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FARM POWER *and* EQUIPMENT COSTS *in* NORTHERN ALABAMA

An analysis of the use and cost of operation of farm tractors and workstock and their associated equipment on 479 Northern Alabama farms in 1945

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FARM POWER *and* EQUIPMENT COSTS *in* NORTHERN ALABAMA

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CONTINUED farm labor shortages, high farm wage rates, and recent changes in organization of farms have focused a great many farmers' attention to the possibility of shifting to the use of tractors and tractor equipment on their farms. Many farmers who realize the economic possibilities of mechanizing their farming operations are already rapidly moving in that direction. Those farmers already largely mechanized are now planning future adjustments to utilize more efficiently the power they now have. A third group, and perhaps the largest of the three, is still undecided about using tractor power and tractor equipment on their farms. It is anticipated that the trend towards more complete mechanization will continue.

Farmers are now raising questions as to the cost of operating farm tractors and the relative accomplishments of tractors and tractor equipment as compared to workstock as a source of power. Since a large number of farmers in northern Alabama have had considerable experience with tractor power in recent years, it was felt that their experiences could make a valuable contribution with respect to what might be expected of tractor power on farms in this and in other similar areas.

In June 1946, basic data on the use and cost of operation of farm power and equipment were obtained from a survey[1] of 479 farms in this area. The farms included in the survey were distributed as shown in Figures 1 and 2. Basic data were obtained on 112 farms operated with tractor power only, on 197 farms operated with both tractor and workstock power, and on 170 farms operated with workstock power only.

The purposes of this bulletin are (1) to present basic informa-

[1]Appreciation is expressed to R. M. Reaves and J. L. Liles, Jr., of the Alabama Agricultural Extension Service for their helpful suggestions in planning the project, and to all of the Extension Service personnel in northern Alabama who assisted in the collection of the basic information upon which this study is based.

tion on the cost of operation of farm tractors, tractor equipment, workstock, and workstock equipment; (2) to compare the requirements for major farm operations when accomplished with different levels of power and equipment; (3) to indicate the variations in costs that occur between farms operated with different sources of power; and (4) to indicate the variations in power and machinery costs that occur between different type-of-farming areas in northern Alabama.

No attempt is made in this bulletin to enumerate or to explain the possible uses of the data shown herein. It should be emphasized, however, that the data in this report are based upon actual farmers' estimates, and that the figures, which appear in the following tables and discussion, are averages of these estimates. They should be used as such. Variations are normally expected to occur from year to year, or even within the same year between individual farms. Such variations must be taken into account in using these data.

AREA SURVEYED

The northern Alabama area included in the survey, Figures 1 and 2, represents approximately 26 per cent of the total farm land area of the state.[2] It includes two major type-of-farming areas and part of a third area.[3]

The Tennessee Valley area[4] is characterized by "heavy soils, reasonably level topography, and numerous large holdings of land have encouraged . . . the use of tractors and other types of labor-saving farm implements in this area."[5] Crop yields are relatively high. Agriculture is centered around cotton as the principal cash crop. In recent years, some shift has been made towards an increase in feed crop and livestock production; the area "is looked upon as a very important potential livestock area."[6]

The Highland Rim area is a part of the Tennessee Valley type-of-farming area. It differs from the remainder of the area mainly in its soil characteristics. Its soils are more difficult to cultivate; they have a tendency to thaw out and warm up later in the spring; they are more difficult to drain and are somewhat less

[2]1940 Census.
[3]See Alvord, et. al., "Factors Influencing Alabama Agriculture." Ala. Agr. Expt. Sta. Bul. No. 250, 1941. The area descriptions in this section are based largely upon this bulletin. For a more complete description of the several areas, see pages 65-72.
[4]This area includes part of the Coosa River Valley area of Alabama, Figures 1 and 2.
[5] Op. cit., page 65.
[6]Ibid., page 69.

