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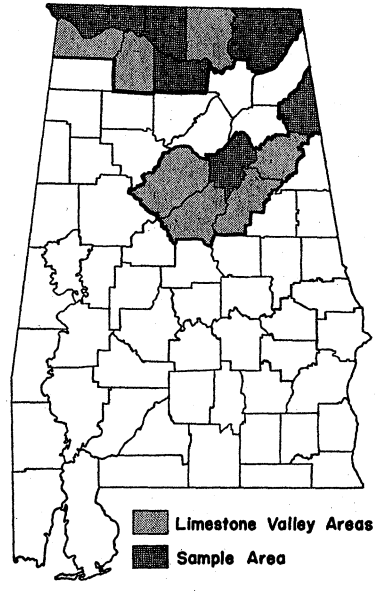
COTTON PRODUCTION PRACTICES *in the* LIMESTONE VALLEY AREAS *of Alabama*



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CONTENTS

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COTTON PRODUCTION PRACTICES *in the* LIMESTONE VALLEY AREAS *of Alabama* *

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AMONG THE PRINCIPAL cotton-producing areas of Alabama are the Limestone Valleys. For many years, cotton has been the major cash crop produced in these areas. In recent years, however, the relative importance of cotton has declined in terms of both acreage and income.

Cotton acreage harvested has been reduced almost 50 per cent during the last two decades. In 1944, however, 65 per cent of the Limestone Valley farmers were still producing cotton.[1] Moreover, total cotton production in recent years, despite decreasing acreage, has averaged about the same as the average annual production of 20 years earlier. Decreased cotton acreages have been offset by increases in yield per acre, Appendix Table 1.

In the Limestone Valley areas of Alabama, high production costs, high labor requirements, maintenance of satisfactory farm incomes, and maintenance and improvement of soil resources are major problems facing cotton producers. Farmers, therefore, must seriously consider (1) all possible ways of increasing cotton yields, increasing production efficiency, and lowering costs of production, and (2) the addition or expansion of enterprises to supplement cotton and/or a shift to alternative enterprises that may completely exclude cotton from individual farm programs.

In view of these considerations and of the present importance of cotton in these areas, a study of cotton production practices

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[1] "United States Census of Agriculture, 1945, Alabama—Statistics for Counties," Vol. I, Part 21, Bureau of the Census: County Tables I and II, pp. 18-78.

in the Limestone Valley areas was started in the summer of 1948 with a field survey being made in six counties of northern Alabama – Lauderdale, Limestone, Morgan, Jackson, Cherokee, and St. Clair, (cover).[2] These six counties were selected as being representative of the areas. Major objectives of the study were:

(1) To obtain current information on cotton production practices,

(2) To determine variations in current cotton production practices with respect to type of power and equipment used, by size of cotton enterprises,

(3) To interpret and evaluate the economic significance of current cotton production practices and techniques, and

(4) To compare current cotton production practices with Experiment Station recommendations, and to emphasize points where improvement is needed.

This report describes current cotton production practices in the Limestone Valleys, indicates variations in these practices, and compares present practices with recommendations of the Alabama Agricultural Experiment Station.

Current production practices as described in this report are based on an analysis of farm records obtained by personal interview with 105 farmers who produced cotton in the Limestone Valleys in 1947. Approximately the same number of farms with small, medium, and large cotton enterprises were selected as representative of cotton enterprises of these areas. For purposes of this study, the range in cotton acreage for each of the three groups was: small, less than 10 acres; medium, 10 to 29 acres; and large, 30 acres or more per farm, Appendix Table 2. Nearly half of all cotton producers in the Limestone Valley areas of Alabama produced less than 10 acres of cotton per farm in 1944, Table 1. Farms with these small cotton enterprises accounted for only 17 per cent of the areas' total cotton acreage and only 15 per cent of their total production. Farmers who produced 30 acres or more per farm made up only 10 per cent of the total cotton producers in these areas. However, these farms accounted for 41 per cent of the areas' total acreage of cotton and 46 per cent of the total production of the areas.

Wide variations occurred in average yield of cotton per acre between the three size groups. In 1944, farms with small cotton enterprises produced an average of 334 pounds of lint per acre;

[2] This study is a part of a larger over-all study that includes all of the major cotton-producing areas of Alabama. These areas include — Limestone Valleys, Sand Mountain, Upper Coastal Plain, Piedmont, Black Belt, and Lower Coastal Plain.

TABLE 1. DISTRIBUTION OF FARMS GROWING COTTON, ACREAGE HARVESTED, BALES PRODUCED, AND PRODUCTION PER ACRE, BY SIZE OF COTTON ENTERPRISE, LIMESTONE VALLEY AREAS OF ALABAMA, 1944[1]

Size of cotton enterprise (Acres in cotton)	Farms reporting cotton		Acreage harvested		Bales produced		Lint cotton produced per acre
	Total number	Per cent of total	Total number	Per cent of total	Total number	Per cent of total	
	No.	*Per cent*	*No.*	*Per cent*	*No.*	*Per cent*	*Pounds*
Small (Less than 10 acres)	12,338	48	68,117	17	47,594	15	334
Medium (10-29 acres)	10,879	42	166,730	42	120,374	39	345
Large (30 acres or more)	2,469	10	163,467	41	140,694	46	411
TOTAL (All farms)	25,686	100	398,314	100	308,662	100	370

[1] "Cotton Farms Classified by Acreage Harvested." (A special report prepared by the Bureau of the Census) National Cotton Council of America. Table 2, pp. 28-29. 1945.

farms with medium-sized enterprises produced an average of 345 pounds per acre; and farms with large cotton enterprises averaged 411 pounds per acre. These differences were associated with differences in production practices between farms with small, medium, and large cotton enterprises.

DESCRIPTION of SAMPLE FARMS

Some of the more important characteristics of sample farms that should be examined before evaluating cotton production practices include cropland organization and use, tenure of operators, labor organization, livestock organization, and degree of farm mechanization in existence, Table 2.

Farms with small cotton enterprises were small in terms of both cotton acreage and total farm acreage. In 1947, these farms averaged 62 acres in size, only 27 of which were cropland. Of the 27 acres of cropland, 6 acres were in cotton.

Farms with medium-sized cotton enterprises averaged 130 acres in size, 51 of which were cropland. Cotton acreage on these farms averaged 13 acres, or more than twice as many as on farms with small cotton enterprises.

Farms with large cotton enterprises, all of which were relatively large units and which relied heavily on share cropper and/or tenant labor, averaged more than 200 acres in size. Nearly three-fourths of the acreage on these farms was cropland, averaging more than 150 acres per farm. These farms also had a high percentage of cropland devoted to cotton, averaging more than one-third of the total or about 50 acres per farm.

TABLE 2. LAND USE, AND CROPLAND, LIVESTOCK, AND FARM LABOR ORGANIZATION PER FARM, BY SIZE OF COTTON ENTERPRISE, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Item	Size of cotton enterprise		
	Small	Medium	Large
	Number	*Number*	*Number*
Number of farms	32	40	33
	Acres	*Acres*	*Acres*
Land use:			
All land in farms	62.0	129.9	206.8
Owned	44.5	103.1	153.5
Rented in	17.5	26.8	80.1
Total cropland	27.0	50.7	152.6
Permanent pasture	6.8	43.4	25.9
Cropland organization:			
Cotton	6.3	14.7	71.2
Corn	12.2	22.0	48.8
Small grain	.5	2.5	3.9
Lespedeza hay	.4	2.9	1.4
Truck crops	.8	.5	2.1
Other crops	6.0	8.1	19.5
	Number	*Number*	*Number*
Livestock organization:[1]			
Workstock	1.4	1.8	2.4
Milk cows	1.1	1.7	2.1
Other cattle	1.8	3.9	5.9
Brood sows	.6	.8	.5
Other hogs	2.1	4.9	5.8
Hens and pullets	52.3	43.5	54.8
Tractors per farm, *av. no.*	.1	.3	.7
Labor organization:			
Families:			
Operator	.9	.9	.9
Cropper	.1	.1	1.6
Other tenant	.0	.1	.4
Wage hand	.1	.0	.1
Workers:			
Operator	1.8	2.4	2.0
Cropper	.3	.3	6.7
Other tenant	.0	.3	1.0
Wage hand	.2	.0	.3

[1] Operator's livestock only.

