimated expenses accrued against an "average bale" of cotton moving from farms to domestic mills and port areas. The estimates consider only bales marketed--costs and charges are on a per bale marketed basis rather than a per bale produced basis. Where possible, estimates reflect reduced costs of handling cotton which bypasses one or more of the marketing functions. Also, foreign shipments are traced only to port areas, since we did not consider ocean freight rates from domestic to foreign ports (the predominant item of cost) to be particularly subject to influence by cotton producers through research or through adoption of new technology or practices. A possible exception is containerization,

Table 1.--Total assembly cost per bale, using 1/2-ton pickup truck and 6-bale trailer, by number of trips and approximate round-trip mileage, Western region, 1970 1/

Trips per trailer	Approximate round-trip mileage					
	1.8	4.2	6.7	9.3	12.0	14.4
	Dollars per bale					
1	28.33	28.39	28.46	28.53	28.60	28.67
2	14.37	14.43	14.50	14.57	14.64	14.71
3	9.72	9.78	9.85	9.92	9.99	10.06
4	7.39	7.45	7.52	7.59	7.66	7.73
5	5.99	6.05	6.12	6.19	6.26	6.33
6	5.06	5.12	5.19	5.26	5.33	5.40
7	4.40	4.46	4.53	4.60	4.67	4.74
8	3.90	3.96	4.03	4.10	4.17	4.24
9	3.51	2.57	3.64	3.71	3.78	3.85
10	3.20	3.26	3.33	3.40	3.47	3.54
11	2.95	3.01	3.08	3.15	3.22	3.29
12	2.74	2.80	2.87	2.94	3.01	3.08
13	2.56	2.62	2.69	2.76	2.83	2.90
14	2.40	2.46	2.53	2.60	2.67	2.74
15	2.47	2.33	2.40	2.47	2.54	2.61

1/ Source: (10)

which way offer substantial savings in foreign shipments and thus deserve further research attention

The estimated total cost of moving cotton from the Southwestern area, it will be noted, is considerably lower than that shown in the Texas Tech study (15). The primary reasons for the difference are that the Texas study included the farm to gin transportation cost, transportation costs to foreign markets, and longer periods of storage and financing.

Ginning

The Department of Agriculture publishes annual ginning charges and number of bales ginned by State (5). We weighted the published charges for 1969/70 by the number of bales ginned in each State in arriving at the estimated charge for each region. These estimates do not reflect revenue received by ginners for the sale of cottonseed.

Estimated 1969/70 costs of ginning, based on sample survey studies of commercial gins, were available for the Midsouth (9) and Southwest (16). No estimates were available for the West and Southeast. It was necessary to assume that costs in the West were similar to those in the Southwest and that costs in the Southeast were similar to those in the Midsouth. These two assumptions are somewhat weak, in that volumes ginned (or percentages of ginning capacity utilized), which have a significant effect on costs, can vary appreciably from West to Southwest and from Southeast to Midsouth. Labor, another significant contribution to ginning costs, also varies among regions. To the extent that charges may reflect costs, the estimates of cost for the West are understated and those for the Southeast are overstated (comparing table 5 with table 4 and table 2 with table 3).

Receiving at Compress or Warehouse

Charges for receiving cotton have been published by State for 1969/70 by ERS (5). We weighted the published charge for each State by the volume ginned in the State (published in the same source) in developing estimated charges for receiving by region. These charges were comparable at around $1 per bale except in the West, where the charge was $0.72 per bale.

Regional costs for 1969/70 receiving have also been published by ERS (6). These costs were incorporated directly into this report. Estimated costs of receiving were nearly identical to charges in the Southeast, 8 to 9 cents lower (per bale) than charges in the West and Southwest, and about 15 cents lower than charges in the Midsouth.

Storage

We estimated regional storage charges by multiplying the regional charge per bale per month by the average length of time in storage. Storage charges by State (5) were weighted by the bales ginned in each State (5) to derive the regional storage charge. The average time in storage was obtained directly from the ERS storage cost study (6). Rounded to the next highest whole month, these storage periods were 4 months for the Southeast and Southwest and 6 months for the Midsouth and West. 4/ Charges per month reflect commercial tariff rates which are published (5) and the generally lower rate paid for storage of Government cotton in public facilities. The number of bales stored for the Commodity Credit Corporation (CCC) in each region was obtained from published Agricultural Stabilization and Conservation Service (ASCS) records (14).

4/ In the Southwest, for example, table 1 of the report shows:

	Months in storage	Bale months by storage
warehouses	5.1	1,566,031
compresses	2.8	4.191,450

The weighted average months storage is 3.4 (rounded to 4 months), accordingly.