TRACTOR POWER AND EQUIPMENT

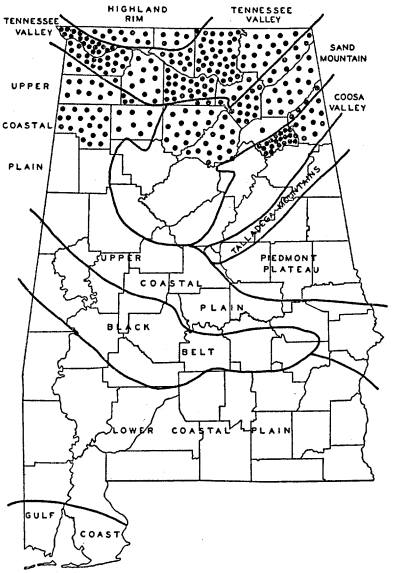

FIG. 1. — Distribution of sample farms in Northern Alabama in study of tractor power and equipment costs, 1945.

WORKSTOCK POWER AND EQUIPMENT

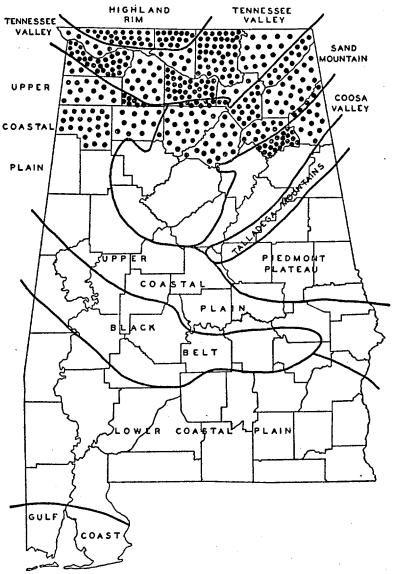

FIG. 2. — Distribution of sample farms in Northern Alabama in study of workstock power and equipment costs, 1945.

responsive to good soil treatments; and they are not inherently as fertile as are those of the remainder of the Valley area. Highland Rim farms are generally smaller, but farmers follow the same farming systems as in the Valley area. Crop yields are slightly lower than on Valley soils.

The Sand Mountain area varies in topography from rugged mountains to gently rolling plateaus. Soils are chiefly sandy, have high water-holding capacity, and are exceptionally responsive to proper treatments of commercial fertilizers, manure, and green manure crops. Farms are generally small family-size units. As a rule, farmers are self-sufficient in food and feed production. Cotton is the principal cash crop. Crop yields are high. Pastures in this area are poor; livestock, with the exception of poultry and some hogs, are kept largely for home use.

The Upper Coastal Plain area, shown in Figures 1 and 2, represents only about 22 per cent of this area in the state.[7] The

[7]The data shown in this bulletin for the Upper Coastal Plain area are for the sample area only. They may not be representative for the entire Upper Coastal Plain area of the state.

area shown is characterized by rolling to hilly topography and severely-eroded silt and sandy loam soils. Farms are generally small; farming is mostly in small "patchy" fields. Cotton is the principal cash crop. Crop yields are at about the state average. Commercial livestock is not important. Much idle cropland exists in the area, even on farms in active operation.

FARM POWER and EQUIPMENT INVENTORIES

Available Labor and Power on Farms

The permanent labor force on the northern Alabama farms studied consisted of 2.1 families per farm in 1945, including the operator's family. Each family handled about 47 acres of crops in 1945. Families on farms operated with workstock only handled 30 acres of crops per family; on farms where tractor power was used, each family handled more than 50 acres of crops. On most farms in this area, power is supplied both by tractors and by workstock. Within the area, the range is from all tractor power on some farms to all workstock power on others. The process of change to mechanical power may be quite rapid in some areas, but farmers usually are reluctant to dispose of their workstock when tractors are first introduced on farms.

Assuming that one tractor should replace the equivalent of 5 head of workstock,[8] farms operated with workstock only utilized less power per crop acre than tractor operated farms. Power available per crop acre was highest on farms where both tractors and workstock were used; this may indicate a surplus of power on many of these farms.

Cotton, the principal cash crop in this area, occupied fewer acres per unit of power on farms where both tractors and workstock were used than it did on either farms operated with tractors only or with workstock only. Variations in the acreages of other major crops, as related to available farm power, are shown in Table 1.

[8]This study indicates that the actual replacement rate in northern Alabama has been 4.5. But on the basis of average amount of work performed in 1945, each tractor should have replaced approximately 5.0 head of workstock.