In 1947, tractors were reported on 9 per cent of the farms with small cotton enterprises, on 28 per cent of those with medium-sized cotton enterprises, and on 73 per cent of those with large cotton enterprises. Farms with large cotton enterprises were the only group that used tractors extensively in producing cotton. In the two smaller enterprise groups, tractors when used were used only for breaking and preparing land for planting. In the large-enterprise group, tractors in some cases were used to perform all cotton production operations except chopping, hoeing, and harvesting.

Most farms with small- and medium-sized cotton enterprises were family farms and were operated largely with workstock power and with family labor. Farms with large cotton enterprises depended heavily on share cropper and/or tenant labor; in many cases, tractors were the principal source of power. Consequently, on farms with small- and medium-sized cotton enterprises, corn was relatively more important than any other crop, whereas on farms with large cotton enterprises, cotton was relatively more important from the standpoint of acreage.

All major livestock enterprises handled by operators increased in size as the size of cotton enterprises increased. In no group, however, was livestock of major importance. Cotton was the principal cash enterprise and principal user of labor, power, and materials for all groups studied.

With respect to land ownership, there was no consistent pattern between the three groups studied. Generally, farmers on farms with large cotton enterprises owned a smaller percentage of the land they operated than did farmers on farms with medium- and small-sized cotton enterprises. Farmers with large cotton enterprises owned 66 per cent of the land they operated, farmers with medium-sized cotton enterprises owned 79 per cent, and farmers with small cotton enterprises owned 72 per cent. Operators were not necessarily "owner operators."

More than 80 per cent of the farms with small- and medium-sized cotton enterprises were operated without cropper or tenant labor, whereas only 36 per cent of the farms with large cotton enterprises did without such labor. On the remainder of the farms, croppers and tenants alone or various combinations of operators, croppers, and tenants supplied the labor for cotton production.

COTTON PRODUCTION PRACTICES

Based on the results of many years of research work and of field testing and observation, the Alabama Agricultural Experiment Station has developed a series of recommendations for producing cotton both economically and efficiently. While some recommendations are specific and others are general, most of them must be adapted to individual farms, to individual farm resources, and to capabilities of individual farm operators.

To facilitate an understanding and appraisal of the economic significance of current cotton practices and techniques, both present and recommended practices are given in this report for comparison and for determining needed practice adjustments. Present and recommended practices are discussed by major op-

erations including land preparation, seed and seeding rate, planting and spacing, fertilization, cultivation and weed control, insect control, and harvesting.

Land Preparation

Recommendations. The operations recommended for land preparation are those that will result in a good seedbed, good weed and grass control, conservation of moisture, and a good stand.

On farms operated with workstock, land should be prepared by cutting stalks with a rolling stalk cutter or a disc harrow, and breaking with a moldboard or a disc plow to a depth of 6 to 8 inches. Planting beds should then be laid off with a middlebuster early enough to allow them to be settled by rain. Just prior to planting, beds should be cultivated with a section harrow or drag.

On tractor farms, crop residues may be leveled by use of a rolling stalk cutter or a disc harrow. After cutting stalks, the land should be broken with a moldboard or disc plow to a depth of 6 to 8 inches, and early enough to allow the ground to be settled by rain before planting begins. Flat-broken land should be harrowed with a disc harrow just prior to planting.

When a cover crop precedes cotton, care should be taken in timing the planting with respect to the time of turning the cover crop. Since germination of cotton planting seed may be seriously impaired or destroyed by coming into contact with fermenting material, cover crops should be turned 2 weeks or longer before planting to allow for the completion of the fermentation process. An alternative is to plant immediately after turning the cover crop in order that the cottonseed may germinate before fermentation begins.

Present Practices. On farms operated with workstock as the principal source of power, the usual procedure in preparing land was to cut stalks with a one- or two-row stalk cutter, followed by flat-breaking with a moldboard plow. Then, the flat-broken land was harrowed one time over with a section harrow and rows were laid off with a middlebuster or a Georgia stock.

On tractor farms, the usual procedure for preparing land was to cut stalks with a two-row stalk cutter or a disc harrow, and to flat-break with a two-disc plow followed by harrowing with a disc harrow. Laying off rows was usually accomplished with a one- or two-row cultivator, Appendix Tables 5, 6, and 7.

In most cases, the equipment used in preparing land was the type recommended for such operations. However, since most of

the cotton land normally was prepared between the middle of March and the first part of April in these areas, many farmers probably did not allow sufficient time for seedbeds to settle between the time land preparation was completed and the crop was planted. Such a practice often results in a loose seedbed, and may seriously affect the stand and yield of cotton.

Seed, Seeding Rate, Planting *and* Spacing

Recommendations. A good variety of cotton should be a high yielder, and should have a good lint turnout, a staple length that is in demand, good strength, and character. A relatively large boll facilitates hand picking and an early-maturing variety is desirable in the presence of insect infestation. Some of the varieties that are recommended for these areas and that have most of these characteristics are Stoneville, Empire, Coker 100-Wilt, Deltapine 15, White Gold, Stonewilt, and Plains. In order to insure a reliable source of seed, farmers should purchase seed of certified quality or better. The use of home-grown seed usually involves a greater possibility of contamination and mixing. Farmers, however, should not hesitate to save home-grown seed of high quality where proper precautions can be taken to preserve quality.

The recommended planting rate for the Limestone Valley areas is three-fourths to one bushel of non-delinted cottonseed per acre. The planting rate for mechanically delinted seed is one-half to one bushel per acre. When using acid-delinted seed, approximately one-half bushel per acre is recommended. All cotton planting seed should be treated, but whether planting seed is delinted or not delinted is optional. Spacing recommendations are 12 to 18 inches between hills regardless of whether spaced by hill dropping or by hand chopping. A row width of 42 inches is recommended. Cotton may be planted solid in the drill or hill dropped with one- or two-row planters. No yield difference has been observed between hill-dropped cotton and cotton planted solid in the drill, provided a uniform stand was obtained with both plantings. Cotton should be planted in the Limestone Valley areas between April 10 and 25.

Present Practices. Planting rates varied somewhat between farms with small, medium, and large cotton enterprises, depending on the method of planting (solid in the drill or hill dropped), and according to the type of the planting seed used (delinted or non-delinted). The pounds of delinted and non-delinted seed planted per acre solid in the drill and hill dropped in 1947 are shown in Table 3.

TABLE 3. SOURCE, TREATMENT, AND METHOD AND RATE OF PLANTING COTTONSEED, BY SIZE OF COTTON ENTERPRISE, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Item	Unit	Size of cotton enterprise		
		Small	Medium	Large
Number of farms	*Number*	32	40	33
Cotton planted	*Acres*	201	588	2,351
Purchased seed:				
Proportion of farmers using	*Per cent*	44	65	52
Proportion of acreage planted	*Per cent*	40	52	23
Proportion of purchased seed:				
Delinted	*Per cent*	84	88	98
Treated	*Per cent*	86	75	97
Proportion of home-grown seed:				
Delinted	*Per cent*	28	22	24
Treated	*Per cent*	28	18	67
Delinted Seed:				
Proportion of farmers using	*Per cent*	47	78	76
Proportion of acreage planted	*Per cent*	41	67	45
Proportion of acreage planted with delinted seed:				
Solid in the drill	*Per cent*	80	79	88
Hill dropped	*Per cent*	20	21	12
Proportion of acreage planted with non-delinted seed:				
Solid in the drill	*Per cent*	66	77	100
Hill dropped	*Per cent*	34	23	0
Pounds of seed per acre:				
Delinted:				
Hill dropped	*Pounds*	25	19	22
Solid in the drill	*Pounds*	33	27	25
Non-delinted seed:				
Hill dropped	*Pounds*	28	22	0
Solid in the drill	*Pounds*	25	32	28

There was no apparent difference between the amounts of delinted and non-delinted seed planted per acre solid in the drill in 1947; nor was there any apparent relationship between size of farm and the amount of cottonseed planted per acre. A slightly smaller amount of seed was planted when hill dropped than when planted solid in the drill. Less than half of the cotton acreage was planted with purchased seed, although more than half of the farmers interviewed used some purchased seed.