Table 2.--Estimated costs and charges involved in moving Southeastern cotton from farms to domestic mills and ports, 1969/70

Item	Estimated cost	Estimated charge
	Dollars per bale	
Ginning	18.05	15.10
Receiving at compress or warehouse	1.02	1.01
Storage	2.02	2.39
Compression	--	--
Break-out and shipping	1.79	1.79
Transportation	2.22	2.22
Financing	2.88	2.88
All other	3.71	3.71
Total	31.69	29.10

Table 3.--Estimated costs and charges involved in moving Midsouth cotton from farms to domestic mills and ports, 1969/70

Item	Estimated cost	Estimated charge
	Dollars per bale	
Ginning	18.05	18.02
Receiving at compress or warehouse	.91	1.06
Storage	2.56	3.94
Compression	1.94	2.05
Break-out and shipping	1.36	1.60
Transportation	5.06	5.06
Financing	4.50	4.50
All other	4.61	4.61
Total	38.99	40.84

Table 4.--Estimated costs and charges involved in moving Southwestern cotton from farms to domestic mills or ports, 1969/70

Item	Estimated cost	Estimated charge
	Dollars per bale	
Ginning	26.89	20.02
Receiving at compress or warehouse	.94	1.02
Storage	1.60	2.38
Compression	1.76	2.30
Break-out and shipping	1.05	1.13
Transportation	4.32	4.32
Financing	2.60	2.60
All other	4.84	4.84
Total	44.00	38.61

Table 5.--Estimated costs and charges involved in moving Western cotton from farm to domestic mills or ports, 1969/70

Item	Estimated cost	Estimated charge
	Dollars per bale	
Ginning	26.89	21.96
Receiving at compress or warehouse	.63	.72
Storage	1.80	3.51
Compression	1.99	2.32
Break-out and shipping	1.22	1.40
Transportation	7.19	7.19
Financing	4.86	4.86
All other	4.44	4.44
Total	49.02	46.40

Using the Southwest as an example, the estimated storage charge for the average bale of cotton marketed was calculated as follows:

Bales ginned	3,027,000
Average length of storage	4 months
Weighted average tariff	$0.60 per month
CCC rate 5/	$0.5124 per month
Bales acquired by CCC	127,748
"Free" bales	2,899,252

Thus, the weighted monthly storage charge is $0.5963 per bale: $\$0.60 \left(\frac{2,899,252}{3,027,000}\right) + \$0.5124 \left(\frac{127,748}{3,027,000}\right)$. The average bale marketed was in storage for 4 months for a total storage charge of $2.38.

The same procedures were used in developing the estimated storage costs. The basic storage cost estimate per month, by region, was obtained from the ERS storage cost study (6).

Compression

Compression charges and costs reflect varying compression practices and requirements. In developing the estimates of charges and costs, we made adjustments for the proportions of regional production compressed to standard density, to high density directly or to standard and then high density (double compression) in each region. The basic data on compression charges were obtained from the ERS report of ginning charges and related data (5). Storage cost estimates were developed from information reported in the ERS storage cost study (6). We obtained supplemental information on practices by regions in informal interviews with cotton warehousemen and shippers.

No estimates of compression charges or costs were made for the Southeast, since nearly all bales are marketed to domestic mills as flat bales. During 1969/70, about 95 percent of the cotton exported from the Midsouth was double compressed, according to the informal field interviews. That is, it was compressed to standard density on arrival at the compress, then to high density on shipment for export. In the Southwest and West, however, practically all cotton was stored flat and compressed on order.

As an example of the way compression charges and costs were estimated for the average bale of cotton marketed from each region, the following procedure for the Southwest is cited:

Bales ginned	3,027,000
Bales exported	6/ 1,701,000

5/ Average of warehouse ($0.55 per bale) and compress ($0.50 per bale) rates. The average is "weighted" by storage capacity warehouses and compresses in the Southwest.

6/ Estimates developed from census data by the Foreign Agricultural Service.

Charges for compression to:	
Standard density	$2.29 per bale
High density	$2.30 per bale
Costs of compression to:	
Standard density	$1.59 per bale
High density	$1.90 per bale

Then, for compression charges, (43.8 percent) ($2.29) + (56.2 percent) ($2.30) = $2.30 per bale. For compression costs, (43.8 percent) ($1.59) + (56.2 percent) (1.90) = $1.764 per bale.