TABLE 1.—TOTAL AVAILABLE FARM POWER PER FARM RELATED TO NUMBER OF FAMILIES PER FARM AND TO CROPLAND ACREAGE PER FARM ON 479 FARMS IN NORTHERN ALABAMA, 1945

Item	Unit	Type of power used			All farms
		Tractors only	Tractors and workstock	Workstock only	
Number of farms	No.	112	197	170	479
Power available per farm					
Tractors	No.	1.2	1.2	0	.8
Workstock	No.	0	2.8	2.4	2.0
Total Available farm power[1]	Units	6.0	8.8	2.4	6.0
No. families per farm	No.	1.8	2.8	1.5	2.1
Power available per family	Units	3.3	3.1	1.6	2.8
Cropland acreage per farm	Acres	100	143	44	98
Cropland acreage per family	Acres	56	51	30	47
Power available per 100 acres cropland	Units	6.0	6.2	5.4	6.1
Crops planted per unit of power					
Cotton	Acres	4.2	3.6	4.2	4.0
Corn	Acres	6.0	4.8	6.7	5.8
Small grain	Acres	2.3	2.5	1.7	2.2
All hay	Acres	1.8	2.2	2.9	2.4
Winter legumes, turned	Acres	2.8	3.7	4.6	3.8

[1]Assumes that one tractor should replace the equivalent of 5.0 head of workstock (based on average amount of work performed with available equipment as calculated from the data shown in Tables 11 and 18 of this bulletin).

INVESTMENT IN FARM POWER AND EQUIPMENT

The 1945 inventory value of farm power and equipment on northern Alabama farms averaged $1,447 per farm for tractor farms, $2,094 per farm for farms using both tractors and workstock, and $603 per farm for workstock farms. This represented an average investment of $14.47, $14.65, and $13.70 per crop acre for the respective groups, Table 2.

In all major type-of-farming areas in northern Alabama, the total inventory value per farm was highest on farms where both tractors and workstock were used. In all areas the average inventory value per crop acre was lowest on farms using workstock only. This does not necessarily indicate that the costs of operating power and equipment per crop acre will be also lowest for this group of farms.

TABLE 2.—AVERAGE INVESTMENT IN FARM POWER AND EQUIPMENT PER FARM AND PER CROP ACRE BY TYPE OF POWER USED ON 479 FARMS IN NORTHERN ALABAMA, 1945

Item	Type of power used					
	Tractors only		Tractors and workstock		Workstock only	
	Per farm	Per crop acre	Per farm	Per crop acre	Per farm	Per crop acre
	(Dol.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)
Tractors	771	7.71	803	5.62	--	--
Tractor equipment	676	6.76	592	4.14	--	--
Workstock	--	--	493	3.45	427	9.70
Workstock equipment	--	--	206	1.44	176	4.00
Total	1,447	14.47	2,094	14.65	603	13.70

FARM POWER and EQUIPMENT COSTS

All of the cost data that follow are for the crop year 1945, and are based upon a study of actual farm records obtained from farm operators in northern Alabama in June 1946. The cost data shown are averages and should be used as such. Considerable variation will occur between individual farms and even on the same farm from year to year, due to variations in total investment, age and expected useful life of equipment, amount of annual use, type of work done, efficiency of use, care in the operation, maintenance, service and storage of equipment, and to many other factors. The data shown here, however, may be useful in getting the overall situation in view and in studying the economics of farm power costs. A great many of the farmers' questions relative to farm power costs and the relative accomplishments of different levels of power and equipment can be answered from the data presented herein.

COST OF OPERATING FARM TRACTORS

Records on 337 individual tractors for the crop year 1945 provide the basic data from which tractor costs for this area have been determined. Variations in the cost of operation normally are to be expected. Such variations might be due to the size of tractor, the proportion of full capacity used, the number of days used per year, the type of work performed, and to the age and estimated useful life of the tractor. Each of these factors have

been related to the cost of operation and the results of these analyses follow.