More than 75 per cent of the purchased seed used in 1947 had been delinted and treated when bought. About a fourth of the home-grown seed was delinted. Only a fourth of the home-grown seed used on farms with small and medium cotton enterprises was treated, whereas two-thirds of the seed used on farms with large cotton enterprises was treated.

The most popular variety of cotton planted in 1947 was Delta-pine. Other important varieties, particularly home-grown seed,

were Stoneville and White Gold. On farms with large cotton enterprises, 48 per cent of the home-grown seed planted was of unknown varieties. Most home-grown seed used by all three enterprise groups was 2 years or more from breeder seed. The major proportion of purchased seed was 1 year from breeder seed, and a small proportion was direct from the breeder. Generally, the quality of cotton planting seed was questionable in that only 36 per cent of all seed planted by farmers was 1 year or less from the breeder. However, the quality of purchased seed planted by farmers was fair; 64 per cent of this seed was 1 year or less from breeder seed, Appendix Table 3.

More than 75 per cent of the cotton in the Limestone Valley areas was planted solid in the drill and all of it was hand chopped to a stand. Most of the cotton planted solid in the drill on workstock farms was planted in 36- to 38-inch rows and spaced 9 to 12 inches in the rows. On tractor farms, cotton was planted in 40- to 42-inch rows and spaced 9 to 11 inches in the rows. Hill dropped cotton on workstock farms was planted in 36- to 44-inch rows with 12- to 17-inch spacing between hills in the rows.

Farmers in the Limestone Valley areas were usually within the range of recommendations for planting, rate of seeding, variety, and method of planting and spacing. Farmers on workstock farms were using a narrower spacing than is recommended. As a whole, farmers were planting from the last part of April to the first part of May which was later than the area recommendation of April 10 through April 25. The narrower spacing on workstock farms apparently did not affect cotton yields in 1947, but the later planting may affect attaining a stand, and may particularly affect yield when insect infestation is a problem.

Fertilization

Recommendations. About 600 pounds per acre of 6-8-4 fertilizer should be used at planting time on the more productive soils in the Limestone Valley areas. The poorer red soils should receive 600 pounds of 6-8-4 at planting time and 16 pounds of nitrogen applied either at planting time or as a side-dressing. The gray soils should receive about 600 pounds of 6-8-8 fertilizer at time of planting and 16 pounds of nitrogen applied either at planting or later as a side-dressing. On tractor farms, the fertilizer may be applied with a fertilizer attachment on the planter. On workstock farms, either a distributor or a planter attachment may be used. When applying fertilizer at planting time, it should be placed 2 inches below and to the side of the seed. Side-dressing

may be applied with fertilizer attachments on cultivating equipment or with a distributor at about the time of the first or second cultivation after chopping.

Present Practices. Only 1 out of the 105 farmers interviewed used no fertilizer in 1947. On all other farms, some type of commerical fertilizer was used on all cotton planted. The average rate per acre when only complete fertilizer was used varied from 395 pounds on farms with medium-sized cotton enterprises to 433 pounds on farms with small cotton enterprises. The average rate per acre for complete fertilizer where both complete fertili-

TABLE 4. FERTILIZER PRACTICES BY SIZE OF COTTON ENTERPRISE, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Item	Unit	Size of cotton enterprise		
		Small	Medium	Large
Number of farms	*Number*	32	40	33
Cotton planted	*Acres*	201	588	2,351
Proportion using complete fertilizer only:				
Farms	*Per cent*	91	87	85
Acreage	*Per cent*	88	87	92
Proportion using complete fertilizer and side-dressing:				
Farms	*Per cent*	9	13	15
Acreage	*Per cent*	12	10	8
Rate of application where used:				
Complete only	*Pounds*	433	395	431
Complete and side-dressing:				
Complete	*Pounds*	518	408	479
Side-dressing	*Pounds*	70	128	162
Rate of application per planted acre:				
Complete	*Pounds*	433	393	444
Side-dressing	*Pounds*	11	13	11
Analysis of complete fertilizer:				
Proportion of acreage receiving:[1]				
6-8-4	*Per cent*	68	66	72
4-10-7	*Per cent*	27	30	21
4-10-4	*Per cent*	10	11	8
Other	*Per cent*	6	5	0
Analysis of side-dressing:				
Proportion of acreage receiving:				
Sodium nitrate	*Per cent*	8	11	9
Potash	*Per cent*	5	0	0
Summary of fertilizer elements:				
N per fertilized acre of cotton	*Pounds*	25	24	36
P_2O_5 per fertilized acre of cotton	*Pounds*	37	35	38
K_2O per fertilized acre of cotton	*Pounds*	22	20	20

[1] Summed percentages do not total the sum of percentages using complete only and complete with side-dressing, because some farms used two complete fertilizers on the same acreage.

zer and side-dressing were used varied from 408 pounds on farms with medium-sized cotton enterprises to 518 pounds on farms with small cotton enterprises; the rate for side-dressing varied from 70 pounds per acre on farms with small cotton enterprises to 162 pounds per ace on farms with large cotton enterprises. Almost 88 per cent of the cotton acreage was fertilized with complete fertilizer only and about 10 per cent was fertilized with complete fertilizer in conjunction with some side-dressing. The most popular analysis was 6-8-4, although a considerable proportion of the acreage received 4-10-7, Table 4.

On workstock farms one-row distributors were used in fertilizing, while on tractor farms two-row distributors and fertilizer attachments on planting and cultivating equipment were used.

The amount of plant food in the fertilizer used ranged from 20 to 40 pounds per acre for N, from 27 to 54 pounds for P_2O_5, and from 13 to 33 pounds for K_2O. The approximate average per acre was: N, 30 pounds; P_2O_5, 38 pounds; and K_2O, 21 pounds, Table 4.

The over-all average rate of fertilizer application indicates that the Limestone Valley farmers were somewhat under the recommended rate of 600 pounds of 6-8-4 fertilizer (36 pounds of N, 48 pounds of P_2O_5, and 24 pounds of K_2O per acre) for the more productive soils. They were considerably under the recommendations for the poorer red soils and for the gray soils in these areas.

Many farmers in the Limestone Valley areas of Alabama need to increase their cotton fertilization rates to the amounts recommended. Farmers can increase yields by using more fertilizer, and can reduce labor requirements by using fertilizer attachments on planting and cultivating equipment for applying fertilizer.

Cultivation and Weed Control

Recommendations. Cultivation should begin just before cotton comes up or just after cotton is up to a good stand. Cotton should be cultivated to a depth of 1 to 3 inches with one- or two-row cultivators with sweeps. Cultivation should be continued throughout the plant's normal growing season as often as is necessary to control weeds and grass. Cotton should be chopped when it is up to a stand and after the permanent leaves are present. Chopping should allow a spacing of 12 to 18 inches between hills with two to three stalks per hill. Hoeing may be necessary if grass and weeds cannot be controlled by cultivation.

Present Practices. On workstock farms in 1947, cultivation usually was accomplished with a combination of one-half and one-

row equipment; two-row equipment was used on tractor farms. On the average, cotton was cultivated about five times. It was chopped once, and on the average, it was hoed twice.

Farmers using workstock may be able to reduce materially both labor requirements and costs of production by using one-row cultivating equipment instead of using combinations of half-row equipment with other sizes. Earlier cultivation should reduce the number of times that cotton needs to be hoed. As a whole, farmers in 1947 were using recommended types of equipment, Appendix Table 7.

