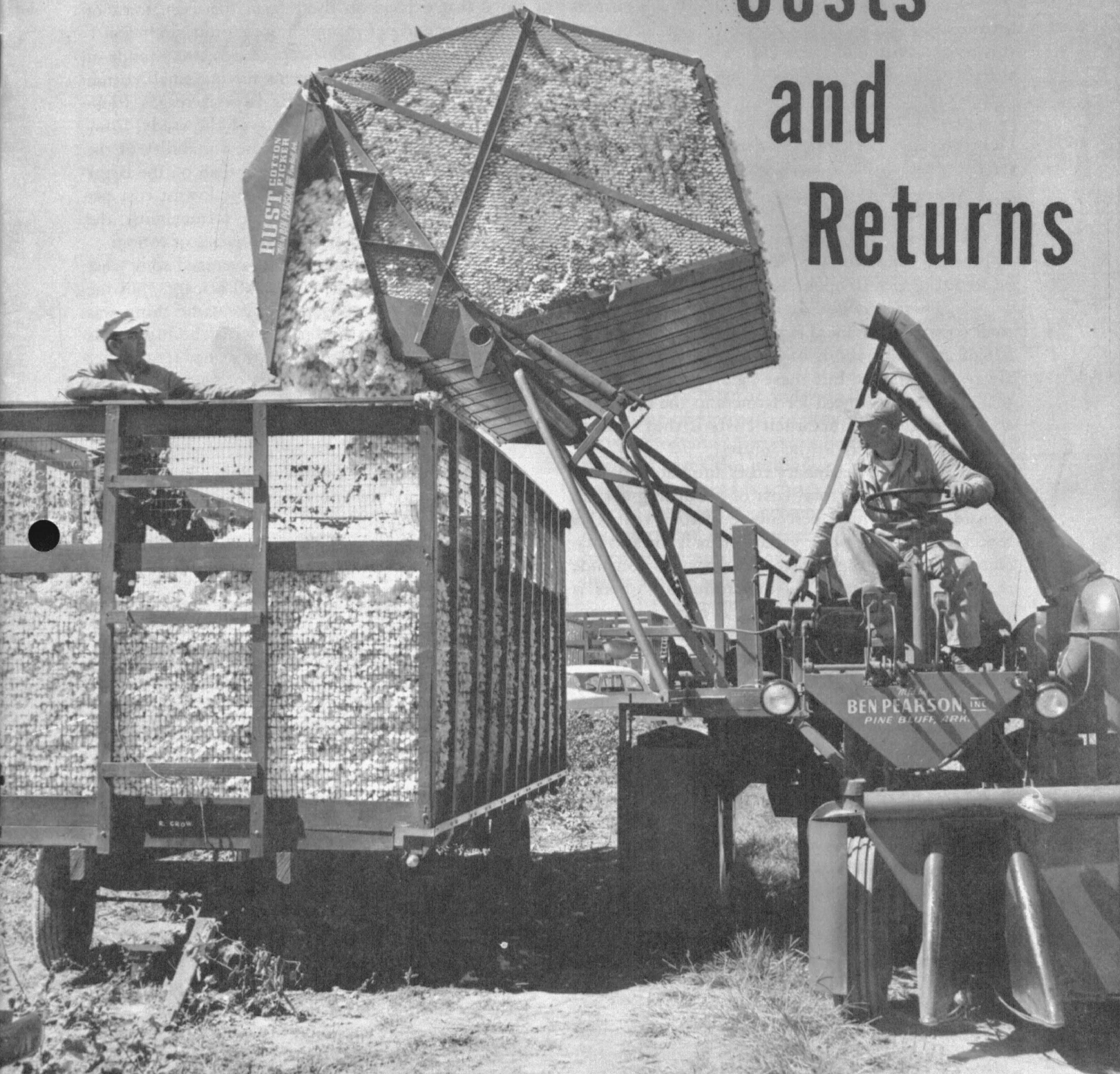


Cotton Production

Costs and Returns



B758 NOVEMBER, 1960
UNIVERSITY OF MISSOURI
AGRICULTURAL EXPERIMENT STATION

SUMMARY

Detailed production records kept by 42 farmers on the 1959 cotton crop provided the data used in this report. Purpose of this project was to determine the costs and returns of producing cotton by size of cotton enterprise (acres), and to study the influence of various factors such as level of mechanization, lint yield per acre, price received for lint, and level of fertilizer use on net income.

Among the more important results revealed were:

1. It cost farmers in this study \$149.05 per acre to produce cotton in 1959. The average cost amounted to \$22.03 per 100 pounds of lint.

2. There was considerable variation in costs; total costs on individual farms varied from \$15.44 to \$28.68 per 100 pounds of lint. Some variation can always be expected but these data point out clearly that there is a real need for farmers in the upper end of this range to reduce their costs if they wish to compete successfully in the future.

3. Labor and machinery costs amounted to nearly 58 percent of the total cost of producing cotton. Considering the high percentage of total costs this represents and the wide variation in labor and machinery costs on these farms it is easy to conclude that no other phase of cotton production offers as great a challenge for cost cutting as these two items. This is particularly true of farmers with small cotton acreages.

4. 1959 was an excellent year for cotton production in Missouri. Average lint yield on the study farms was 680 pounds per acre. As the farmers received an average of \$31.36 per cwt. of lint, the lint receipts amounted to \$202.14 per acre. Total receipts from lint and cotton seed averaged \$234.49 per acre.

5. Net returns to management averaged \$85.44 per acre, which clearly indicates that cotton producers enjoyed a very profitable year. For every \$100 these farmers spent for the use of land, labor, and capital they received an average of \$158.71 in returns.

6. Tremendous variation occurred in the net returns per acre on individual farms with the range being from \$30.18 to \$169.28.

Many factors influence the net income received by farmers and it is difficult to determine the exact effects of each. Following statements reveal relation-

ships that existed on these farms between some of the factors and net income from cotton production.

7. Total costs per acre and per 100 pounds of lint averaged higher on farms having small cotton acreages than on those having larger acreages. Probably a more important finding of the study, however, was that there was far more variability in the total costs on the smaller acreages than on the larger acreages. Both the farmer with the lowest cost per acre in the entire study and the farmer with the highest cost produced less than 20 acres of cotton.

8. Returns to management averaged somewhat lower on the farms with the small acreages, but the difference was not consistent. The same thing was true as with costs; the farmer with the highest as well as the farmer with the lowest net returns per acre produced less than 20 acres of cotton.

9. The study revealed that the place the small farmer must be most careful is in labor and machinery costs as he must be particularly careful to hold down fixed machine ownership costs.

10. One of the most significant results of the study was the tremendous influence lint yields had on net returns per acre. Farmers, by increasing their lint yield from 520 to 831 pounds per acre, almost doubled their net income per acre.

11. Although it was impossible to isolate the exact effects of price received for lint, the data revealed that farmers should strive for high quality cotton and carefully analyze their marketing alternatives.

12. One of the major factors in obtaining high cotton yields is the proper use of commercial fertilizer. There was no doubt that using high rates of fertilizer on these farms was profitable in 1959.

13. Because of the variability of bottomland soils in the Bootheel a comparison was made of the costs and returns of producing cotton by soil textural properties. Lint yields were highest on the "heavy" soils but because of the higher costs on these soils the farmers having sandy loam soils received the highest net returns per acre. Farmers on the light sandy soils had the lowest lint yields, lowest costs and the lowest net returns per acre.

14. Generally speaking, the more labor involved in the harvesting operation the higher were the total harvesting costs per acre and per 100 pounds of lint.

Cotton Production Costs and Returns

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INTRODUCTION

Cotton producers, like producers of most other agricultural commodities, are faced with adjustment problems. Large surpluses of cotton accumulated in the United States after World War II. Consequently, governmental programs were enacted with the goal of maintaining production at a level that would support a reasonable price. The problem has been aggravated by the development of synthetic fibers and the expansion of cotton production in certain foreign countries, particularly Mexico, Argentina, India, Pakistan, and Peru.

Cotton production in the United States has tended to move westward with Texas, New Mexico, Arizona, and California now producing over half of the national total. New production technology such as irrigation, adaptable cotton varieties, and mechanical harvesters, has been a major factor in this geographic shift.

These developments raise many questions in the minds of persons connected with cotton production in Missouri, such as:

1. With the continued development of synthetic fibers how large will the need for cotton be?

2. How well can Missouri cotton producers compete with producers in other areas of the United States and in foreign countries?

3. What adjustments (including the adoption of new technology) will the individual Missouri producer have to make to compete successfully and make a reasonable profit?

4. As governmental programs will probably remain in the picture for some time, what kind of program is best for Missouri producers?