The procedure used to estimate compression charges and costs for the Mid-south was a little more complicated:

Bales ginned	3,681,000
Bales exported	425,000
Bales exported to Canada (Standard density)	190,000
Charges for compression to:	
Standard density	$1.900 per bale
High density	$2.440 per bale
Costs of compression to:	
Standard density	$1.784 per bale
High density	$2.534 per bale
Bales pressed to standard density 7/	3,446,000
Bales pressed to high density 8/	235,000
Bales double compressed 9/	223,250

Then for compression charges:

3,446,000 @ $1.90	=	$6,547,400
235,000 @ $2.44	=	573,400
223,250 @ $1.90	=	425,175
		$7,544,975

and $\frac{\$7,544,975}{3,681,000} = \$2.05$ per bale.

The identical weighting procedure was used to derive the $1.94 per bale compression cost.

Break-Out and Shipping

Regional costs for break-out and shipping for 1969/70 are published by USDA (6). Charges for break-out and shipping are not readily available.

7/ 3,681,000 minus 235,000.

8/ Exports minus exports to Canada (425,000-190,000).

9/ Ninety-five percent of cotton exported at high density.

Since charges and costs are both available for the receiving function, and since the receiving and break-out and shipping functions require similar labor and equipment inputs, we assumed that break-out and shipping charges bear the same relationship to break-out and shipping costs as receiving charges bear to receiving costs.

For example, in the Southwest, the ratio $\frac{\text{receiving cost}}{\text{receiving charge}} = \frac{\$0.945}{\$1.018} =$ \$0.9282. Thus, $\frac{\text{break-out and shipping cost}}{\text{break-out and shipping charge}} = .9282$ by assumption, or $\frac{1.051}{X} = .9282$, $X = \frac{\$1.051}{.9282} = \$1.132$ per bale charge estimated for break-out and shipping.

Transportation

No distinction was made between transportation costs and charges. Regional transportation cost to the cotton marketing system reflects the average transportation rate for transporting cotton from major cotton trading areas in each region, weighted by proportions transported to major domestic mill points and to primary port areas for export. The total volume of cotton moving from each region to mill points or port areas was estimated from preliminary results of an unpublished cotton distribution study being conducted by ERS (7). Transportation rates were obtained from National Cotton Council data (13) and a report of the Cotton Economic Research Committee of Texas (8). Table 6 shows the derivation of average transportation rates from the four study regions to domestic mill points and port areas. Translated into dollars per bale, the rates are \$7.19, \$4.32, \$5.06, and \$2.22 for the West, Southwest, Midsouth, and Southeast, respectively.

Financing

No distinction could be made between financing charges and costs. The financing expense to the cotton marketing system represents interest charges for the period during which a typical bale of cotton is in the marketing system. This period was assumed to approximate the average length of storage; further, it was assumed that all bales marketed were financed.

The financing expenses for each region were computed on the basis of the average financing period multiplied by the estimated monthly interest charge. Monthly interest charges are the product of the weighted average value per bale (17) and the monthly interest rate for short-term business loans. 9/ Table 7 shows the derivation of the financing expense by region.

9/ Annual interest rates were obtained from U.S. Department of Commerce, Survey of Current Business, and converted to monthly rates. Since no rate was reported for the Midsouth, the Southeastern rate was used for that region.

Table 6.--Derivation of average transportation rate for cotton moved to domestic mill points and port areas, by region, 1969/70

Region and destination	Rail rate from average origin 1/	Estimated percent of total shipments 2/	Weighted rail rate
	Cents/cwt.	Percent	Cents/cwt.
West:			
California ports	50	41	20.50
Combined 201, 200 Alabama, and Georgia mills	209	59	123.31
Total	--	100	143.81
Southwest:			
Houston-Galveston	61	63	38.43
201 and 200 mill	138	12	16.56
Alabama-Georgia mills	126	25	31.50
Total	--	100	86.49
Midsouth:			
New Orleans	64	8	5.12
201 mills	101	38	38.38
200 mills	111	41	45.51
Georgia-Alabama mills	93	13	12.09
Total	--	100	101.10
Southeast:	--	--	3/44.44

1/ Based on rates provided by the National Cotton Council (13)
2/ Based on preliminary results of distribution study (7).
3/ No new rates available. Based on previous shipper cost study (8) and assumption of 20-percent increase in costs, based on average increase in the other regions.