Insect Control

Recommendations. The following materials were recommended for general use in the control of cotton insect pests in 1951:

Insecticide	Lb. per acre	Application
3 per cent gamma BHC-5 per cent DDT, or	10 — 15	When 25 per cent infestation at 5-day intervals until top bolls are mature; during migration at 4-day intervals.
20 per cent toxaphene, or	10 — 15	Same as above.
Calcium arsenate alternated with 3 per cent gamma BHC-5 per cent DDT, or	7 — 10 10 — 15	Same as above. Same as above.
Calcium arsenate alternated with calcium arsenate containing 2 per cent nicotine	7 — 10 10 — 15	Same as above. Same as above.

With added precautions these materials may be used: (1) A mixture of 2.5 per cent aldrin – 5 per cent DDT, and (2) 1.5 per cent dieldrin – 5 per cent DDT. These materials have not been tested as long as have other cotton poisons, but they have given good results for two years in experimental tests. They are recommended only for tractor or airplane spraying.

For boll worm control, apply 10 per cent DDT or 20 per cent toxaphene at the rate of 15 pounds per acre. If a good boll weevil control program is followed, boll worms are not apt to become numerous.

Except where stated, cotton poisons can be applied as a dust or as a spray. Dust can be put on with hand, mule-drawn, tractor, or airplane equipment. Dust when the air is still and cotton plants are dry.

Spray can be applied by tractor or airplane, but row spacing must be taken into consideration where tractor poisoning equipment is used, since this equipment is usually designed for specific row spacings. The amount of diluted spray used to cover an

acre may vary from 2 to 10 gallons. The right amount of poison to use per acre for each application (regardless of the volume of spray) is as follows:

⅓ to ½ pound of gamma isomer BHC plus ½ or more pounds of DDT.

2 to 2½ pounds of technical toxaphene.

1/4 pound aldrin plus ½ pound of DDT.

1/5 pound dieldrin plus ½ pound of DDT.

Calcium arsenate is effective only as a dust.

Insecticides should be applied while the plants are setting and maturing the crop, and when the number of squares punctured indicates 25 per cent or more infestation. After starting, poisoning should be repeated at 5-day intervals until the top bolls are mature. During a normal year, six to seven effective applications should be enough; more applications may be needed during seasons of heavy infestation and/or frequent rainfall.

The recommendation for boll weevil control in 1947 was calcium arsenate at the rate of 8 to 10 pounds per acre. The time and frequency of application was the same as that shown for other poisons in the 1951 recommendations. The difference between 1947 and 1951 cotton poisoning recommendations was due to the fact that in 1947 the newer insecticides now recommended had not undergone extensive testing necessary to obtain conclusive evidence of their effectiveness.

Present Practices. Present practices are based on the crop year 1947. In the Limestone Valley areas, slightly more than 2 per cent of the cotton acreage received only one application of poison. Poisoning occurred only on those farms with medium and large cotton enterprises that were partially mechanized. The rate of application ranged from 3 to 8 pounds of calcium arsenate per acre. Approximately 6 per cent of the farmers interviewed had poisoned their cotton in the last 10 years.

Method *and* Time *of* Harvesting

Recommendations. Cotton if hand harvested should be picked immediately after the bolls are open and dry. Precautions should be taken to prevent picking wet or green cotton. It should be picked as clean as possible, and usually it will require three pickings during the harvest season. Harvesting dates in the Limestone Valley areas are usually from about October 1 to December 30.

Present Practices. All of the cotton harvested on the farms surveyed in 1947 was hand picked. Farmers averaged picking their cotton fields in 1947 about three times. Two-thirds of the cotton was harvested with family labor. The highest proportion of hired labor used for harvesting was found on farms with large cotton enterprises, ranging from 27 per cent on farms with small enterprises to 35 per cent on farms with large cotton enterprises. The seed cotton required to make a 500-pound gross-weight bale of cotton was about 1260 pounds, Appendix Table 4.

Farmers were following harvesting recommendations in 1947. Cotton fields were picked over two to four times with an average of three. Picking began in September of that year, with most of the cotton being picked during October and November.

About 60 per cent of the total labor required to produce an acre of cotton was required for harvesting. Harvesting requirements can be reduced by picking thoroughly a minimum number of times.

LABOR *and* POWER REQUIREMENTS

High labor and power requirements for cotton production are major factors limiting the most efficient and profitable production of cotton in these areas.

The following estimates indicate the relative importance of usual labor and power costs to total costs of producing cotton. On workstock farms power costs amount to approximately 14 per cent of the total production cost and labor costs amount to approximately 54 per cent of the total. Thus, power and labor costs make up more than two-thirds of the cost of producing cotton on workstock farms.

On tractor farms power costs are about 10 per cent of the total production cost and labor costs amount to about 38 per cent of the total. Therefore, on tractor farms power and labor make up roughly one-half of the cost of producing cotton. Power requirements are greatest for land preparation, planting and cultivating, while labor requirements are greatest during the chopping, hoeing, and harvesting seasons.

With power and labor costs making up from one-half to over two-thirds of the cost of producing cotton, any sizeable reduction in power and labor requirements, should both increase efficiency and decrease the cost of producing cotton.

Use of Power.

The use of different kinds and combinations of power varied greatly among the farms surveyed. Forty-seven of the 105 farms used workstock only, 45 used both workstock and tractors (combination farms), and 13 used tractors only, Table 5. The largest proportion of tractors were found on farms with large cotton enterprises, where 27 per cent used tractors only for power. These farms accounted for almost 40 per cent of the total cotton acreage in these areas.

TABLE 5. DISTRIBUTION OF FARMS BY SIZE OF COTTON ENTERPRISES, AND BY TYPES OF POWER USED, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Type of power group	Size of cotton enterprise						All farms	
	Small		Medium		Large			
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Workstock farms	19	59	22	55	6	18	47	45
Combination farms[1]	12	38	15	38	18	55	45	43
Tractor farms	1	3	3	7	9	27	13	12
TOTAL	32	100	40	100	33	100	105	100

[1] Farms which used both workstock and tractors as sources of power.

Usual Labor Requirements

The usual amounts of man labor used varied from 89 hours per acre on combination (operator) farms[3] with large cotton enterprises to 141 hours per acre on workstock (cropper) farms with small cotton enterprises. Approximately 34 hours of animal power or 8 hours of mechanical power (tractor and truck or car) were required to produce an acre of cotton, Appendix Tables 5 and 6.

In comparing labor requirements for various operations among different size and tenure groups, chopping and hoeing, and harvesting were considered separately, since these operations required a relatively large amount of labor and varied widely between size and tenure groups. Chopping and hoeing required about a fifth of the total man labor needed to produce an acre of cotton; harvesting required about three-fifths of the total. Workstock farms with medium-sized or large cotton enterprises were more efficient in use of labor than were farms with small cotton enterprises, Figure 1.

No significant differences were found on workstock and tractor farms between operator and cropper operations other than in labor used in chopping, hoeing, and harvesting. The differences

[3] Combination farms are those that used both workstock and tractors for power in producing cotton.