Tractors were divided into three size groups – small, medium, and large – based on maximum rated drawbar-horsepower for the make and model of each particular machine.[9] Tractors that were rated less than 18 horsepower were classified as small, those rated from 18 to 24 horsepower were classified as medium, and those rated over 24 horsepower were classified as large. The average rated horsepower for the small group was found to be 14.7, for the medium group 20.0, and for the large group 28.9. The distribution of tractors by size and by type-of-farming areas as found on the farms studied in northern Alabama in 1945 is shown in Table 3.

TABLE 3.—DISTRIBUTION OF FARM TRACTORS BY SIZE IN SPECIFIED AREAS OF NORTHERN ALABAMA, 1945

Size of tractor[1]	Tennessee Valley		Highland Rim		Sand Mountain		U. Coastal Plain		All areas	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Small	63	30	9	60	43	60	25	66	140	42
Medium	87	41	4	27	16	22	8	22	115	34
Large	62	29	2	13	13	18	5	12	82	24
Total	212	100	15	100	72	100	38	100	337	100

[1]See Appendix Table A.

This table indicates that less than one-third of the tractors in the Tennessee Valley area are small tractors, whereas nearly two-thirds of the tractors in all other northern Alabama areas are small tractors. This variation has a marked effect upon the average cost of operation of tractors for the several areas.

The costs per 10-hour day for operating tractors of different sizes are summarized in Table 4. Total operating costs are made up of two types: (1) cash costs, and (2) overhead or "fixed" costs. Each of these should be carefully considered by the farmer. The cash costs are influenced by the size of tractor, the type of work done, and the days of annual use. Overhead costs are influenced mainly by the purchase price, the age and expected useful life of the tractor, and the number of days of use. Annual overhead costs represent an item of cost that must be covered regardless of the number of days the tractor is used each year.

[9]Based on Official Nebraska Tractor Tests, as reported in "The Tractor Field Book," Farm Implement News Co., Chicago, Ill., 1946. Also see Appendix Table A.

TABLE 4.—AVERAGE COST OF OPERATING SMALL, MEDIUM, AND LARGE TRACTORS PER 10-HOUR DAY IN NORTHERN ALABAMA, 1945

Item	Unit	Av. of all farms operating			All tractors
		Small tractors	Medium tractors	Large tractors	
No. of tractors	No.	140	115	82	337
Av. rated drawbar horsepower	H.P.	14.7	20.0	28.9	20.0
Av. purchase price	Dol.	842	1,111	1,260	1,036
Present age	Yr.	4	5	5	5
Est. total useful life	Yr.	11	13	12	12
Cost per 10-hr. day					
Cash costs[1]					
Fuel (gas or fuel oil)	Dol.	1.59	1.97	2.54	1.95
Grease, oil, filters	Dol.	.26	.45	.62	.41
Repairs and new tires	Dol.	.87	1.12	.97	.98
Service labor	Dol.	.22	.32	.31	.28
Total cash costs	Dol.	2.94	3.86	4.44	3.62
Overhead costs					
Depreciation[2]	Dol.	1.01	.92	1.04	.98
Interest[3]	Dol.	.34	.36	.38	.36
Taxes, housing, ins.	Dol.	.14	.29	.30	.26
Total overhead costs	Dol.	1.49	1.57	1.72	1.60
Total cost per 10-hour day[4]	Dol.	4.43	5.43	6.16	5.22
Hours used per year					
On farm	Hr.	557	786	814	697
Custom work	Hr.	124	56	93	96
Total	Hr.	681	842	907	793
Total cost per hour[4]	Dol.	.44	.54	.62	.52
Total cost per year[4]	Dol.	301.81	456.99	558.38	413.90

[1]Gasoline $0.199 per gallon, fuel oil $0.104 per gallon, lubricating oil $0.190 per quart, grease $0.145 per pound, oil filters $0.66 each, service labor $0.41 per hour, and repairs and new tires as reported by farmers.
[2]Purchase price less 10 per cent (for trade-in-value) divided by the estimated total years of useful life.
[3]One-half of the purchase price plus 10 per cent (for trade-in-value) multiplied by 5 per cent.
[4]Exclusive of the wages paid or value of the labor of the tractor driver.

In comparing tractor costs by sizes, particular attention should be given to the fact that large tractors develop more horsepower; and, when used with the proper size of equipment, they will accomplish more work in a given amount of time than will small tractors.