Table 7.--Derivation of the estimated average financing expense against the typical bale of cotton marketed, by region, 1969/70

Region	Weighted average value per bale	Annual interest rate	Estimated financing expense 1/
	Dollars	Percent	Dollars per bale
West	116.00	8.33	4.86
Southwest	93.50	8.35	2.60
Midsouth	110.05	8.18	4.50
Southeast	104.15	8.18	2.88

1/ Average financing periods, the same as for storage, are: West - 6 months, Southwest - 4 months, Midsouth - 6 months, Southeast - 4 months.

All Other Costs and Charges

This miscellaneous category of cost includes expenses such as buying and selling commissions; legal, audit, and overhead costs of marketing agencies; and classing and grading fees. The totals for these items, by region, were published for the 1964/65 season (8). We inflated these totals by 25 percent in estimating the charges for 1969/70, based primarily on price indexes published by the Bureau of Labor Statistics. Table 8 shows the derivation of these expenses by region.

POSSIBILITIES FOR REDUCING COSTS

Several possibilities for reducing off-farm costs are receiving considerable attention from the cotton industry. Some of the approaches are quite old in concept, while others are relatively new. Central ginning is a concept which has been discussed and studied for years in this country, and implemented in other countries. On the other hand, systems analyses designed to foster greater efficiency across the broad spectrum of cotton handling and marketing is a topic of quite recent vintage.

This section of the report gives limited attention to various possibilities for reducing off-farm costs of moving cotton. It is intended to provide some tentative insights into potential reductions, against the background of the cost (and charges) estimates developed above. Three avenues of possible cost reduction considered here are mechanization, changes in industrial structure, and additional research.

Table 8.--Derivation of "all other" expenses of moving cotton, by region, 1969/70

Item of expense	Region							
	West		Southwest		Midsouth		Southeast	
	1964-65 study	1969-70 estimate	1964-65 study	1969-70 estimate	1964-65 study	1969-70 estimate	1964-65 study	1969-70 estimate
	Dollars per bale							
Buying and local delivery	0.83	--	0.70	--	0.70	--	0.59	--
Selling	.91	--	1.08	--	.95	--	.56	--
Miscellaneous	.45	--	.30	--	.50	--	.51	--
Overhead	1.36	--	1.79	--	1.54	--	1.31	--
Total	3.55	1/4.44	3.87	1/4.84	3.69	1/4.61	2.97	3.71

1/ Estimated to be 125 percent of the 1964/65 total.

Mechanization

Within the context of this study, possibilities of reducing costs through mechanization and automation center largely in the ginning and warehousing (and compression) functions. Little information was available on which to judge the potential savings available through greater mechanization of the warehousing and compression functions. Automation of dinky presses; semiautomated conveyor receiving lines for weighing, sampling, and tagging; and automated stacking equipment for getting cotton into storage are all available. However, no cost-benefit data were found which would provide the basis for judging cost-cutting potential.

The cotton ginning function may be regarded as three separate functions--unloading of seed cotton, seed cotton conditioning and ginning, and packaging. Looney suggests that unloading and packaging lend themselves more readily to further automation (11). Each of these account for about one-third of the labor used in ginning. Moreover, unloading by air suction requires heavy consumption of energy, suggesting potential savings are possible from further automation.

Various alternative seed cotton unloading systems have been studied. A dumping system which eliminates unloading fans and suction pipes recently has been developed at the USDA Cotton Ginning Research Laboratory at Stoneville, Miss. (12). A modification of this system is operating successfully in a large plant in California. Using 6-bale trailers with a dumping system of unloading only, requires dumping of three to four trailers per hour at a 24-bale per hour gin. For this reason, one workman most likely could replace the yard or suction crew. For a 6-bale gin, this would mean reducing the yard crew by only one man, but for the 24-bale gin, the reduction would be at least three men. Energy consumption would be reduced significantly.

The move to net-weight trading probably will encourage greater adoption of automatic packaging, reducing the packaging crew by one man in a 6-bale gin and by three to four men in a 24-bale gin. Adoption of dump unloading and automatic pressing would reduce labor requirements by about one-third in smaller gins and by about one-half in the largest gins, but would require considerable capital expenditures. Thus, some assurance of continued, sufficient volume per gin is required before these potential reductions in per bale costs can be realized.

Based largely on the most recent model ginning cost study conducted by the Economic Research Service, tables 9 through 12 indicate the estimated potential savings obtainable through automation of seed cotton handling and lint packaging in the Midsouth (10).

Further improvements in sampling and packaging at gins probably could reduce costs and improve the quality of cotton delivered to mills. Automatic sampling at gins and subsequent trading on the basis of samples drawn would improve bale appearance and lint quality and alleviate the costs of subsequent sampling. Packaging practices relate not only to adoption of technology, but also to structural arrangement. The acceptance by industry of a uniform (universal) density bale would make possible the compression and packaging of cotton at the gin in a form suitable for both domestic and export use. A substantial part of the compression cost shown in this study for each region could be eliminated.