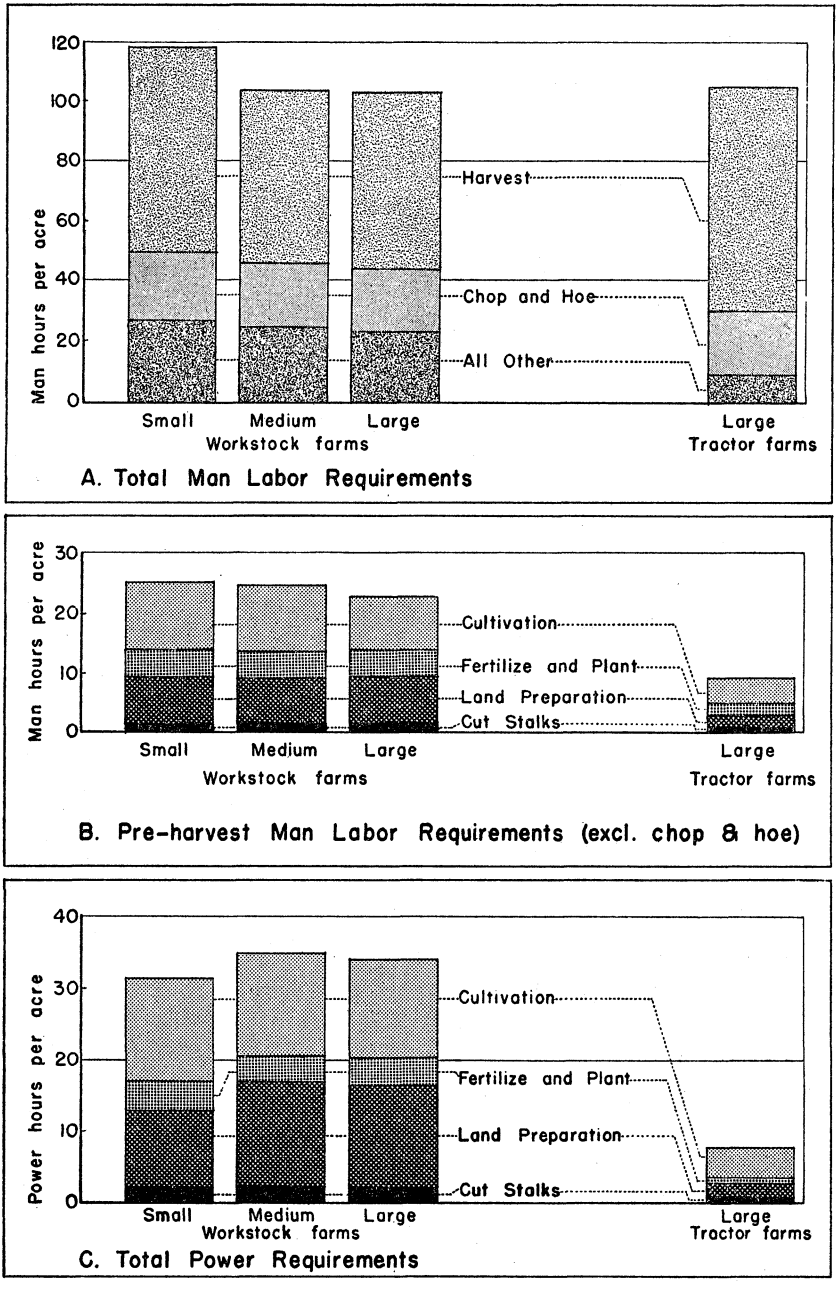

FIGURE 1. Usual labor and power requirements in hours per acre by size of cotton enterprise and by operations on workstock and tractor farms, Limestone Valley Areas of Alabama, 1947.

that occurred in these operations were for the most part due to an additional time over for hoeing and picking. These differences were closely associated with variations in yield.

Figure 1 shows that less man labor was required on workstock farms with medium and large cotton enterprises than on workstock farms with small cotton enterprises. This difference was largely due to labor requirements of harvesting which in turn were influenced by yield variations. Pre-harvest man labor and power requirements were slightly less on farms with medium and large cotton enterprises than on farms with small cotton enterprises. Pre-harvest man labor requirements on farms with the smaller cotton enterprises can be reduced by the substitution of larger equipment.

Figure 1 indicates that man labor was greatly reduced by use of tractor power in pre-harvest operations (chopping and hoeing excluded). However, the wide differences between pre-harvest labor and power requirements on workstock and tractor farms shown in Figure 1 may be reduced approximately 50 per cent by the substitution of mechanical power and large equipment for workstock power and small equipment.

Considerable differences were found in labor requirements between farms with large and medium cotton enterprises and those with small cotton enterprises. The operators of farms with large cotton enterprises were able to make better use of machinery and equipment and thus reduce man labor requirements substantially. Usual labor requirements, assuming that all cotton is hand picked, indicate that tractor power can reduce total man labor requirements about 13 per cent, but can reduce pre-harvest labor requirements approximately 31 per cent. Tractor power can reduce the man labor required in planting and cultivating about 53 per cent. This indicates that a man with a tractor can plant and cultivate probably more than twice the acreage that a man with workstock can handle.

Time of Operation

Proper timing of production operations may mean the difference between success and failure in cotton production. During a year in which normal weather conditions prevail, a cotton grower usually will have no difficulty in timing production operations to produce a crop. However, when adverse weather conditions occur, those farmers that are equipped to cover large acreages in a short time have a great advantage. Land preparation usually begins in March with preparation of the seedbed. Cotton is

planted during the last part of April and the first part of May. In the Limestone Valley areas, peak labor requirements occur normally during June largely because of the requirements for chopping and hoeing, and during October and November, which are the peak harvest months.

Variation *from* Usual Operations

A wide variety of machinery and equipment of varying sizes was used in producing cotton in 1947. The greatest variation was found in the types of equipment used for land preparation and for cultivation, Appendix Table 7. However, these variations are important chiefly from the standpoint of saving labor rather than from quality of work.

Variations *in* Time Required *to* Perform Usual Operations

The methods of performing usual operations that saved the most labor were selected for comparison with the most common methods used in performing the same operations. The greatest labor-saving methods on workstock farms required 98 hours of man labor and 26 hours of animal work to produce and harvest an acre of cotton yielding 360 pounds of lint, Table 6. This represented a saving of 10 man hours or about 9 per cent of usual requirements. The saving in workstock hours was 9 hours or about 25 per cent of usual requirements.

TABLE 6. SELECTED VARIATIONS FROM USUAL IN PER-ACRE LABOR REQUIREMENTS FOR PRODUCING COTTON USING ANIMAL-DRAWN EQUIPMENT, WITH COMPARISONS, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Item	Size of equipment	Times over	Hours per acre[1]	
			Man	Animal
Cut stalks	2-horse stalk cutter	1	1.0	2.0
Flat-break	2-horse moldboard plow	1	4.4	8.4
Bed	1 time per row	1	1.6	2.6
Cultivate beds	Section harrow	1	1.4	2.1
Plant	2-row planter	1	1.2	1.1
Fertilize	2-row distributor	1	1.5	1.1
Cultivate	2-horse cultivator	5	4.0	8.0
Chop and hoe	Hand	2	20.9	.0
TOTAL PRE-HARVEST			36.0	25.3
Harvest	Hand	3	61.4	.0
Haul	Wagon	-	.1	.3
TOTAL			97.5	25.6
Comparison (usual total)			107.0	34.3
Labor and power saved			9.5	8.7
Per cent labor and power saved			8.9	25.4

[1] Poisoning was not considered; it would add a small amount of time to the total requirements.

TABLE 7. SELECTED VARIATIONS FROM USUAL IN PER-ACRE LABOR REQUIREMENTS FOR PRODUCING COTTON USING TRACTOR-DRAWN EQUIPMENT, WITH COMPARISONS, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Item	Size of equipment	Times over	Hours per acre[1]		
			Man	Tractor	Truck
Cut stalks	2-row stalk cutter	1.0	0.4	0.4	.0
Flat-break	2-disc plow	1.0	1.6	1.6	.0
Cultivate flat-broken land	Section harrow	1.0	.4	.4	.0
Fertilize and plant	2-row planter and fertilizer attachment	1.0	.9	.5	.0
Cultivate	2-row cultivator	5.4	3.8	3.8	.0
Chop and hoe	Hand	2.0	20.9	.0	.0
Total pre-harvest			28.0	6.7	.0
Harvest	Hand	3.0	76.2	.0	.0
Haul	Truck or trailer	—	.1	.0	0.1
TOTAL			104.3	6.7	.1
Comparison (usual total)			106.1	7.9	.1
Labor and power saved			1.8	1.2	.0
Per cent labor and power saved			1.7	15.2	.0

[1] Poisoning was not considered; it would add a small amount of time to the total requirements.