A detailed breakdown of the costs of operation for tractors by size groups is given in Table 4. All tractors averaged $3.62 per 10-hour day for cash costs. Fuel comprised over 50 per cent of this amount. Cash costs per 10-hour day of use increased as the size of tractor increased. On many farms service labor may not be a direct cash expense because some farmers will drive

and service their own tractors. Annual repair costs per tractor in northern Alabama were high in 1945, amounting to an average of 98 cents per 10-hour day of use for all tractors. Most of the explanation for this high cost is apparently due to lack of proper care in operation and storage of tractors, lack of timeliness of repairs and lubrication, and to some extent to the age of tractors and the topography of the land on which they are used. Most tractors in operation in 1945 were relatively old machines, and were probably being used more than in normal times. Shortages of repair parts due to the war increased repair costs and needs. Repair costs are also affected by the amount of annual use and by the experience of the operator.

Overhead costs (depreciation, interest on investment, taxes, housing, and insurance) averaged $1.60 per 10-hour day of use for all tractors. Few tractors are used to the point where only junk value remains. Most tractors are traded in on new ones before they are completely worn out. A trade-in value of 10 per cent of the new cost was assumed in figuring depreciation. Annual depreciation was based on farmers' estimates of the useful life of the tractors and the average purchase price minus 10 per cent. The interest rate used was 5 per cent. This rate is less than is usually paid by farmers when machinery is purchased on a credit arrangement. However, it is more than farmers can realize by investing their money elsewhere in normal times, and is more than farmers would generally pay on long-time loans. In computing interest charges, it was assumed that dealers would make an average concession of about 10 per cent from list prices of new tractors in the form of trade-in values for old ones. The annual interest charge, therefore, was based on 5 per cent of one-half of the new cost plus 10 per cent. Costs of taxes, housing, and insurance are farmers' estimates.

Total operating costs per 10-hour day averaged $5.22 for all tractors. On an hourly basis, total operating costs for small tractors amounted to 44 cents, medium tractors 54 cents, and large tractors 62 cents. In 1945, small tractors were used 681 hours, medium tractors 842 hours, and large tractors 907 hours.

Tractor costs were higher on farms where both tractors and workstock were used than on farms operated with tractors only. The data in Table 5 indicate that the cost per hour of use amounted to 56 cents where both tractors and workstock were used but was only 46 cents where tractors were the only source of

TABLE 5.—AVERAGE COST OF OPERATING TRACTORS RELATED TO TYPE OF POWER USED ON FARMS IN NORTHERN ALABAMA, 1945

Item	Unit	Type of power used on farms	
		Tractor power only	Tractors and workstock
No. of tractors	No.	134	203
Av. rated drawbar horsepower	H.P.	19.0	20.7
Cost per 10-hour day			
Cash costs	Dol.	3.29	3.85
Overhead costs	Dol	1.36	1.71
Total	Dol.	4.65	5.56
Hours used per year			
On farm	Hr.	703	693
Custom work	Hr.	122	79
Total	Hr.	825	772
Costs per hour used	Dol.	.46	.56
Total annual costs	Dol.	384.68	429.23

power. This difference is due both to the difference in average rated horsepower of the two groups and to the number of days used as shown in Table 5.

By type-of-farming areas, tractor costs were highest in the Tennessee Valley area and lowest in the Upper Coastal Plain area of northern Alabama. The Valley area had larger tractors on the average than any other area, Table 6. Farms in this

TABLE 6.—AVERAGE COST OF OPERATING TRACTORS IN SPECIFIED AREAS OF NORTHERN ALABAMA, 1945

Item	Unit	Tennessee Valley	Highland Rim	Sand Mountain	U. Coastal Plain
No. of tractors	No.	212	15	72	38
Av. rated drawbar horsepower	H.P.	21.0	18.3	18.7	17.1
Costs per 10-hour day					
Cash costs	Dol.	4.17	3.47	2.89	2.31
Overhead costs	Dol.	1.59	1.61	1.80	1.21
Total	Dol.	5.76	5.08	4.69	3.52
Hours used per year					
On farm	Hr.	797	573	475	599
Custom work	Hr.	27	139	205	248
Total	Hr.	824	712	680	847
Cost per hour used	Dol.	.58	.51	.47	.35
Total annual costs	Dol.	474.30	361.90	318.96	298.10

area were also larger than in other areas; consequently, tractors were used more hours per farm in the Valley than in other areas. Custom work was lowest in the Valley area and highest in the Upper Coastal Plain area.