Table 9.--Comparison of crew requirements, labor saving, and dollar saving for conventional and automatic unloading systems for seed cotton, by rated capacity, Midsouth, 1970/71

Unloading system	Bale capacity per hour 1/									
	6	8	10	12	16	18	20	24	30 2/	36 2/
	Men									
Conventional 3/...	2	3	3	3	3	3	3	4	5	5
Automatic 4/......	1	1	1	1	1	1	1	2	2	2
Savings:										
Crewmen.........	1	2	2	2	2	2	2	2	3	3
	Percent									
As percentage of: total labor cost...........	17	29	25	23	20	18	17	16	23	22
	Dollars									
Per bale..........	.47	.71	.56	.48	.35	.31	.29	.24	.29	.24
Per season........	2,171	4,374	4,312	4,435	4,312	4,297	4,466	4,435	6,699	6,653

1/ Manufacturers' rating.
2/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.
3/ Includes use of manually operated suction pipes.
4/ Dump unloading system with 2 pits and sets of cylinders and one vacuum.

Table 10.--Comparison of crew requirements, labor saving, and dollar saving for conventional and automatic strapping systems for baled lint by rated capacity, Midsouth, 1970/71

Strapping system	Bale capacity per hour 1/									
	6	8	10	12	16	18	20	24	30 2/	36 2/
	Men									
Manual............	2	2	3	3	4	4	5	5	--	--
Automatic.........	1	1	2	2	2	2	3	3	4	4
Savings:										
Crewmen.........	1	1	1	1	2	2	2	2	--	--
	Percent									
As percentage of: total labor cost...........	17	15	13	11	20	18	17	16	--	--
	Dollars									
Per bale..........	.47	.36	.29	.23	.35	.31	.29	.24	--	--
Per season........	2,171	2,218	2,233	2,125	4,312	4,297	4,466	4,435	--	--

1/ Manufacturers' rating.
2/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.

Table 11.--Energy requirements and costs and savings associated with dump pit unloading of seed cotton for model gins operating at full seasonal capacity, Midsouth, 1970/71

Item	Bale capacity per hour 1/									
	6	8	10	12	16	18	20	24	30	36
Cost per kw.-hr. (cents)	2.78	2.78	2.74	2.76	2.73	2.73	2.71	2.71	2.76	2.73
Kw.-hr. per bale (total)	52.78	45.84	42.55	42.33	44.74	43.33	41.64	39.30	43.28	42.16
Kw.-hr. per bale: Unloading (fans)	5.56	4.17	4.30	3.58	3.18	4.53	4.08	4.06	4.97	4.98
Kw.-hr. per bale: Unloading (dump)	1.07	.84	.75	.73	.62	.59	.60	.56	.70	.63
Savings:										
Kw.hr. per bale	4.49	4.31	4.34	2.85	2.56	3.94	3.48	3.50	4.27	4.34
Costs per bale (dollars)	.12	.12	.12	.08	.07	.11	.09	.09	.12	.12
Dollars per season	554	739	924	739	862	1,525	1,386	1,663	2,772	3,326
Percentage of total energy cost	8.2	9.4	10.3	6.8	5.9	9.3	8.8	8.5	18.9	18.4

1/ Manufacturers' rating.

Table 12.--Total savings of labor and energy associated with automatic seed cotton unloading and bale strapping for model gins operating at full seasonal capacity, Midsouth, 1970/71

Item	Bale capacity per hour 1/									
	6	8	10	12	16	18	20	24	30 2/	36 2/
	Men									
Crewmen	2	3	3	3	4	4	4	4	3	3
	Dollars									
Per bale	1.06	1.19	.97	.79	.77	.73	.67	.57	.41	.36
Per season	4,987	7,330	7,469	7,300	9,486	10,118	10,318	10,534	9,471	9,979
	Percent									
Percentage of total ginning cost	5.9	7.3	6.2	5.2	5.4	5.2	4.8	4.2	3.2	2.9

1/ Manufacturers' rating.
2/ Dump unloading only. Models have automatic strapping already incorporated.

Structural Change

Off-farm cost studies have definite implications for possible cost-reducing structural changes within the cotton marketing system. Limited attention is given to the subject of potential cost reduction through organizational or structural changes. These changes are within the context of the present price and production control system. Thus, any detailed consideration of approaches which would replace the present system, such as marketing orders or marketing control boards with broad powers, are not given consideration here. Rather we investigate consolidation of facilities and/or functions, central ginning, and group action.