With tractor power, the saving in man labor by using larger equipment was approximately 2 per cent of the usual requirements in 1947; however, the saving in tractor hours was 15 per cent, Table 7. Man labor required to produce an acre of cotton primarily with one-row tractor-drawn equipment was 109 hours compared to 104 hours with two-row equipment. Particular attention should be given to labor requirements of chopping, hoeing, and harvesting, which together accounted for approximately 97 of the total hours required with either type of equipment. Tractor time required with one-row tractor equipment was 85 per cent greater than that required with two-row equipment; therefore, power requirements were reduced approximately 46 per cent by the use of two-row equipment instead of one-row equipment.

Savings in man and tractor hours through use of larger equipment and by shifting to the use of more tractor power are of major importance in reducing both labor and power costs of producing cotton.

Possibilities of Further Changes, and Limitations and Effects of Mechanization[4]

The Limestone Valley areas will probably continue as major cotton-producing areas of Alabama. Although the extent of pos-

[4] Prepared on the basis of information furnished by the Agricultural Engineering Department, Alabama Agricultural Experiment Station.

sible increases in the degree of farm mechanization may be limited by the topography of these areas, a considerable proportion of the Valleys' cotton land is relatively level. It is in large enough fields to make it particularly suited to mechanization. Shifts to mechanized production will require that certain adjustments in production practices be made because of physical limitations of the mechanical equipment now available. Well planned field layouts will aid in reducing both labor and power requirements of many operations performed with machines.

In cutting stalks, it is essential that cotton stalks be well shredded or broken up to obtain efficient use of planting and cultivating equipment during subsequent operations. The use of either horizontal- or vertical-type cutters is satisfactory for this operation. However, when green stalks are present, the power-driven, rotary-type cutter is more efficient. By performing this operation as soon after harvesting as possible, a protective covering for the soil may be obtained, and decay of stalks and insect control may be aided.

Since the type of seedbed preparation influences subsequent mechanized operations, a well prepared seedbed is of utmost importance. The soil should be thoroughly broken to a depth of at least 6 inches, using a moldboard or disc plow well in advance of planting time. After breaking, a firm seedbed may be formed with harrows and/or cultipackers.

The planting operation will be of particular importance if mechanical harvesting is to be practiced, because some mechanical cotton harvester manufacturers have designed their equipment to operate best at a standard row spacing of 40 inches. Cotton that is to be mechanically harvested, therefore, should be planted in 40-inch rows. Also, it should be planted on the flat, and solid in the drill to obtain efficient use of mechanical harvesting equipment. Thick stands are necessary for the use of rotary hoes and mechanical choppers. Also they result in more suitable plants for mechanical harvesting. The rotary hoe is effective in early weed and grass control, and may be used three to five times beginning with cotton emergence. Each time the rotary hoe is used the cotton stand may be reduced from 5 to 7 per cent. To maintain a good stand, a heavier rate of seeding is required in order to allow for reduction of stand resulting from use of the rotary hoe and mechanical chopper.

Insect control has become increasingly important in these areas due to the increase in insect infestation during the last few years. Sprayers and dusters are equally effective equipment for applying

insect control materials. Tractor fenders may be necessary to reduce damage to rank cotton.

Defoliation is becoming an important phase in cotton production in many areas. Defoliation is essential for machine harvesting, and in addition, it has been found to reduce boll rot and to facilitate hand picking. The conventional cotton duster is used to apply the defoliant, which is put on at recommended rates per acre. Defoliation is done when most of the cotton bolls are mature. The defoliant should be applied either in late evening or early morning since contact with moisture is essential for its maximum effectiveness.

Although use of mechanical equipment now available requires some adjustments in cotton production practices, the labor saving aspects of mechanization make a further shift to mechanization appear more desirable in a period of short labor supply, high prices, and good demand for cotton.

The more labor-saving methods of producing cotton are shown in Table 7. Proper use of the rotary hoe and mechanical chopper can reduce the labor requirements of chopping and hoeing approximately 50 per cent. The use of mechanical harvesters can reduce harvest labor requirements to about 2 man hours per acre. By substituting this equipment for that shown in Table 7, total man labor requirements for producing an acre of cotton can be reduced to about 20 hours, a saving of approximately 80 per cent of the labor usually required. By using the latest methods of insect control and defoliation, total power and labor requirements would not be seriously affected. This indicates that considerable savings in the labor requirements of cotton production for these areas can be attained if further improvements are made in mechanical harvesters and in ginning facilities. These developments must be made, however, before mechanical harvesting can be recommended in these areas.

Saving man labor does not necessarily mean that cotton can be produced more profitably. The relative costs of labor and machinery together with the possible effects of mechanical harvesting on cotton quality and price will determine for individual producers how much machinery to substitute for labor and workstock power.

SUMMARY *and* CONCLUSIONS

The Limestone Valley areas are among the principal cotton-producing areas of Alabama. In view of the importance of cotton production in these areas, high production costs, high labor requirements, and other major problems facing cotton producers, a study was begun in the summer of 1948 with a field survey being made in six counties selected as being representative of the Limestone Valley areas, to (1) obtain current information on cotton production practices, and (2) to compare current cotton production practices with Experiment Station recommendations in order to point out where improvement is needed.

In most cases, the equipment used in preparing land was the equipment recommended. However, there is a possibility that costs can be decreased and efficiency increased through use of larger equipment on some farms, particularly on workstock farms. Most of the land was prepared during the latter part of March and the first part of April. A better seedbed may be obtained by breaking land earlier and allowing more time for it to settle before planting.

The most popular varieties of cotton were Deltapine, Stoneville, and White Gold, all of which were recommended for these areas. Farmers were also within the scope of recommendations for seeding rates; no relationship was observed between size of enterprise and seeding rates, but a slightly smaller amount of seed was used when hill dropped than when planted solid in the drill. Less than one-half of the acreage was planted with purchased seed. More than 75 per cent of all seed was treated. Improvement in the quality of planting seed and further treatment may help to increase cotton yields. Although some hill dropping was done, all cotton was hand chopped and hoed. More frequent and thorough cultivation may decrease the number of times that hoeing is necessary and reduce hoe labor costs accordingly.

Although all cotton was fertilized with some type of commercial fertilizer, the application per acre was considerably below recommended rates. The per-acre yield of cotton can be improved by increasing fertilizer applications up to recommended rates. Costs of applying fertilizer can be decreased by using fertilizer attachments on planting and cultivating equipment.

Implements used for cultivation and weed control in most cases were the types of equipment recommended. There is a possibility that costs of performing these operations may be reduced by using larger equipment where practicable, and cultivat-

ing earlier and more frequently to decrease hand-labor requirements for hoeing.

Farmers who poisoned to control cotton boll weevils in 1947 used calcium arsenate at somewhat below recommended rates. In that year, only 2 per cent of the total acreage was poisoned. Recommendations as to frequency of poisoning were not closely adhered to. Improvements have been made in cotton insecticides since 1947, and if cotton yields are to be maintained or increased, current poisoning recommendations should be followed when insect infestation is a problem.

Farmers were following recommended cotton harvesting practices. The majority picked over their cotton fields an average of three times. On some farms, harvest labor may be reduced by picking thoroughly a minimum number of times. Experimental results have shown that there are possibilities of reducing harvest labor requirements with mechanical strippers. Before this practice can become economical, however, mechanical strippers, and cleaning and ginning equipment will have to be improved to prevent or offset the loss in grade of machine-stripped cotton.

Power and labor requirements for cotton are relatively high. Many farmers in these areas can reduce requirements through increased and efficient utilization of equipment already available on farms. When conditions permit a shift to more mechanical power, additional savings in power and labor requirements can be achieved. The use of two-row equipment instead of smaller implements on workstock farms can lower production costs and raise efficiency. On tractor farms, the use of two-row equipment instead of one-row equipment can reduce power requirements as much as 46 per cent.

Cotton growers are faced today with the problem of how far they should go in substituting machinery for man labor under existing economic conditions. The extent to which these shifts should be made on individual farms will depend on the topography of cotton land on these farms, future government-control programs, and relative costs of machinery and labor.