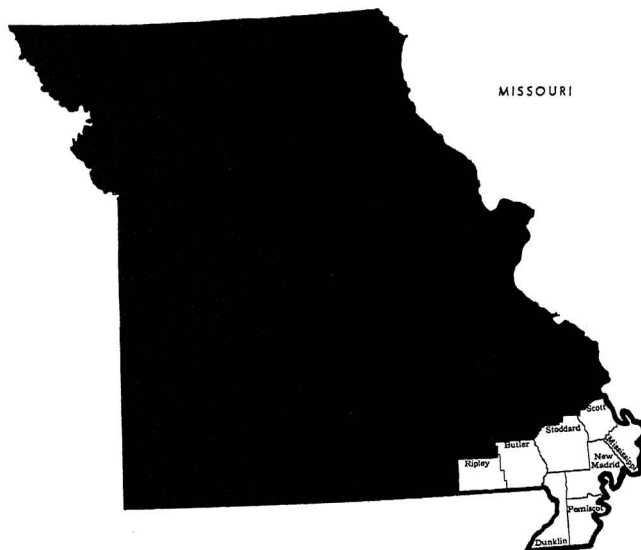


Fig. 1—The eight cotton producing counties of Missouri—Bootheel Area.

5. How can the individual producer take full advantage of alternatives provided by these governmental programs? For example, the 1960 government program gives the individual producer a choice of producing within his acreage allotment and receiving a price based on 75 percent of parity or increasing his allotment by 40 percent and receiving a price based on 60 percent of parity. Which is most profitable for the individual producer?

The need to supply data to answer these or other important questions was the major reason for undertaking the study discussed in this report.

METHOD AND OBJECTIVES OF STUDY

Results presented are first fruits of a cooperative research project conducted by personnel of the Department of Agricultural Economics and the Agricultural Extension Service. Extension personnel obtained the cooperation of 44 cotton producers in keeping detailed records on their 1959 cotton crop. Upon completion the records were sent to the University and summarized by personnel in the Department of Agricultural Economics.

The records were detailed to the extent that they provided data on hours of labor and machine use by the various field operations. The specific objectives of this study were:

1. To determine the physical input-output relationship and the costs and returns of producing cotton in Missouri by size of cotton enterprise.

2. To determine the physical input-output relationships, and the costs and returns of producing cotton in Missouri by level of mechanization.
3. To determine the effects of factors such as yields, amount of fertilizer used, and various production practices on the costs and returns of producing cotton.

Detailed cotton records are being kept on the 1960 crop and plans are complete to continue the project beyond 1960 to study costs and returns over a period of years and different production conditions (particularly weather).

GENERAL DATA ON FARMS STUDIED

Detailed records of 44 cotton producers were sent in and summarized. All data presented in this report, however, are from 42 farms as two records were discarded because of inadequacies in the data.

Records were kept on 2,392 acres of cotton. The cotton enterprises on individual farms ranged from 5 to 261.6 acres, with over half of the producers having less than 50 acres of cotton.

These farmers produced a total of 1,542,209 pounds of lint which grossed them \$483,562. Total receipts from lint and cotton seed amounted to \$528,030. As the total cost of producing this cotton was \$331,252, these producers received a net return to management of \$206,778.

AVERAGE DATA ON FARMS STUDIED²

Costs and returns were computed on the basis of data provided in the cotton records. Specific methods and assumptions used in the calculation are presented in the Appendix.

It cost the farmers in this study \$149.05 per acre to produce cotton. There was considerable variation in costs, however, with costs on individual farms ranging from \$100.00 to \$242.45 per acre (Table 2).

Total cost per cwt. of lint produced averaged \$22.03. The range on individual farms was from \$15.44 to \$28.68 per cwt. The variation in total cost per cwt. of lint on individual farms is further demonstrated in Table 1.

This large variation in the cost of producing cotton is surprising considering that 1959 was an extremely good year for Missouri cotton production. Although some variation would always be expected these data point out clearly that cotton producers

TABLE 1-NUMBER OF FARMS IN THIS STUDY HAVING TOTAL PRODUCTION COSTS PER CWT. OF LINT IN THE VARIOUS COST CATEGORIES

Costs/Cwt. of Lint (Dollars)		Number of Farms
Under	16.00	2
	16.00 - 16.99	4
	17.00 - 17.99	1
	18.00 - 18.99	2
	19.00 - 19.99	1
	20.00 - 20.99	2
	21.00 - 21.99	7
	22.00 - 22.99	7
	23.00 - 23.99	4
	24.00 - 24.99	5
	25.00 - 25.99	3
	26.00 - 26.99	1
	27.00 - 27.99	1
	28.00 - 28.99	2
Total		42

must study carefully the many parts of their production process if they are to compete in the future. The only way to do this systematically is to (1) keep good production records and (2) use them.

The farmer who can produce cotton at less than \$20.00 per cwt. of lint can certainly compete more favorably with producers in other states and other nations than the farmer having costs above \$24 per cwt. The farmer in the upper cost range must improve if he is to compete.

Many factors influence the costs of producing cotton. Some of these can be changed readily by farmers; others can not. Later, in the discussion on costs the importance of various factors will be brought out.

The average cotton lint yield per acre on these farms was 680 pounds. This compares with the state average lint yield of 609 pounds as reported by the Agricultural Marketing Service. The lint yield varied on the individual farms in this study from 415 to 1,029 pounds per acre. Thus, even though the average yield is somewhat above the state average it is believed that the study includes a good cross section of Missouri cotton producers.

Average price received per cwt. of lint was \$31.51; the range in average price received by individual farmers was from \$25.66 to \$36.24 which is a surprisingly large variation considering the weather conditions in 1959. An analysis of the effects of yield and price received for lint on costs and returns is presented in a later section.

The variation in lint receipts per acre was also large ranging from \$128.15 to \$353.53 per acre. Average lint receipts per acre on the farms studied

TABLE 2-COSTS AND RETURNS PER ACRE AND PER CWT. OF LINT PRODUCE ON 42 SOUTHEAST MISSOURI FARMS IN 1959: AVERAGE PLUS HIGH AND LOW INDIVIDUAL PRODUCERS.

Items	Costs and Returns Per C Cwt. of Cotton			Costs and Returns Per Cwt. of Lint Produced		
	High Individual*	Average	Low Individual*	High Individual*	Average	Low Individual*
Acreage Per Farm	261.6	57	5	261.6	57	5
Pounds of Lint Produced Per Acre	1029	680	415	----	--	---
Costs: (Dollars)						
Total Labor Cost	\$120.37	\$ 42.18	\$ 8.74	\$ 14.24	\$ 6.01	\$ 1.17
Machine Cost						
(Operational Cost)	77.01	25.58	4.23	8.01	3.91	.61
Machine Depreciation (Ownership Cost)	59.88	13.89	3.35	9.00	2.09	.48
Interest on Machinery (Ownership Cost)	18.50	4.35	.48	2.71	.63	.11
Total Labor and Machine Cost	149.92	86.00	41.08	17.73	12.64	5.52
Materials:						
Fertilizer Cost	19.50	10.69	3.33	2.87	1.58	.59
Seed Cost	7.20	2.76	1.06	.93	.42	.16
Other Materials	12.98	3.74	.00	3.29	.59	.00
All Materials (Including Seed & Fertilizer)	32.28	17.19	5.64	5.77	2.59	.95
Ginning, Bagging, Other						
Marketing Charges	52.80	26.72	15.31	6.25	3.92	3.13
Land Charges (Total)	34.82	18.67	5.71	5.47	2.81	.77
Miscellaneous	---	.47	----	----	.07	----
Total of All Costs	242.45	149.05	100.01	28.68	22.03	15.44
Returns: (Dollars)						
Lint Receipts	353.53	214.87	128.15	36.24	31.51	25.66
Total Receipts (Lint + Seed)	382.64	234.49	143.58	38.81	34.41	27.59
Returns to Management	169.28	85.44	30.18	16.54	12.38	5.28
Returns Per \$100 Charged for Land Labor and Capital	207.32	158.71	122.33	----	----	----

*Totals in these columns will not check--different individuals involved.

was \$214.87. Total receipts from lint and cotton seed averaged \$234.49 per acre and \$34.41 per cwt. of lint produced. The per acre total receipts varied on individual farms from a low of \$143.58 to a high of \$382.64.

Net returns to management averaged \$85.44 per acre and \$12.38 per cwt. of lint on these farms. The range in per acre net returns on individual farms was from \$30.18 to \$169.28. Net returns per cwt. of lint varied on individual farms from \$5.28 to \$16.54. Net returns to management will sometimes be referred to in this report as net income or profit.³

One of the best measures of efficiency is the returns per \$100 spent for the use of land, labor, and capital. As was evident in all the returns figures in this study even in the better years there is considerable variation in the profitableness of cotton production on individual farms. Returns per \$100 spent for land, labor, and capital ranged on individual farms from \$122.33 to \$207.23. The remainder of this report will be devoted to analysis of the variations with the purpose of revealing ways that farmers can increase their cotton profits.