Consolidation

Wilmot has suggested the consolidation of smaller, older gin plants into larger, more efficient operations as a possible means of reducing ginning costs (18). In analyzing the potential benefits to be gained from consolidation, he assumes a situation in which four typical 8-bale per hour gins are replaced with a plant of sufficient capacity to gin their combined annual volume. The volume, cost, and related data representing the smaller gins were obtained from a sample of small (8 bales per hour capacity, or less) gins in West Texas during 1969/70. Since actual annual volume was around 12,500 bales, he assumed that one 20-bale per hour plant with a rated annual capacity of 15,400 bales is the smallest size gin to recommend. Cost comparisons for the four smaller and one larger plant are given in table 13.

The 4-plant average net loss was estimated to be $3.48 per bale while the profit for the larger plant was estimated to be $8.11 per bale. At this rate, a 5-percent allowance for depreciation on the investment required for a new 20-bale per hour gin ($2.13 per bale) plus the anticipated net profit of $8.11 per bale would pay off the investment in a little over 4 years, if volume is maintained [$542,000 10/ ÷ ($10.24 x 12,328 bales)] .

The average cost of seed cotton assembly would be increased because of the greater average haul distance. However, in a consolidation of several plants, the cost of constructing a new gin plant replacement would be less than that shown in table 13, since land, office buildings and equipment, tools, and perhaps other auxiliary equipment are already owned. Also, there should be some salvage value from the existing plants.

Consolidation of gins and warehouses--an example of vertical integration--is another potential cost-cutting practice. One ERS study examines this question at some length (19). Some of its essential implications are cited here as indicative of possible cost reductions, although it applies specifically to the Western region of the Cotton Belt.

The study suggests that costs of assembling seed cotton, ginning and packaging, moving bales to warehouses, and receiving can be reduced appreciably by

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10/ Estimated investment in a new 20-bale per hour gin (10).

Table 13.--Comparison of per bale operating costs, revenues, and net margins, 4-gin plant average and 20-bale model gin replacement, based on an annual volume of 12,328 bales, West Texas, 1969/70

Item	Operating cost	
	4-plant average 1/	20-bale model 2/
	Dollars	
Cost:		
Management	3.97	1.62
Depreciation	3.70	2.13
Interest	1.40	1.59
Insurance	.48	.26
Taxes	.46	.48
Energy	2.00	1.24
Labor	5.85	2.30
Bagging and ties	3.00	3.00
Repairs	4.66	1.93
Miscellaneous	2.27	1.65
Total	27.79	16.20
Revenue, total 3/	24.31	24.31
Net margin, total	(3.48)	8.11

1/ Group 1 average, 1969/70, West Texas ginning cost study (16).

2/ Based on operating cost of 20-bale model gin with a seasonal capacity utilization rate of 80 percent. Full seasonal capacity utilization for a 20-bale model is estimated at 15,400 bales based on an assumed sustained rate capacity of 85 percent of manufacturers' ratings and 906 hours of available operating time (10).

3/ Average ginning fees, charges for bagging and ties, and margins on cottonseed.

making changes in numbers and sizes of gin plants and warehouses. Two alternative models, both representing changes from current practices, were considered. Model I consisted of one centrally located warehouse surrounded by four 36-bale per hour gins located at equal distance from the warehouse. Model II consisted of one complex: a warehouse with four 36-bale per hour gin processing lines located adjacent to the warehouse. The costs of operating the two model complexes were compared with the costs of conventional gin-warehouse arrangements involving 12-bale per hour to 24-bale per hour gins.

The principal difference in operating practices (from those in current use) was the elimination at the warehouse of duplication in bale weighing, tagging, and sampling initially performed at the gin. In addition to the cost saving in labor and equipment required to repeat these tasks, bales could be unloaded upon arrival and moved directly into storage compartments for stacking in one continuous operation. Compared with conventional practices incorporating 12-, 18-, and 24-bale gins, total costs for model I were estimated to be about 14, 10, and 8 percent lower, respectively, at comparable rates of seasonal capacity utilization (table 14).

Model II requires lower total capital input since only 2½ times as much land, outside equipment, tools, and office facilities would be required for the four gin processing lines as for a single gin plant. The gin labor force could be reduced by one man per processing line with the elimination of the conventional method of temporarily storing baled cotton on the gin yard. The average cost of seed cotton assembly would be slightly higher because of increases in hauling distance. But bales could be moved with clamp trucks from gin to warehouse at a considerable reduction in cost compared with the current practice. Compared with conventional arrangements of 12-, 18-, and 24-bale per hour capacity, cost savings from use of model II ranged from 16 to 21 percent, assuming comparable rates of seasonal capacity utilization.