APPENDIX TABLE 1. ESTIMATED ACREAGE, YIELD AND PRODUCTION OF COTTON, LIMESTONE VALLEY AREAS OF ALABAMA, 1928-47[1]

Year	Acreage	Yield per acre	Production
	1,000 acres	*Pounds*	*1,000 bales*
1928	797.8	208	332.6
1929	828.7	225	373.1
1930	829.0	199	329.6
1931	769.1	244	374.9
1932	769.2	180	276.2
1933	762.6	175	267.5
1934	491.2	257	252.0
1935	508.2	215	218.0
1936	533.6	252	268.7
1937	608.3	332	404.3
1938	474.3	310	294.2
1939	482.7	241	232.2
1940	489.5	261	255.0
1941	442.9	293	259.9
1942	433.3	343	297.6
1943	450.1	318	286.2
1944	408.8	408	333.5
1945	411.1	387	315.3
1946	491.6	348	341.7
1947	518.8	350	362.8

[1] Source: "Alabama Cotton, Estimated Acreage, Yield, and Production, 1928-1947." Bureau of Agricultural Economics, U.S.D.A., cooperating with Division of Agricultural Statistics, Alabama Department of Agriculture and Industries.

APPENDIX TABLE 2. NUMBER OF FARMS AND ACRES OF COTTON, BY TYPES OF POWER USED AND BY SIZE OF COTTON ENTERPRISE, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Size of cotton enterprise	Type of power used					
	Workstock		Combination		Tractor	
	Number farms	Acres cotton	Number farms	Acres cotton	Number farms	Acres cotton
Small (32)[1]:						
Operator	15	84	11	75	1	7
Cropper	1	9	1	5	0	0
Tenant	3	21	0	0	0	0
Medium (40)[1]:						
Operator	20	280	15	180	3	41
Cropper	1	7	2	33	0	0
Tenant	2	30	2	17	0	0
Large (33)[1]:						
Operator	4	110	12	368	6	169
Cropper	2	29	13	468	2	870
Tenant	2	54	2	114	3	169
Total (105)[1]:						
Operator	39	474	38	623	10	217
Cropper	4	45	16	506	2	870
Tenant	7	105	4	131	3	169
TOTAL ALL FARMS[2]	50	624	58	1,260	15	1,256

[1] Number of schedules included in survey.

[2] Total number of farms does not equal total number of schedules since the farm organization included various combinations of operators, croppers, and tenants.

APPENDIX TABLE 3. VARIETIES AND QUALITIES OF COTTONSEED PLANTED, BY SIZE OF COTTON ENTERPRISE, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Item	Unit	Size of cotton enterprise		
		Small	Medium	Large
Number of farms	*Number*	32	40	33
Cotton planted	*Acres*	202	588	2,351
Proportion of purchased seed by varieties:[1]				
Deltapine	*Per cent*	50	60	73
Half and Half	*Per cent*	0	4	12
Stoneville	*Per cent*	23	4	0
White Gold	*Per cent*	0	18	5
All other	*Per cent*	15	4	5
Mixed seed	*Per cent*	11	10	4
Proportion of home-grown seed by varieties:[1]				
Deltapine	*Per cent*	48	54	29
Half and Half	*Per cent*	0	6	0
Stoneville	*Per cent*	29	5	2
White Gold	*Per cent*	7	13	11
All other	*Per cent*	11	13	11
Mixed seed	*Per cent*	4	10	48
Years from breeder:				
Home-grown seed:				
1 year	*Per cent*	15	14	14
2 years	*Per cent*	27	35	65
3 years and over	*Per cent*	42	35	16
Not known	*Per cent*	16	16	5
Purchased seed:				
Direct from breeder	*Per cent*	0	14	17
1 year	*Per cent*	64	55	33
2 years	*Per cent*	15	5	18
3 years and over	*Per cent*	0	0	6
Not known	*Per cent*	21	26	27

[1] Varieties listed are those most commonly used.

APPENDIX TABLE 4. COTTON HARVESTING PRACTICES, YIELD OF LINT COTTON PER ACRE, AND SEED COTTON PER 500-POUND BALE, BY SIZE OF COTTON ENTERPRISE, LIMESTONE VALLY AREAS OF ALABAMA, 1947

Item	Unit	Size of cotton enterprise		
		Small	Medium	Large
Number of farms	*Number*	32	40	33
Acres harvested	*Acres*	202	588	2,349
Proportion of cotton:				
Hand picked	*Per cent*	100	100	100
Porportion of cotton hand picked by:				
Family labor	*Per cent*	73	68	65
Hired labor	*Per cent*	27	32	35
Bales produced	*Number*	160	410	1,917
Lint yield per acre	*Pounds*	396	350	408
Seed cotton per 500-lb. bale	*Pounds*	1,253	1,257	1,278

APPENDIX TABLE 5. MAN LABOR REQUIREMENTS PER ACRE FOR PRODUCING COTTON, BY USUAL OPERATIONS PERFORMED, BY SIZE OF COTTON ENTERPRISE, AND BY TYPE OF POWER USED, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Size of cotton enterprise by power groups	Number of records	Man labor used per acre by specified operations												
		Land preparation												
		Cut stalks	Flat breaking	Cultivate after flat breaking	Bed after flat breaking	Cultivate beds	Lay off rows; open furrows	Planting	Fertilize	Cultivate	Chop and hoe	Harvesting	Hauling	Total
	(No.)	(Man hours per acre)												
WORKSTOCK FARMS:														
Small:														
Operator	(15)	1.3	5.9	1.1	--	--	--	2.0	2.6	10.6	20.9	66.3	0.1	110.8
Cropper[1]	(4)	1.3	4.4	2.7	1.6	.8	1.5	2.0	2.4	14.0	30.9	79.4	.1	141.1
Medium:														
Operator	(20)	1.3	4.4	1.2	--	--	1.5	2.0	2.4	11.4	20.9	56.3	.1	101.5
Cropper[1]	(3)	1.3	4.4	2.7	1.6	1.5	--	2.0	2.4	10.0	20.9	78.8	.1	125.7
Large:														
Operator	(4)	1.0	4.4	1.2	--	--	1.5	2.0	2.4	10.0	20.9	56.6	.1	100.1
Cropper[1]	(4)	1.3	4.4	1.2	1.6	1.3	--	2.0	2.4	8.5	20.9	61.3	.1	105.0
TRACTOR FARMS:														
Large:														
Operator	(6)	.5	1.6	.8	--	--	--	.9	1.1	4.1	20.9	62.1	.1	92.1
Cropper[1]	(5)	.4	1.2	.5	--	--	--	.9	1.1	4.7	20.9	90.2	.1	120.0

[1] Tenants were combined with croppers.

APPENDIX TABLE 6. POWER REQUIREMENTS PER ACRE FOR PRODUCING COTTON, BY USUAL OPERATIONS PERFORMED, BY SIZE OF COTTON ENTERPRISE, AND BY TYPE OF POWER USED, LIMESTONE VALLEY AREAS OF ALABAMA, 1947

Size of cotton enterprise by power groups	Number of records	Power used per acre by specified operations												
			Land preparation											
		Cut stalks	Flat breaking	Cultivate after flat breaking	Bed after flat breaking	Cultivate beds	Lay off rows; open furrows	Planting	Fertilize	Cultivate	Chop and hoe	Harvesting	Hauling	Total
	(No.)	(Power requirements [hrs.] per acre)												
WORKSTOCK FARMS:														
Small:														
Operator	(15)	2.6	5.9	1.8	--	--	--	1.8	2.0	13.8	--	--	0.1[1]	28.0
Cropper[2]	(4)	2.6	8.4	5.4	2.6	1.2	2.8	1.8	1.8	18.2	--	--	.3	45.1
Medium:														
Operator	(20)	2.6	8.4	2.2	--	--	2.8	1.8	1.8	14.8	--	--	.3	34.7
Cropper[2]	(3)	2.6	8.4	5.4	2.6	1.5	--	1.8	1.8	13.0	--	--	.3	37.4
Large:														
Operator	(4)	2.0	8.4	2.2	--	--	2.8	1.8	1.8	13.0	--	--	.3	32.3
Cropper[2]	(4)	2.6	8.4	2.2	2.6	1.3	--	1.8	1.8	15.0	--	--	.3	36.0
TRACTOR FARMS:														
Large:														
Operator	(6)	.5	1.6	.8	--	--	--	.5	.4	4.1	--	--	.1[1]	8.0
Cropper[2]	(5)	.4	1.2	.5	--	--	--	.5	.4	4.7	--	--	.1[1]	7.8

[1] Truck or car power.
[2] Tenants were combined with croppers.