COSTS OF PRODUCTION

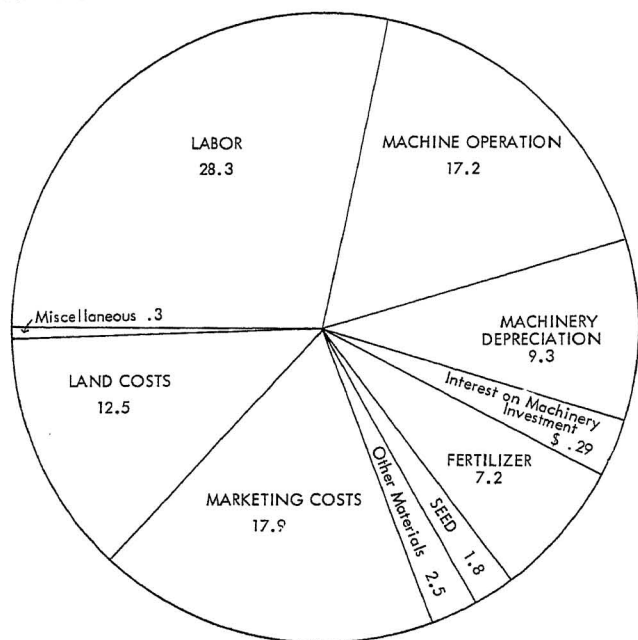
A breakdown of the various production costs per acre and per cwt. of lint is presented in Table 2. To illustrate the variation in the individual items the figures for the low and high individual producer with respect to each item is also shown.

Labor and Machinery

As would be expected, labor and machinery costs were the major cost items in the production of cotton. The average farmer spent \$86 per acre and \$12.64 per cwt. of lint on labor and machinery. This amounted to 57.7 percent of the total cost of producing cotton (Figure 2). On the average the machinery costs were slightly greater than the cost of labor, but this varied appreciably depending upon the method of harvesting and to a lesser degree the methods employed in weed control.

Machinery costs were divided into two categories in this study: (1) operation costs and (2) ownership costs. Operation costs include a charge for such items as fuel, lubricants and repairs. Owner-

Fig. 2—The percentages various costs were of total cost of producing cotton on 42 Missouri farms.



ship costs include primarily a charge for depreciation and interest on capital invested in machinery.

This division was made because the implications of the costs to the individual farmer are different. Operation costs for a specific machine are basically the same *per hour* of machine use whether the machine is used 100 hours or 200 hours. *Total operation cost* varies therefore in proportion to the amount of use of the machine.

Total ownership costs of a machine on the other hand are the same whether the machine is used 100 or 200 hours, but *per hour* the ownership costs would be only half as much if the machine is used 200 hours. Farmers need to understand the difference between these two classes of costs because of the importance of spreading the fixed ownership costs over an adequate number of bales of cotton. This is particularly true of the farmers with small cotton acreages, who must be very careful to hold down their machinery investment to a level that can be justified by their size of business.

Materials

Materials, which included seed, fertilizer, insecticides and other chemicals averaged 11.5 percent of the total production costs (\$17.19 per acre). Larger farmers tended to use more chemicals in weed, in-

sect, and fungicide control than did the smaller farmers. The same thing was true with defoliation.

The farmers spent an average of \$10.69 per acre for fertilizer in 1959. Smallest amount spent by an individual for fertilizer was \$3.33 per acre; largest amount spent was \$19.50 per acre. Fertilizer figures include an annual charge for applications of fertilizers such as limestone and rock phosphate which will benefit crops for more than one year.

Marketing Costs

Marketing costs, which include charges for ginning, bagging, C.C.C., and in some cases dues of organizations working with cotton farmers, were approximately 18 percent of the total cost of production. These costs amounted to \$26.72 per acre and \$3.92 per cwt. of lint produced. As these costs are directly associated with the actual amount of cotton produced it is obvious that farmers having the highest per acre yields also have the highest per acre marketing costs. Variation in these charges per cwt. of lint can be explained by the number of charges involved (higher for those paying organization dues and C.C.C. charges), and some difference in the ginning and bagging charges of the individual gins.

Land Costs

Land taxes and interest on the investment in land averaged \$18.67 per acre. This was 12.5 percent of the average total cost of production. On individual farms the land cost varied from \$5.71 to \$34.82 per acre. The range was large as the land on which the cotton was produced varied a great deal in physical properties, from light sand to heavy gumbo soil. The land charge averaged lower on the smaller farms as a number of these were located on the less productive soils in Butler and Ripley Counties. The surprisingly large variation in general real estate taxes, and the special drainage district taxes paid on certain farms also contributed to the difference in land charges.

Miscellaneous Costs

This category of costs included a multitude of items that could not be justifiably placed somewhere else. Examples of these items are: (1) the cost of rye and vetch seed—where this combination of crops was used as winter cover on fields in continuous cotton, (2) purchase cost of geese used to clean weeds out of cotton, and (3) the cost of hiring a cotton insect scout. These costs averaged only 47 cents per

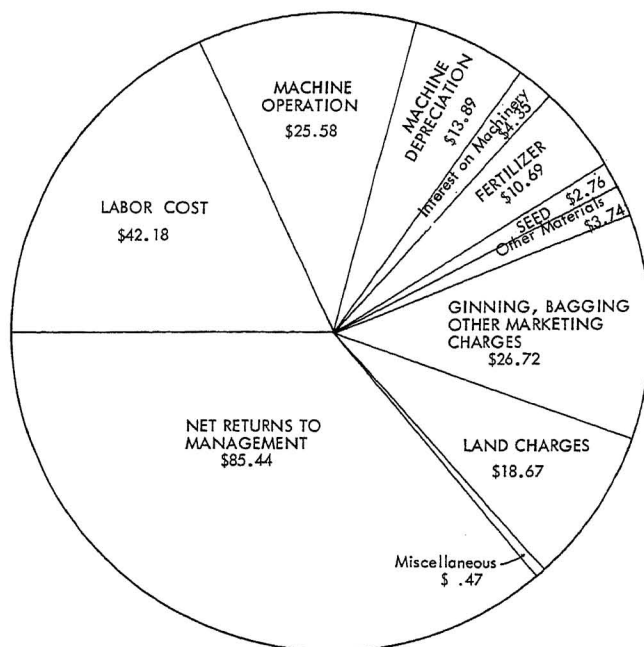
acre on all farms, but on certain individual farms they were major expenditures.

COMPARISON OF SIZE OF ENTERPRISE AND COSTS AND RETURNS

Many articles have been published on the increasing size of farm businesses in the United States. Greater production efficiency is the primary reason usually given for farmers increasing their size of businesses. On cash grain and cotton farms the only ways a farmer can increase his size of business (and still be employed exclusively on the farm) are to increase the number of acres operated or to increase crop production on existing acreage by using more fertilizer and other inputs. It is obvious that not all farmers can increase their acreages as the total land supply is relatively fixed. Government acreage allotments provide a further restriction on the opportunities a farmer has to expand the size of his cotton enterprise. One of the objectives of this study therefore was to determine the relationship of acres of cotton to costs and returns.

On the farms studied the total production cost per acre and per cwt. of lint averaged higher on the smaller farms than on the larger farms (Tables 3 and

Fig. 3—Distribution of total cotton receipts per acre on 42 Missouri farms in 1959.



Total Receipts Per Acre - \$234.49

TABLE 3-COTTON COSTS AND RETURNS PER ACRE OF COTTON BY SIZE OF COTTON ENTERPRISE ON 42 MISSOURI FARMS IN 1959.

Item	Average of All Farms	Averages of Farms Having:					
		5-24 Acres	24-49 Acres	50-74 Acres	75-99 Acres	100-124 Acres	125 or More Acres
Number of Farms in Each Class	42	19	6	4	4	4	5
Average Acreage	57	12.1	37.8	61.6	83.8	106.5	185.5
Pounds of Lint Produced Per Acre	680	702	763	587	635	668	622
Costs: (Dollars)							
Total Labor Cost	\$ 42.18	\$ 50.29	\$ 55.95	\$ 37.25	\$ 31.16	\$ 20.40	\$ 27.73
Machine Cost							
(Operation Cost)	25.58	27.79	24.23	13.70	24.04	32.50	24.04
Machine Depreciation (Ownership Cost)	13.89	16.15	18.68	11.42	6.78	9.45	10.14
Interest on Machinery (Ownership Cost)	4.35	4.99	5.36	4.03	2.01	3.21	2.43
Total Labor & Machine Cost	86.00	99.22	104.22	66.40	63.98	66.56	64.34
Materials;							
Fertilizer Cost	10.69	10.43	10.61	9.65	12.27	13.45	9.09
Seed Cost	2.76	3.24	2.40	2.07	2.73	2.87	1.87
Other Materials	3.74	3.59	2.40	4.30	2.23	4.49	6.11
All Materials (Including Seed & Fertilizer)	17.19	17.26	15.41	16.02	17.23	20.81	17.07
Ginning, Bagging, Other Marketing Charges	26.72	27.95	30.49	21.18	25.12	26.41	23.90
Land Charges (Total)	18.67	16.02	19.38	21.02	20.48	25.39	19.22
Miscellaneous	.47	.27	1.38	2.27	.19	1.34	.16
Total of All Costs	149.05	160.72	170.88	126.89	127.00	140.51	124.69
Returns: (Dollars)							
Lint Receipts	214.87	221.61	243.19	182.81	202.24	213.78	191.90
Total Receipts (Lint + Seed)	234.49	242.23	264.35	198.26	221.58	233.63	210.09
Returns to Management	85.44	81.51	93.47	71.37	94.58	93.12	85.40
Returns Per \$100 Charged for Land Labor and Capital	158.71	152.28	156.07	156.37	175.10	166.60	168.76