It may be more realistic to assume that ginning facilities would, on the average, process around 90 percent of their potential seasonal volumes while those of conventional arrangements would average about 60 percent. Comparisons at these rates would show cost savings up to 32 percent for model II.

A separate study has indicated potential savings of $5 or more per bale from coordinating ginning activities with those of warehouses or oil mills. (3).

Adoption of automatic sampling, a universal density bale, and integration of ginning and warehousing functions would pave the way for greater attention to assembly of uniform quality lots of cotton at gin points. Extension of the ginning season over more time, as discussed in the following section, would increase the opportunity for this practice through provision of a greater annual volume at each gin point. Certain larger volume gin points perhaps could run consecutively ginned bales into lots of 25, 50, or 100 bales which could be offered as sufficiently uniform in quality for a mill purchase. The USDA classification could serve as a check on the uniformity of quality within each lot. Or, perhaps, a limited number of quality groups could be set up and cotton bales assigned to each on the basis of the USDA classification. These are only two alternative ways of assembling cotton for shipment to mills which may warrant further study.

Table 14.--Comparison of per bale costs for performing 4 marketing services among 5 different ginning warehousing arrangements--3 conventional and 2 proposed models, California-Arizona, 1971 1/

Ginning 2/ warehousing arrangement	Level of potential annual output, in percent					
	100	90	80	70	60	50
	Dollars					
12-bale conventional....	22.80	23.52	24.40	25.54	27.04	29.09
18-bale conventional....	21.71	22.34	23.17	24.21	25.56	27.42
24-bale conventional....	21.28	21.93	22.72	23.72	25.08	26.91
Model I.................	19.57	20.22	21.03	22.00	23.32	25.16
Model II................	17.94	18.49	19.21	20.10	21.26	22.88

1/ This comparison assumes 6 seasonal trips per trailer for seed cotton assembly. Marketing services include: (1) hauling seed cotton from field to gin, (2) ginning and packaging, (3) moving baled lint to warehouses, and (4) warehouse receiving.

2/ Costs of conventional arrangements are low compared with estimated costs in table 5. This results largely from the fact that data above are based on new, model gin setups, whereas costs in table 5 reflect estimates of conditions in the area.

Obviously, certain problems accompany each of the changes cited. Despite this fact, however, each change does represent one potential avenue to reduced marketing costs and is cited here as an area worthy of further attention, not as a recommended change.

Central Ginning

Central ginning has long been discussed as a possible means of reducing substantially the off-farm costs of processing cotton. Perhaps the most extensive, definitive, and recent studies are those conducted by the Farmer Cooperative Service of USDA (2), (3), and (4). Since these studies are published, only brief highlights are cited here. The latest report indicated possible savings of $5 to $10 per bale from central ginning, primarily from greater and more uniform utilization of inputs--particularly labor and equipment. Blending of seed cotton to obtain lots of more uniform quality was cited as a related benefit. Potential problems cited were those associated with marketing seed cotton rather than lint, storage of seed cotton, and possible quality deterioration of lint and/or seed. Estimated costs of alternative systems of handling cotton are available in the published reports and are not duplicated here.

Considering the estimated savings to be derived from some manageable system for using expensive ginning facilities over greater periods of time and the attendant improved efficiency of labor utilization, additional study is recommended to further evaluate the net gains from such a system, considering the possibility and cost of overcoming related problems. Included in these evaluations could be a consideration of double usage of labor--on the farm and at the gin--through establishment of complexes in which several efficient farm production units would utilize one efficient gin or gin-warehouse complex operated both during the harvesting season and for some time thereafter. Part of the required gin labor would be provided by production units and the gin facility would be utilized for a longer period of time.

The immediate gross effect on ginning costs of an extension of the season (expansion of volume ginned) is to substantially reduce average total ginning cost per bale. For example, referring to table 13, doubling the volume of the 20-bale model to 24,656 bales would reduce the total cost per bale ($16.20) to an estimated $13.16, even if the per bale energy, labor, bagging and ties, repair, and miscellaneous costs remain the same. Realistically, all of these costs, except for bagging and ties, should be reduced. So long as the added costs of seed cotton handling and storage do not exceed this difference ($16.20-$13.16 = $3.04), a net savings would result from the extended season. A lack of definitive information on the cost of seed cotton handling and storage precludes a quantitative estimate of net savings per bale.