APPENDIX TABLE 7. AVERAGE ANNUAL USE AND RATES OF PERFORMANCE FOR SPECIFIED OPERATIONS IN PRODUCING COTTON, BY TYPES OF EQUIPMENT USED, LIMESTONE VALLEY AREAS OF ALABAMA, 1947[1]

Operations performed by size of equipment used	Farms using	Times over	Annual use		Acres per 10-hour day	One time over		
			Acres cov'd	Hours used		Man hours per acre	Mule hours per acre	Tractor hours per acre
	Number	*Number*	*Acres*	*Hours*	*Acres*	*Hours*	*Hours*	*Hours*
Cut stalks								
1-row (mule)	33	1.0	13.6	17.7	7.7	1.3	2.6	--
2-row (mule)	30	1.0	19.4	19.4	10.0	1.0	2.0	--
Drag (mule)	3	1.0	8.8	10.6	8.3	1.2	2.5	--
Disc harrow (tractor)	5	1.0	33.8	16.9	20.0	.5	--	.5
2-row (tractor)	5	1.0	48.0	19.2	25.0	.4	--	.4
Flat-break:								
Moldboard:								
1-bottom (1-mule)	22	1.0	9.7	57.2	1.7	5.9	5.9	--
1-bottom (2-mule)	42	1.0	14.6	64.2	2.3	4.4	8.4	--
2-bottom (tractor)	7	1.3	152.4	297.2	6.7	1.5	--	1.5
Disc harrow (mule)	4	1.0	24.2	87.1	2.8	3.6	7.3	--
Disc plow (tractor):								
2-disc	38	1.1	21.3	37.5	6.2	1.6	--	1.6
3-disc	6	1.0	34.7	41.6	8.3	1.2	--	1.2
4-disc	4	1.0	26.5	23.8	11.1	.9	--	.9
5-disc	4	1.0	24.5	29.4	8.3	1.2	--	1.2
Disc harrow (tractor)	14	1.1	15.7	13.8	12.5	.8	--	.8
Cultivate flat-broken land:								
Section harrow (mule)	54	1.3	16.1	25.1	8.3	1.2	2.2	--
Disc harrow (mule)	9	1.0	10.1	27.3	3.7	2.7	5.4	--
Drag (mule)	15	1.0	18.4	20.2	9.1	1.1	1.8	--
Section harrow (tractor)	21	1.1	74.8	32.9	25.0	.4	--	.4
Disc harrow (tractor)	47	1.1	44.1	34.0	14.3	.7	--	.7
Drag (tractor)	5	1.2	23.2	19.5	14.3	.7	--	.7

(Continued)

[1] Comparable types of equipment in all size and power groups were averaged to obtain rates of performance by types of equipment used for specified operations.

APPENDIX TABLE 7 (*Continued*). AVERAGE ANNUAL USE AND RATES OF PERFORMANCE FOR SPECIFIED OPERATIONS IN PRODUCING COTTON, BY TYPES OF EQUIPMENT USED, LIMESTONE VALLEY AREAS OF ALABAMA, 1947[1]

Operations performed by size of equipment used	Farms using	Times over	Annual use		Acres per 10-hour day	One time over		
			Acres cov'd	Hours used		Man hours per acre	Mule hours per acre	Tractor hours per acre
	Number	*Number*	*Acres*	*Hours*	*Acres*	*Hours*	*Hours*	*Hours*
Bed after flat-break:								
1 time to row (mule)	18	1.0	13.1	21.0	6.2	1.6	2.6	--
Cultivate after bedding:								
Scratcher (mule)	8	1.0	14.0	21.0	6.7	1.5	1.5	--
Drag (mule)	4	1.0	8.4	67.2	12.5	.8	1.2	--
Section harrow (mule)	4	1.0	7.5	7.5	10.0	1.0	2.1	--
Top harrow (mule)	11	1.0	18.0	30.6	5.9	1.7	1.7	--
Lay off rows and open furrows:								
Georgia stock (mule)	25	1.0	12.0	21.6	5.6	1.8	1.9	--
1-row cultivator (mule)	17	1.1	14.4	23.8	6.7	1.5	2.8	--
Plant:								
1-row planter (mule)	76	1.0	12.8	23.0	5.6	2.0	1.8	--
2-row planter (mule)	26	1.0	30.2	33.2	9.1	1.2	1.1	--
1-row planter (tractor)	8	1.0	123.1	73.9	16.7	1.0	--	.6
2-row planter (tractor)	13	1.0	30.5	12.2	25.0	.6	--	.4
Fertilize:								
1-row distributor (mule)	72	1.0	13.3	23.9	5.6	2.4	1.8	--
2-row distributor (mule)	27	1.0	29.4	32.3	9.1	1.5	1.1	--
1-row distributor (tractor)	9	1.0	110.7	66.4	16.7	1.2	--	.6
2-row distributor (tractor)	12	1.0	30.1	12.0	25.0	1.1	--	.4
Side-dress:								
1-row distributor (mule)	17	1.0	12.8	24.3	5.3	2.1	1.9	--
2-row distributor (tractor)	7	1.0	21.6	8.6	25.0	1.2	--	.4

(Continued)

[1] Comparable types of equipment in all size and power groups were averaged to obtain rates of performance by types of equipment used for specified operations.

APPENDIX TABLE 7 (*Continued*). AVERAGE ANNUAL USE AND RATES OF PERFORMANCE FOR SPECIFIED OPERATIONS IN PRODUCING COTTON, BY TYPES OF EQUIPMENT USED, LIMESTONE VALLEY AREAS OF ALABAMA, 1947[1]

Operations performed by size of equipment used	Farms using	Times over	Annual use		Acres per 10-hour day	One time over		
			Acres cov'd	Hours used		Man hours per acre	Mule hours per acre	Tractor hours per acre
	Number	*Number*	*Acres*	*Hours*	*Acres*	*Hours*	*Hours*	*Hours*
Cultivate:								
½-row (mule)	16	4.8	16.0	222.7	3.4	2.9	2.9	--
½-row and 1-row (mule)	36	5.5	14.2	156.2	5.0	2.0	2.6	--
1-row (mule)	31	5.2	16.1	142.3	5.9	1.7	3.0	--
1-row and 2-row (mule)	8	5.8	16.6	144.4	6.7	1.5	3.0	--
2-row (mule)	6	1.0	33.7	27.0	12.5	.8	1.6	--
1-row (tractor)	8	5.4	21.1	136.7	8.3	1.2	--	1.2
2-row (tractor)	34	5.3	32.7	121.3	14.3	.7	--	.7
Chop and hoe:								
1 time over	39	1.0	21.5	258.0	.8	12.0	--	--
2 times over	58	2.0	17.0	302.6	1.1	8.9	--	--
3 times over	20	3.0	19.2	576.0	1.0	10.0	--	--
4 times over	3	4.0	289.0	11,444.4	1.0	9.9	--	--
Poison:								
4-row duster (tractor)	3	1.0	24.0	9.6	25.0	.4	--	.4
Haul:								
Mule and wagon	62	1.0	29.1	2.9	100.0	.1	.3	--
Truck and/or car and trailer	70	1.0	19.1	1.9	100.0	.1	--	.1[2]

[1] Comparable types of equipment in all size and power groups were averaged to obtain rates of performance by types of equipment used for specified operations.

[2] Truck or car hours.