TABLE 4-COTTON COSTS AND RETURNS PER 100 POUNDS LINT BY SIZE OF COTTON ENTERPRISE ON 42 MISSOURI FARMS IN 1959

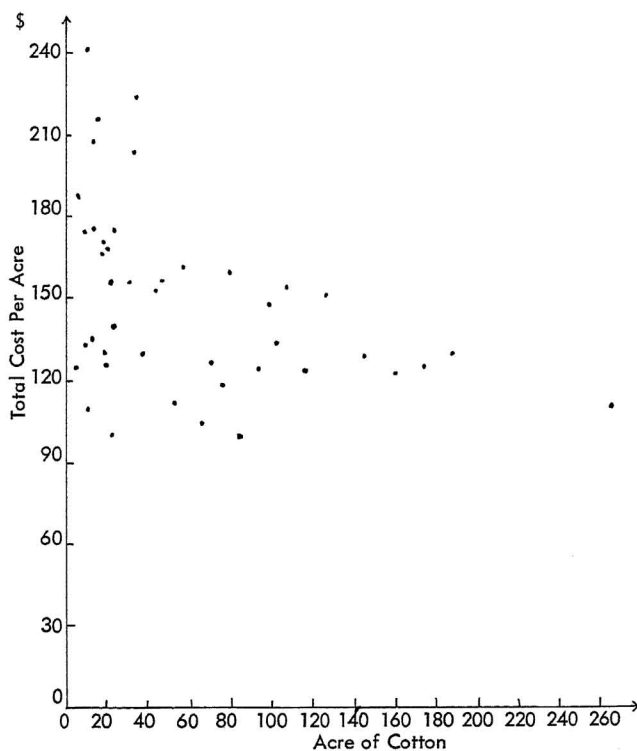
Items	Average of All Farms	Averages of Farms Having:					
		5-24 Acres	25-49 Acres	50-74 Acres	75-99 Acres	100-124 Acres	125 or More Acres
Number of Farms in Each Class	42	19	6	4	4	4	5
Average Acreage	57.0	12.1	37.8	61.6	83.8	106.5	185.5
Costs: (Dollars)							
Total Labor Cost	\$ 6.01	\$ 6.97	\$ 7.22	\$ 5.66	\$ 4.83	\$ 3.17	\$ 4.40
Machine Cost							
(Operation Costs)	3.91	4.00	3.34	2.84	4.08	5.12	4.06
Machine Depreciation							
(Ownership Cost)	2.09	2.45	2.35	2.15	1.06	1.48	1.71
Interest on Machinery							
(Ownership Cost)	.63	.74	.70	.73	.30	.50	.40
Total Labor & Machine Cost	12.64	14.16	13.61	11.38	10.27	10.27	10.57
Materials:							
Fertilizer Cost	1.58	1.48	1.48	1.66	1.84	1.88	1.52
Seed Cost	.42	.49	.31	.38	.46	.45	.32
Other Materials	.59	.52	.32	.73	.40	.83	1.02
All Materials							
(Including Seed & Fertilizer)	2.59	2.49	2.11	2.77	2.70	3.16	2.86
Ginning, Bagging, Other							
Marketing Charges	3.92	3.99	3.98	3.60	3.99	4.02	3.72
Land Charges (Total)	2.81	2.36	2.56	3.77	3.04	3.74	3.14
Miscellaneous Costs	.07	.04	.07	.48	.10	.22	.09
Total of All Costs	22.03	23.04	22.33	22.00	20.10	21.41	20.38
Returns: (Dollars)							
Lint Receipts	31.51	31.58	31.61	31.14	31.69	32.02	30.91
Total Receipts (Lint + Seed)	34.41	34.53	34.38	33.79	34.62	35.03	33.84
Returns to Management	12.38	11.49	12.05	11.79	14.52	13.62	13.46

4). These average figures are consistent with usually suggested relationship, but do not tell the entire story. As many farmers having smaller acreages devote more effort and take greater pains with their cotton than farmers with large acreages, a certain part of this added cost is not due to inefficiency of production. The average per acre yield on the smaller acreages was higher than on the larger farms, consequently total receipts per acre were also higher.

Returns to management in 1959 averaged somewhat lower per acre and per cwt. of lint on the smaller farms than on the larger farms, but the difference was not consistent. The average net return per acre was very satisfactory for all sizes of cotton enterprises.

Averages can hide important relationships; therefore, a more intensive examination of costs and returns was made. In Figure 4 the total cost per acre on individual farms is plotted by acres of cotton on each farm. Each dot represents the total cost per acre on an individual farm. This vividly illustrates that there was far more variability in the total cost per acre on the smaller acreages than on the larger acreages. The farmer with the lowest per-acre cost in the entire study as well as the farmer with the highest per-acre cost produced less than 20 acres of cotton. If more farmers having large cotton acreages

Fig. 4—Total Cost per acre of producing cotton on the 42 farms studied; plotted by acres of cotton on individual farms.



had been included in the study, more variability in their costs would have been expected, but probably not nearly as much as on the small farms.

The net returns to management data further revealed that both the farmer with the highest net returns per acre and the farmer with the lowest net returns per acre produced less than 20 acres of cotton. Variation of net returns per acre was greater on the small acreages than on the large acreages (just as it was for costs). It is significant to note, however, that net returns varied more than total costs per acre on the larger farms.

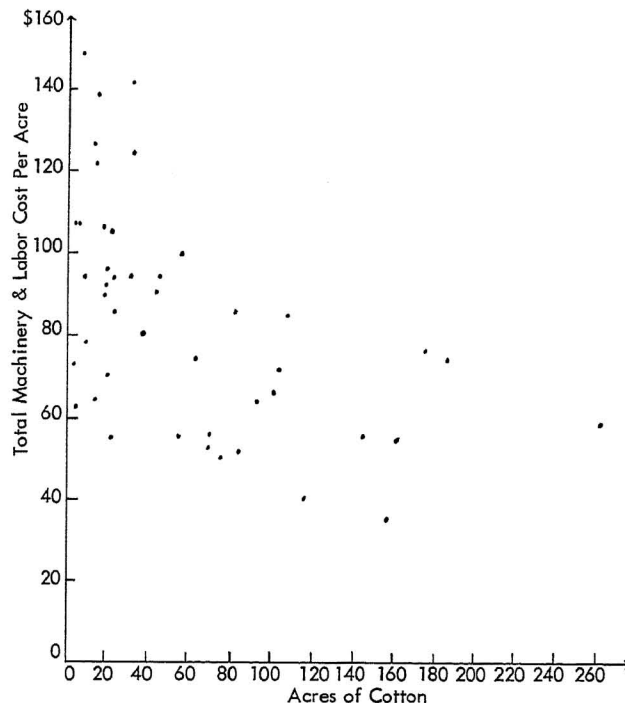
Results of this study, based on 1959 records, show that the small cotton producer can compete with the larger producer on a per acre basis, but that the small producer must strive for higher yields and strive to hold down his costs per cwt. of cotton produced. **Holding down costs does *not* mean cutting down on fertilizer, or not using insecticides, or not using chemicals in weed control, as these are important in obtaining high yields.**

The place where the small farmer must be most careful is in his labor and machinery costs. As shown in Figure 5, the total labor and machinery costs per acre were considerably higher and varied much more on the small farms. Of particular importance is the necessity of the small farmer to hold down his fixed machinery ownership costs. The larger producer can justify owning certain machines far better than the small producer because he can spread the fixed ownership costs over a large number of bales of cotton. The small producer often must forego owning certain machines because he does not have an adequate size of business over which to spread the ownership costs.

Some small producers in this study did a good job of holding down their fixed machinery ownership costs but for other producers these costs were very high per cwt. of lint. It is obvious that the various production operations must be performed but the cotton farmer, particularly the small farmer, must carefully consider all the alternative ways available to him to perform these operations. It is beyond the scope of this publication to discuss all of the aspects of machinery decisions, but the alternatives available to an individual farmer for performing a specified job may include:

- (1) Doing the job with hand labor.
- (2) Hiring the job done by a custom operator.
- (3) Renting the machine needed to do the job.

Fig. 5—Total labor and machinery cost per acre of cotton on the 42 Missouri farms plotted by acres of cotton on individual farms.



- (4) Entering into a work and/or machine exchange agreement.
- (5) Buying used instead of new machinery.
- (6) Buying the machine and doing custom work.

Not all these alternatives are available to every farmer but a producer must carefully consider all of his alternatives.