Group Action

Where many individual producers of a commodity are involved, as in the case of cotton, individual (independent) production planning activities tend to give rise to wide fluctuations in supply and to a price-taking position of the producer in both buying of productive inputs and selling of the product. This implies a need for group action, which historically has been met partially by the Federal Government through supply control. But there is an additional benefit from group action, perhaps, in terms of <u>cost reduction</u>. That is, integrating or combining two or more marketing functions to achieve lower costs. One possible means of achieving this integration is summed up quite well in a recent article by Cable, Alstad, and Taylor, of the Arizona Extension Service (<u>1</u>):

> As a group, cotton growers must use some of the same organizational, legal, and financial tactics that other businessmen use to control and regulate production and marketing. These tactics include formation of corporations and cooperatives--some are already in existence--and eventually, perhaps, the merger and consolidation of some of these. Forward pricing, cost-plus pricing, production-sales contracts and profit-sharing arrangements would most likely be involved. Based on present trends, it is conceivable that farmer-owned marketing businesses may broaden their activities to provide stockholders with processing, storing, transporting, and financing services.

A move toward integration of functions may be initiated by any one of several groups--producers (as indicated above), ginners, warehousemen, merchandisers, or even textile manufacturers. The primary interest here is in possible cost reductions, however, not in who initiates the integration.

Additional Research

Mechanization and structural change within the industry certainly require research--the discussion in this section is in no way intended to imply the contrary. Whereas emphasis in the preceding sections was on adoption of mechanization and structural changes, this section emphasizes the need for additional research in various areas which would explore and develop new, improved ways of marketing cotton, including both new technology and alternative structural organization.

Judging strictly from the magnitude of the cost estimates developed in this report, one would suggest ginning research as the most promising area for productive cost-cutting research. Studies of consolidation and central ginning also suggest the need for further research in this area. On the other hand, it would seem that storage is at the other extreme--research is not likely to change the pattern of cotton production or consumption materially and the estimated storage cost is small relative to ginning costs. Knowledge of certain double handling practices implies that research might contribute to a reduction of the receiving, compression, and break-out and shipping costs, although each is small relative to ginning costs. Financing costs probably would be difficult to reduce through research designed to streamline the whole spectrum of cotton marketing.

One promising approach to the study of off-farm costs and their reduction is through various forms of systems analysis. These studies consider the entire sequence of cotton marketing, or some subpart of the system consisting of two or more functions. The objective of such studies is to analyze the effectiveness of the system against some norm or objective. The study cited earlier which considered consolidation of gins and warehouses is a form of systems analysis (19). The Fibers and Grains Branch of the Marketing Economics Division, ERS, is currently developing optimizing flow models of the cotton marketing system to be used as guides in determining the most economical methods of handling cotton and the least-cost flow patterns from the farm to the mill or port. Essentially, these are econometric models of the flow of cotton which use mathematical relationships to approximate the relationships which exist among various subparts of the system. By hypothesizing changes in one or more aspects of the system, the overall net effect on the cost of moving cotton can be estimated and evaluated.

The approach currently being used is to (1) "describe" the present real-world flow of cotton and estimate the associated cost, and (2) make changes in types and/or numbers of ginning and warehousing facilities or in flow patterns to determine the extent to which costs are reduced as a result of the changes. These studies require considerable data inputs, intimate knowledge of the cotton marketing system, use of electronic computers, and innovative thinking concerning possible changes in the system which could reduce off-farm costs of moving cotton and which are workable in relation to the rest of the marketing system.

The systems approach to reducing costs is highly recommended. In fact, it should be further broadened to "merge" with farm production practices and with mill requirements, in a systems sense. In other words, the movement of cotton from farm to mill is really a subpart of a larger system.

Finally, research on further development of and use of automated fiber testing is needed by the industry. Possibilities for using automated fiber-testing facilities to determine the quality of each bale and to serve as the basis for both marketing and utilization of cotton have received a lot of attention recently. Although one may not normally think of this as a potential cost-reducing practice, it can effectively serve as such when perfected. A better description of the quality of each bale should lead to more efficient use of cotton in the mill, reducing the effective cost to the mill. If automated fiber testing could replace the fiber testing now done first by USDA and then again by mills, the result would be a substantial reduction in cost. Potentially, a hidden benefit is also involved. When automated fiber testing is perfected and experience is gained in use of the results, better utilization of cotton in the mill should result, since cottons could be selected more precisely for given end uses.

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