COST OF PERFORMING VARIOUS OPERATIONS

Farmers cooperating in this study kept records of the hours of labor and machinery they used in doing various operations. This permitted a detailed analysis of the cost of performing various production jobs. As farms use different types and sizes of machinery and follow different practices to perform the same production job no attempt was made to find the per acre costs of specific operation such as plowing, disking, etc. The cost figures as far as machinery is concerned include operating costs only; they do not include ownership costs.⁴

Seedbed Preparation

Farmers in this study employed a number of different specific practices and combinations of practices to prepare the land for planting. Seventeen of the 42 farmers bedded their land before planting cotton. The practices varied primarily because of type of soil, kinds of equipment available, weather custom in the community, and the preference of individual farmers. It was therefore virtually impossible with the limited number of farms studied to determine the costs of each of these specific practices. The average farmer spent 2.1 hours of labor and 2.1 hours machine use per acre in preparing his land for planting. Hours of labor and machine use declined from 2.2 hours per acre on the farms with less than 50 acres of cotton to 2.0 hours per acre on the larger acreages. The actual difference at first glance does not seem very important, but on 100 acres of cotton this reduction on larger farms amounts to a savings of 20 hours. In a wet spring 20 hours saved could be quite important.

The total labor and machine operating costs averaged \$4.27 per acre for seedbed preparation. As the acres of cotton increased, a downward trend in seedbed preparation costs prevailed, with the exception of somewhat higher costs on the farms having 100 to 124 acres of cotton. The higher costs on the 100 to 124-acre enterprises were due to higher per hour wage rate on the four farms in this size category. There is no logical reason for a higher per hour wage rate on this particular size of cotton enterprise; it was probably only coincidence.

Planting, Fertilizing, and Accompanying Operations

Most of the farmers in this study combined some other task with their planting. Attachments on planters permitted farmers to apply fertilizer and, in a few cases, preemergence weed sprays at the same time they were planting cotton. Therefore, planting, fertilizer applications, and preemergence applications were combined into one category if done in the same operation as planting. It needs to be stressed however that the cost of fertilizer and spray materials is not included, only the application cost.

The average farmer in this study used 0.9 hour of labor per acre for planting, fertilizing, etc. He used machinery 0.8 hour per acre on these tasks. The difference between the hours of labor and hours of machine use is due to the extra man that some

farmers employed to help handle seed and fertilizer. The total labor and machine operating costs of planting, applying fertilizer, etc. averaged \$1.80 per acre. As with seedbed preparation, the hours and cost of labor and machine used declined per acre as the acres of cotton increased. The decline was not consistent, however, as the lowest cost per acre was found on farms having 50 to 74 acres of cotton. The varying proportions of farmers in the different size categories using four-row planting equipment is evidently the major reason for this inconsistency in hours of machine use.

Cultivating, Chopping, and Insect Control

Expenditures for weed and insect control are partly due to planned action by farmers and partly due to the existing incidence of a problem. For example a farmer applies preemergence weed control chemicals and treats seed with fungicides as a means of controlling weeds and fungi he expects will be a problem. These are planned actions and are made before the problem actually exists. On the other hand the expenditure for hand chopping of cotton depends upon the amount of weeds in the cotton and is not planned. Another expenditure that depends on the existence of a problem is the spraying for red spider mites. This expenditure usually is not made unless there actually is an infestation.

Expenditures for weed, fungi, and insect control varied a great deal on these farms, primarily due to variations in the problems. Methods used to combat these problems also varied. In addition to the usual machine cultivation and hand chopping, 11 farmers used chemicals in their weed control programs and five used geese for weeding. Four farmers used mechanical choppers and one cross-cultivated.

A total of 29 farmers used insecticides and/or fungicides on their 1959 cotton crop.

The average producer in this study used 18.7 hours of labor per acre for weed and insect control. An average of 2.5 hours of machine use was employed per acre. The labor of the machine operator is included in the 18.7 hours total; thus 16.2 hours of labor per acre were spent in hand chopping.

Weed, insect, and fungi control cost the average producer \$14.87 per acre just for labor and machine operating expenses. In a number of cases chemicals were applied by custom operators using airplanes. The cost of application in most of these cases is included with the materials costs as it was

TABLE 5-HOURS AND COST OF LABOR AND MACHINE USE* PER ACRE FOR COTTON ENTERPRISE GROUPED BY SIZE OF ACREAGE.**

Items	Average of All Farms	5-24 Acres	25-49 Acres	50-74 Acres	75-99 Acres	100-124 Acres	125 or More Acres
<u>Seed Bed Preparation:</u>							
Hours of Labor Use	2.1	2.2	2.2	2.1	2.0	2.0	2.0
Cost of Labor (\$)	1.63	1.74	1.61	1.62	1.53	1.63	1.25
Hours of Machine Use	2.1	2.2	2.2	2.1	1.9	2.0	2.0
Cost of Machine Use (\$)	2.64	2.70	2.64	2.62	2.48	2.65	2.66
Total Cost of Labor & Machine (\$)	4.27	4.44	4.25	4.24	4.01	4.28	3.91
<u>Planting, Fertilizing, etc.:</u>							
Hours of Labor Use	.9	1.0	.9	.6	.9	.8	.8
Cost of Labor (\$)	.70	.78	.64	.46	.67	.74	.51
Hours of Machine Use	.8	1.0	.6	.6	.8	.7	.5
Cost of Machine Use (\$)	1.10	1.36	1.03	.66	.96	.92	.81
Total Cost of Labor & Machinery (\$)	1.80	2.14	1.67	1.12	1.63	1.66	1.32
<u>Cultivating, Chopping, and Insect Control:</u>							
Hours of Labor Use	18.7	20.9	19.5	19.5	14.1	15.0	15.4
Cost of Labor Use (\$)	11.46	13.05	10.92	12.77	8.96	8.53	9.33
Hours of Machine Use	2.5	2.8	2.9	1.8	2.4	2.2	2.1
Cost of Machine (\$)	3.41	3.47	3.60	2.15	3.14	5.35	2.70
Total Cost of Machine + Labor (\$)	14.87	16.52	14.52	14.92	12.10	13.88	12.03
<u>Harvesting:</u>							
Hours of Labor Use	33.3	39.7	49.0	23.4	23.2	13.0	21.9
Cost of Labor (\$)	28.61	34.58	42.65	22.27	19.73	9.41	16.64
Hours of Machine Use	1.8	1.6	2.1	1.6	2.3	2.4	2.2
Cost of Machine Use (\$)	17.97	19.64	16.73	8.13	17.01	22.80	17.87
Total Cost of Machine + Labor (\$)	46.58	54.22	59.38	30.40	36.74	32.21	34.41
<u>Irrigation & Miscellaneous:</u>							
Hours of Labor Use	.2	.2	.4	.2	.2	.3	----
Cost of Labor (\$)	.12	.14	.13	.13	.17	.09	----
Hours of Machine Use	.2	.6	.2	.2	.2	.1	----
Cost of Machine Use (\$)	.46	.62	.23	.14	.55	.78	----
Total Cost of Labor & Machinery (\$)	.58	.76	.36	.27	.72	.87	----
<u>Totals of All Operations:</u>							
Hours of Labor Use	55.2	64.0	72.0	45.8	40.4	31.2	40.1
Cost of Labor (\$)	42.52	50.29	55.95	37.25	31.16	20.40	27.73
Hours of Machine Use	7.3	8.2	8.0	6.3	7.6	7.4	6.8
Cost of Machine Use (\$)	25.58	27.79	24.23	13.70	24.04	32.50	24.04
Total Cost of Labor Plus Machinery (\$)	68.10	78.08	80.18	50.95	55.20	52.90	51.77

*Includes only machine operation costs. Machine ownership costs are omitted from this specific comparison.

**Based on the study of 42 Missouri farms, 1959.

not possible to distinguish between materials and application cost. Farmers in this study spent \$1,626 on weed control chemicals, \$3,854 on insecticides, and \$1,167 on geese used in weed control. Total costs (with the exception of machine ownership costs) of weed, insect, and fungi control averaged \$17.65 per acre.

Labor and machine operating costs in performing these jobs declined per acre as the acreage of the cotton increased. Fewer hours of both labor and machine use per acre were found on the larger acreages. The use of four-row cultivators on large farms was the main reason for reduction of machine use per acre. Greater use of chemicals on large farms and

more hand chopping on the small farms (part of this probably due to greater effort made on small farms to keep cotton as clean as possible) were also factors contributing to lower labor and machine costs on larger farms.

Harvesting

Methods of harvesting on the individual farms ranged from all mechanical picking to all hand picking. Over half, however, used a combination of hand and mechanical picking. On some farms the first bolls that opened were picked by hand and later cotton was machine picked; on other farms some fields were entirely hand picked and some machine picked;

in still other cases farmers hand-snapped the "bol-lies" after the cotton had been mechanically picked. Ten of the farmers defoliated their cotton. An analysis of the cost of harvesting by the different methods will be presented in a later section of this publication but the following generalizations are warranted here.

The average farmer in this study used 33.3 hours of labor and employed 1.8 hours of machine use per acre in harvesting. Total labor and machine operating costs for harvesting amounted to \$46.58 per acre. Per-acre harvesting costs differed widely by size of cotton enterprise with farmers producing less than 50 acres of cotton averaging \$20 per acre higher costs.

Care must be exercised in using these harvesting costs, however. The advantage the large farms have in harvesting is really not this great for the following reasons: (1) Machine operating costs include the cost of custom picking but not the ownership costs of a picker on farms where the farmer did his own mechanical picking. Most of the smaller farmers who used machine picking hired the cotton custom picked, whereas many of the large operators owned their own picker. This automatically made the operating costs on smaller farms higher the way the costs are calculated here. It is necessary to examine total harvesting costs per acre to get the true picture. (2) Harvesting costs are directly associated with the cotton yield per acre. This is particularly true of hand picking and custom machine picking. As the average cotton yield per acre was higher on small farms, and nearly all of the small farms either used hand picking or custom machine picking this also would cause their per acre labor and machine operating costs to be higher.

Irrigation and Miscellaneous

This category of labor and machine costs includes, in addition to irrigation, a number of tasks that can not be properly classified in any other category. Examples of items in this category are: (1) fixing fence for geese that were used in weeding, (2) repairing equipment and (3) sowing rye and vetch used as cover crop (where chargeable to cotton). The hourly labor and machine use figures as well as the accompanying cost data in this particular category are not very meaningful as production guides, they only explain the distribution of the labor used on the average farm. For example, five of the farmers in this study irrigated part or all of their cotton

in 1959, yet the per-acre costs on these 5 farms are averaged with the 37 farms that have none to give an average of all farms. No analysis has been made of the implications of irrigation on these farms as only five farms were involved. A publication is forthcoming on the costs and returns of irrigation in Missouri.

Total Labor and Machine Use

The average cotton producer in this study used 55.2 hours of labor per acre. Hours of labor use per acre declined considerably as the acreage of cotton increased, with farmers having over 50 acres of cotton using less than two-thirds the amount of labor per acre used by those producing less than 50 acres. More substitution of machinery for labor, particularly in harvesting, and greater use of chemicals on the larger acreages are major reasons for this relationship.

The average amount of machine use was 7.3 hours per acre. Hours of machine use per acre also decreased with increasing size of the cotton enterprise. Larger machinery on the large acreages was the main reason for this reduction, although some of the other factors mentioned were important.

The total cost of labor plus machine operating expense averaged \$68.10 per acre. The total was approximately \$80 per acre on farms of less than 50 acres and between \$50 and \$55 on farms having more than 50 acres.

High labor and machine operation costs coupled with higher fixed ownership costs on the small farms clearly illustrates the need for small farmers to carefully study their labor and machinery expenditures. Of course, this is important to the cotton farmers with large acreages, too.

The amount and size of machinery each cotton farmer should have and the practices each farmer should follow is strictly an individual matter. Each farmer has a different set of resources available (land, labor and capital), a different organization in terms of crops and livestock produced, and different alternatives to get the production tasks accomplished (availability and cost of custom operations, machinery rental services, etc.).

COMPARISON OF HARVESTING COSTS BY METHOD OF HARVESTING

Probably no other phase of the cotton production process has felt the effects of changing technology as much as harvesting. As a result of the

improvements made during the past decade in the design of mechanical cotton pickers, farmers are now making widespread use of machine pickers. According to Agricultural Marketing Service, U.S.D.A. estimates, 47 percent of the 1959 Missouri cotton crop was picked by machine. A large investment, however, is necessary if a farmer is to own a mechanical picker. Consequently several questions arise, such as: (1) What is the minimum cotton acreage a farmer must have before he can economically justify owning a cotton picker? (2) Should a farmer whose cotton acreage is too small to justify owning a picker hire a custom picker or harvest by hand? Obviously, there are many factors influencing the answers to these questions.

Although this study was not designed to specifically answer these questions, analysis of the harvesting costs on the 42 farms revealed some interesting relationships. As stated earlier, 22 of the 42 farms used both machine picking and hand picking to some degree. Table 6 shows the total harvesting cost per acre and per cwt. of lint for the different methods and combination of methods used on the farms studied. The results are different from those in Table 5 as all harvesting costs are included; labor and machine operation costs, ownership costs of mechanical cotton pickers (where owned by farmer) and trailers, and the cost of defoliation.

Generally speaking, the more labor involved in the harvesting the higher the total costs per acre and per cwt. of lint. This was not entirely true as the lowest costs were on farms which did hand snapping in addition to mechanical picking. But only three farms were in this group so little reliability can be placed on the results.

The farmers using hand picking exclusively had the highest harvesting costs, averaging \$1.65 per cwt. of lint higher than any other method. Nearly

all of the farmers that used hand picking exclusively produced less than 25 acres of cotton. Justifying owning a cotton picker with this acreage would be very difficult unless the farmer used the picker to do custom picking. Custom picking rates paid by farmers in this study varied from \$2.50 to \$3.00 per 100 pounds of seed cotton. At the \$2.50 custom rate it certainly would have paid the farmers who used hand picking to hire the cotton picked. At the \$3.00 custom rate the decision would have been more difficult to make. Factors such as availability of a custom operator when wanted, availability and cost of hand pickers, quality of cotton, and evenness of cotton maturity would have to be considered.

An important consideration in the decision concerning whether or not to use a mechanical picker is the effect of machine picking on cotton grade. Some farmers have experienced lower grades on machine picked cotton. Cotton specialists, however, point out that poor adjustment of the mechanical picker and poor machine operation are the major causes of the grade lowering. Proper adjustment combined with a skilled operator can go a long way to overcome the problem. Waiting until the cotton is dried to the specified moisture content before picking is another highly recommended practice to help maintain cotton quality.

COMPARISON OF LINT YIELD WITH COSTS AND RETURNS

The importance of obtaining high cotton yields has constantly been stressed by Extension Service personnel and others working with cotton producers. Results of this study clearly show why. The 42 producers were divided into three groups based on per-acre lint yields—the low, medium, and high

TABLE 6-TOTAL HARVESTING COSTS PER ACRE AND PER 100 LBS. OF LINT BY METHOD OF HARVESTING ON 42 MISSOURI FARMS IN 1959

Method of Harvesting	Number of Farms	Ave. Lint Yield/A	Total Harvesting Cost/A (\$)	Total Harvesting Cost/Cwt. of Lint (\$)
Machine Picking Only	11	654	42.20	6.63
Machine Picking + Hand Snapping	3	546	30.35	5.74
Machine Picking + Hand Picking	13	675	49.77	7.22
Machine Picking + Hand Picking & Snapping	6	739	58.39	7.69
Hand Picking Only	9	742	68.21	9.34

yield producers (Table 7 and Figure 6). The year 1959 was an excellent cotton year and most of the "low" yields were actually higher than the 10-year Missouri average yield. Yet even in this excellent year the average net returns per acre on the high yield farms nearly doubled the net returns of the producers in the low yield group. This was accomplished by boosting average yield of lint 60 percent (311 lbs.). In terms of returns per \$100 spent for land, labor, and capital this meant the high yield farmers received nearly \$23 more than low yield farmers for every \$100 they spent.

Farmers in the high yield category had higher total costs per acre than the low yield producers. They had somewhat greater expenditures for fertilizer and other production materials, as well as higher marketing costs, but increased labor and machinery costs were the main reasons for the higher per acre costs. Higher yields naturally result in higher marketing costs and higher labor and machinery costs for harvesting, especially when hand picking or custom machine picking is used. In addition to this, however, the higher labor and machinery costs reflect to a certain extent the extra effort on the part of these producers to attain high yields. There is no doubt that the increased effort to obtain high yields was profitable on the farms studied.

Certain production costs are fixed in total no matter what yield is obtained. Interest on investment

Fig. 6—A comparison of lint yields with total cost and net returns per acre.

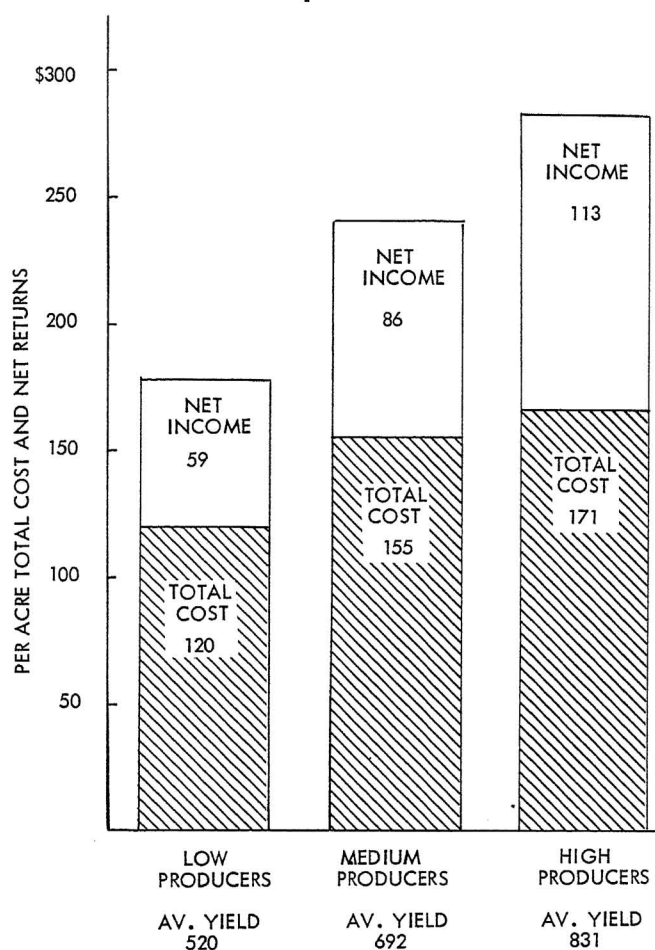


TABLE 7—COMPARISON OF COTTON YIELD (LBS. OF LINT) PER ACRE TO VARIOUS COST AND RETURNS ITEMS ON 42 MISSOURI FARMS IN 1959.

	Low Producers (In Terms of Lint/A)	Medium Producers (In Terms of Lint/A)	High Producers (In Terms of Lint/A)
Number of Farms	14	14	14
Yield Variation on Farms in Group (Lbs. of Lint/A)	415-589	623-735	739-1029
Average Yield of Group (Lbs. of Lint/A)	520	692	831
Costs Per Acre: (Dollars)			
Total Labor & Machinery Cost	66.25	88.60	103.47
Fertilizer Cost	9.33	11.74	10.67
Total Materials Cost (Includes Fertilizer)	15.99	18.15	17.25
Total Costs	120.85	155.44	170.94
Returns Per Acre: (Dollars)			
Lint Receipts/Acre	163.36	221.27	259.99
Total Receipts/Acre	178.93	241.04	283.52
Net Returns to Management	58.08	85.60	112.58
Returns/\$100 Spent for Land, Labor and Capital	148.49	156.54	171.10

in land, taxes, and machine ownership costs are examples of these. The ability to spread the fixed costs over more bales of cotton (units of production) is the major reason why farmers should strive for high yields.

COMPARISON OF PRICE RECEIVED FOR LINT WITH COSTS AND RETURNS

The price a farmer receives for his cotton lint is obviously a very important factor in determining his net income. As stated earlier average price received on individual farms in this study ranged from \$25.66 to \$36.24 per 100 pounds. This is a surprisingly large range for a year of such favorable weather. The price received by a farmer is of course influenced by many things, including weather during growing season and harvest, weeds in field at harvest (these two have major influence on grade of cotton), governmental programs, and the marketing forces that affect the general price level of cotton.

To analyze the importance of cotton lint price, the farms in this study were divided into three groups, the low, middle, and high producers based on average price received per cwt. of lint (Table 8). Contrasting the data of the low and high price group several things stand out. The first is that the aver-

age lint yield per acre was 50 pounds higher on the farms in the high price group. The lint receipts per acre averaged \$50 per acre more on the farms in the group receiving highest prices. This was due to both higher prices and yields. Generally speaking high yields are associated with high quality of lint, but where comparing the average yields of the low and medium price groups it is obvious that there are other factors involved.

The costs were also higher on the farms in the high lint price group. Fertilizer costs were 50 cents per acre higher on these farms, but the major cost difference was the labor and machinery cost. Only part of the increased labor and machinery cost was due to increased harvesting costs associated with higher yields.

Net income was nearly \$22 per acre higher on the farms in the high price group. It is difficult to determine the exact effect of one factor such as price in the analysis because many factors influence the net income of a farmer. The interdependence of these factors further complicates the analysis. We cannot measure the exact effect of price but the size of the difference in net income between these groups clearly demonstrates that farmers should strive for high quality cotton and carefully analyze their marketing alternatives (government program alternatives, etc.).

TABLE 8-A COMPARISON OF PRICE RECEIVED FOR LINT WITH VARIOUS COST AND RETURNS ITEMS ON 42 MISSOURI FARMS IN 1959.

	Low Producers in Terms of Lint Receipts/ Cwt. of Lint	Medium Producers in Terms of Lint Receipts/ Cwt. of Lint	High Producers in Terms of Lint Receipts/ Cwt. of Lint
Number of Farmers	14	14	14
Variation in Price Received/ Cwt. of Lint	25.66-30.23	30.30-32.04	32.69-36.24
Average Price Received/ Cwt. of Lint	29.06	31.46	34.03
Average Lint Yield/Acre (Lbs.)	671	651	721
<u>Costs per Acre: (Dollars)</u>			
Total Labor and Machinery Cost	74.39	80.25	103.37
Fertilizer Cost	9.99	11.12	10.49
Total Materials Cost (Includes Fertilizer)	17.73	18.97	14.68
Total Cost	134.56	143.06	169.61
<u>Returns Per Acre: (Dollars)</u>			
Lint Receipts	194.73	205.05	244.85
Total Receipts	211.85	223.82	267.82
Net Returns to Management	77.29	80.76	98.21

COMPARISON OF FERTILIZER USE WITH COSTS AND RETURNS

High yields are vital in maximizing net income and commercial fertilizers are a major factor in obtaining high yields. Much of the increase in the cotton yield level in the past decade can be attributed to commercial fertilizers.

The yield response of cotton to fertilizer in any particular year depends on many things, including weather (particularly rainfall), type of soil, level of nutrients already in the soil, previous crop, and other production practices followed by the farmer. Although the farmer has limited knowledge about some of these factors (particularly weather) he must consider all these in determining the amount of fertilizer to apply on his cotton. Soil tests provide him with data about the nutrient level in his soil. Moisture content in the soil at the time of planting does not provide information about future weather, but it does give a good idea as to the start the cotton will get.

Fertilizer expenditures on individual farms in this study varied from \$3.33 to \$19.50 per acre. To study the relationship of fertilizer use to costs and returns, the farms were divided in three groups based on fertilizer expenditures—low, medium, and high (Table 9).

Results shown in this table must be used with extreme caution as no attempt has been made to isolate the effects of fertilizer from other factors. There were too few farms in the study to do this. The biggest limitation of the data is that farms of all soil types are averaged together. The commercial fertilizer requirements and the response to fertilizer

treatment vary with soil properties. Sandy soils, for example, must be fertilized more heavily than soils with higher contents of silt or clay particles because of greater leaching and lower nutrient holding capacity.

Taking the farms in the study as a whole, there was a positive relationship between expenditures for fertilizer and cotton lint yield. Farms in the high fertilization class averaged 70 pounds of lint more per acre than those in the low group, and consequently had \$25.59 more total receipts per acre. If all of the increased yield and receipts could be attributed to the additional fertilizer, which of course can not be done, this would mean \$25.59 greater receipts for \$8.43 additional expenditures.

Farms in the high fertilization group averaged \$10 higher net income per acre than those in the low group. Net income per acre for the medium group, however, was not much higher than for the low group even though the average yield was 46 pounds higher. This again illustrates that many things affect net income.

To eliminate as much as possible the variation in response due to differences in soil textural properties the 24 farms on sandy loam soils were separated out and subjected to additional analysis. They were divided into low, medium, and high fertilization categories. Results are in Table 10. There were too few farms in the other soil textural groups for the same kind of analysis.

In dividing the 24 farms on sandy loam soils into these three classes the fertilizer expenditures for each group were very similar to the expenditures when all of the farms in the study were divided in

TABLE 9-A COMPARISON OF FERTILIZER EXPENDITURES TO COSTS AND RETURNS ON 42 MISSOURI FARMS IN 1959.

	Low Producers in Fertilizer Cost/Acre	Medium Producers in Fertilizer Cost/Acre	High Producers in Fertilizer Cost/Acre
Number of Farms	14	14	14
Variation in Fertilizer Cost (\$)	3.33-8.69	8.80-11.99	12.19-19.50
Average Fertilizer Cost/ Acre (\$)	6.27	10.64	14.70
Average Lint Yield/Acre	639	685	718
<u>Costs Per Acre: (Dollars)</u>			
Total Labor & Machine Costs	86.52	82.75	88.75
Total Materials Costs (Includes Fertilizer)	10.66	19.79	20.94
Total Costs	140.21	150.42	156.61
<u>Returns Per Acre: (Dollars)</u>			
Lint Receipts	202.90	213.24	228.49
Total Receipts	221.89	232.63	248.98
Net Returns to Management	81.68	82.21	92.37

TABLE 10-COMPARISON OF FERTILIZER USE TO COSTS AND RETURNS OF COTTON PRODUCED ON 24 MISSOURI FARMS HAVING SANDY LOAM SOILS.

	Low in Fertilizer Cost Per Acre	Medium in Fertilizer Cost Per Acre	High in Fertilizer Cost Per Acre
Number of Farms	8	8	8
Average Acres Per Farm	30.2	46.6	43.9
Variation in Fertilizer Cost (\$)	3.33-7.19	8.16-11.17	11.55-17.88
Average Fertilizer Cost/Acre (\$)	6.00	9.94	14.10
Average Lint Yield/Acre (lbs)	597	725	750
Costs Per Acre: (Dollars)			
Total Labor and Machinery Costs	84.00	86.74	91.00
Total Materials Costs (Includes Fertilizer)	9.63	18.45	21.04
Total Cost	134.52	150.06	162.06
Returns Per Acre: (Dollars)			
Lint Receipts	197.55	211.16	230.80
Total Receipts	215.68	237.62	252.51
Net Returns to Management	81.16	87.69	90.44

TABLE 11-A COMPARISON OF SOIL TEXTURAL PROPERTIES WITH COSTS AND RETURNS OF PRODUCING COTTON ON 42 MISSOURI FARMS IN 1959.

	Light Sandy Soils	Sandy Loam Soils	"Heavy" Soils	Combination* Soils
Number of Farms	4	24	6	8
Average Acres Per Farm	57.4	40.2	39.4	120.0
Average Pounds of Lint Per Acre	593	691	711	673
Costs Per Acre: (\$)				
Total Labor & Machinery Costs	77.71	87.24	105.11	72.12
Fertilizer Cost	11.84	10.02	10.74	11.17
Total Materials Cost (Including Fertilizer)	17.87	16.37	19.26	17.44
Total Cost	137.04	148.88	174.69	136.36
Returns Per Acre: (\$)				
Lint Receipts	184.80	216.24	229.20	215.09
Total Receipts	201.47	235.31	253.16	234.58
Net Returns to Management	64.43	86.43	78.30	98.21

*Farms on which cotton was produced on more than one of the three classes of land.

the same manner. The results, however, were quite different. Although many factors influence yield and net income, the relationships found on these farms on sandy loam soils corresponded closely to what soil scientists would expect from the use of fertilizer. Lint yields increased as more fertilizer was applied but the increase became somewhat smaller per extra unit of fertilizer at the higher levels of fertilizer.

The lint yield averaged 128 pounds higher on the medium-fertilizer-use farms than on the low-use farms, and increased only an additional 25 pounds from the medium to the high use farms.

This is not to say that the high use farms used too much fertilizer. The additional 25 pounds of lint on the higher fertilizer use meant \$14.89 greater gross receipts per acre. If all the increased net income could be attributed to increased fertilizer use it could be said that the additional \$3.94 spent for fertilizer by the medium-use group resulted in \$6.53 more net income per acre, and the additional \$4.16 that the high use farms spent resulted in another

\$2.75 net income per acre. As pointed out, not all the increased net income can be attributed to increased fertilizer, but there is no doubt that use of high rates of fertilizer was profitable on these farms in 1959.

COMPARISON OF SOIL TEXTURAL PROPERTIES WITH COSTS AND RETURNS

The bottomland soils in the Bootheel vary a great deal in physical properties, particularly in texture. Soils having different physical properties require different amounts and kinds of practices. The farms in this study were classified into four soil textural groups—light sandy soils, sandy loam soils, "heavy" soils, and combination soils (farms on which cotton was produced on more than one of the other soil groups).

The lowest labor and machinery cost per acre, lowest total costs per acre, and highest net returns to management per acre occurred on the farms in the combination soils group (Table 11). Because of

the great variability of soils within small distances in southeast Missouri it is logical to expect that the larger producers would more likely have soils classified in more than one of the above categories than the small producers. This certainly was the case as the average acreage of farms in the combination group was more than twice that of farms in the other groups. Thus in directly comparing these farms with the other three groups we have not only the influence of soil textural properties but the influence of larger size of business as well. In studying the relationships of soil textural properties to costs and returns, therefore, it is much better to compare the other three groups.

Light Sandy Soils

The analysis revealed relationships that are generally accepted by persons working with cotton. Producers on light sandy soils had lower labor and machinery costs due at least in part to sandy soils being more easily tilled. Cotton lint yields were lowest on the light sandy soils even though fertilizer expenditures averaged higher than on farms in the other soil categories. As harvesting costs are associated with yield, particularly if hand picking or custom machine picking is used, this also would be a factor in the lower labor and machinery costs.

Net returns averaged \$64.43 per acre on the light sandy soils, which is a very adequate net return. However, this was the lowest average net income of the three soil textural groups.

Sandy Loam Soils

Although considerable variation exists in the productivity of sandy loam soils (due primarily to subsoil characteristics), they are considered by many to be the most desirable bottomland soils. Easier soil working conditions, and fewer internal drainage problems are the main advantages of sandy loam soils over the "heavy" soils.

Sandy loam soils are generally quite productive. Average lint yield was 20 pounds lower per acre on sandy loam soils than on the "heavy" soils. Sandy loam soil net returns per acre, however, were over \$8 higher than the "heavy" soil returns and \$22 higher than the light sandy soil returns. The advantage in net returns that sandy loam held over "heavy" soils can be explained by lower production costs, particularly lower labor and machinery cost. As mentioned, sandy loam soils are more easily

worked and generally require fewer land preparation operations.

"Heavy" Soils

These soils commonly referred to as gumbo soils contain a higher proportion of clay particles than the sandy loam soils. This makes them more difficult to prepare for planting. They are generally quite productive in terms of available plant nutrient levels and nutrient holding capacity, but in wet years internal drainage can be a major problem.

As internal drainage problems were minor in 1959, lint yields averaged quite high on the farms with "heavy" soils. The higher production costs (mainly labor and machinery), however, offset the increased yield over the sandy loam soils and net returns averaged \$8 lower than on the sandy loam soils. A net return of \$78.30 an acre was, however, a fine net income.

■ ■ ■

APPENDIX

Methods and Assumptions Used in Calculating Costs and Returns

1. Labor charges were figured as follows if actual rate paid by a farmer was not available:
 - (a) Hand labor for chopping, etc.—50 cents per hour.
 - (b) Cotton picking labor—\$3.00 per cwt. of seed

cotton. It was assumed that the average hand picker could pick 100 pounds of seed cotton in four hours and 100 pounds of bollies in three hours.

- (c) Tractor operators—80 cents per hour.
- (d) Mechanical picker operators—\$1.00 per hour.

2. Machinery charges

- (a) Fixed ownership costs: Total 1959 machinery investment and depreciation on machinery was proportioned on the basis of acreage of various crops on the individual farms. Secondary data on the hours of use of different machines on various crops was used in this calculation. Each machine was considered separately as to acreage of crops it was used on.

If machines were used for custom work in addition to use on the operator's own cotton a further adjustment was made on the investment and depreciation so that a charge was made only for use on the operator's cotton.

An interest charge of 5 percent was made on machinery investment attributed to cotton.

- (b) Operating costs such as fuel, lubricants, and repairs were figured on a per hour of use basis.

Tractor costs were varied depending upon size of tractor and kind of fuel used. They were calculated on the following basis:

Size of Tractors	Kind of Fuel	
	Gasoline	Diesel Fuel or L.P. Gas
2 plow tractor	\$.80 per hour	-----
3 plow tractor	.95 per hour	\$.85 per hour
4 plow tractor	1.10 per hour	1.00 per hour

Machinery pulled by tractors (other than cotton pickers) was charged at 35 cents per hour regardless of kind of machinery. This charge to cover repairs, lubricants, and other maintenance costs is about average for the variable costs of all tractor-pulled machines used in cotton growing.

For owned mechanical pickers two charges for variable costs were made: Detachable pickers mounted on tractors were charged at \$5.00 per hour for the picker plus a charge for the tractor. The two row picker with built-in power unit was charged at \$8.50 per hour.

Actual machinery expenses vary a great

deal among farmers depending upon repair facilities, repair and maintenance practices followed by the individual farmer, and many other factors. These charges are in reality "averages" based on other research studies.

- (c) Total cost of custom work was divided into two charges, one for operator's labor and one for machine. Operator's labor was charged at \$1.00 per hour and the balance was charged to the machine. The charge most commonly paid for custom picking was \$2.50 per cwt. of seed cotton.

- 3. Seed, fertilizer, weed control chemicals, and other materials were charged as reported. An annual charge was made on applications of limestone and rock phosphate as the benefits of these are realized over a number of years.

- 4. The charge for geese used in weeding was \$5.00 per acre. This was based on the use of 2 geese per acre of cotton and a purchase cost of \$2.50 per goose. If a different rate was indicated, the actual rate was used. The resale value of the geese was assumed to balance the cost of extra feed for the geese and other handling costs.

- 5. A few farmers did land leveling during 1959. If it was an annual operation for cotton the entire cost was charged to the 1959 cotton. If not an annual operation, the total cost was divided by the number of years the farmer expected to obtain benefits to get an "annual cost."

- 6. One farmer used mules for certain tasks. A charge of 20 cents per hour was made for use of mules. This charge was based on Mississippi State Experiment Station Research.

- 7. Several farmers planted rye and vetch after cotton as a winter cover crop. The cost was not charged to the cotton, unless this was an annual practice on land on which cotton was produced every year, and the rye and vetch was not pastured.

- 8. The charge for land was calculated by adding the total land taxes to an interest charge. The interest charge was 5 percent of the fair market value of the land.

- 9. To determine the amount of lint in bollies the total weight of bollies was divided by four. There is actually considerable variation in this percentage and in the grade of the lint from bollies, but as these data were not readily available on most farms the procedure above was used.

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