The effects of the proportion of the full horsepower capacity of tractors utilized on the average cost of operation is indicated by the data on fuel requirements, Table 7. Total operating costs will be higher when tractors are used for heavy drawbar work, such as breaking, disking, and bedding, than when used for such

TABLE 7.—AVERAGE FUEL AND OIL REQUIREMENTS PER 10-HOUR DAY FOR TRACTORS WITH HEAVY AND LIGHT DRAWBAR LOADS AND FOR BELT WORK IN NORTHERN ALABAMA, 1945

Size of tractor	No. of tractors	Requirements per 10-hour day					
		Heavy load[1]		Light Load[2]		Belt work	
		Fuel	Oil	Fuel	Oil	Fuel	Oil
	(No.)	(Gal.)	(Qt.)	(Gal.)	(Qt.)	(Gal.)	(Qt.)
Small tractors	140	12.4	1.0	8.6	.8	8.6	.8
Medium tractors	115	17.7	1.4	13.1	1.3	13.5	1.5
Large tractors	82	24.1	1.4	18.0	1.2	17.0	1.1
All tractors	337	17.1	1.2	12.4	1.1	11.7	1.1

[1]Includes breaking, disking, bedding, etc.
[2]Includes planting, cultivating, combining, mowing, harrowing, etc.

light drawbar work as planting, cultivating, and mowing or for belt work. On the average, from 34 to 46 per cent more fuel was consumed when tractors were doing heavy drawbar work than when doing light drawbar or belt work. Variations in oil consumption were of a lesser degree than fuel consumption.

Calculations of the total operating costs in dollars were not attempted because of the difficulty in arriving at a satisfactory method for allocation of overhead costs, repairs, and service labor costs where tractors were used for both heavy and light drawbar work.

Operating costs of tractors per 10-hour day depend not only on the size of the tractor and the type of work done, but also on the number of days used during the year. The relationship between the number of days used per year and the cost of operating tractors per 10-hour day is shown in Table 8. A total of 54 tractors was used less than 40 days a year at an average cost of 95 cents an hour. One hundred and thirty-four tractors were used from 40 to 80 days at an average cost of 64 cents an

hour. Ninety-six tractors were used from 80 to 120 days at an average cost of 51 cents an hour. The fifty-three tractors used 120 days and over were operated at a cost of 37 cents an hour. Variations in cost per hour for different sizes of tractors in relation to number of days used followed the same general pattern as shown in Table 8.

TABLE 8.—COST PER 10-HOUR DAY FOR OPERATING TRACTORS RELATED TO NUMBER OF DAYS USED PER YEAR IN NORTHERN ALABAMA, 1945

Days used per year	No. of tractors	Av. days used	Cost per 10-hour day			Cost per hour
			Cash	Overhead	Total	
	(No.)	(Days)	(Dol.)	(Dol.)	(Dol.)	(Dol.)
Under 40	54	27	5.36	4.12	9.48	.95
40- 79	134	59	4.29	2.11	6.40	.64
80-119	96	96	3.70	1.42	5.12	.51
120 and over	53	154	2.84	.86	3.70	.37
All tractors	337	79	3.62	1.60	5.22	.52

Farmers who plan to replace workstock with tractors should take these variations into account. On small farms, it should be remembered that some additional use may be made of tractors by engaging in custom work. The possibilities of such a system are indicated by the data on custom work given in Table 6. In the Tennessee Valley area, where farms are generally large, custom work made up less than 4 per cent of total annual use of tractors. In other areas, where farms are generally small, custom work amounted to 20 to 30 per cent of the total annual tractor use. Farmers operating small units should also recognize that a small farm tractor may be too large for the size of farm they are operating. Data on custom work in Table 4 indicate one possibility of increasing the annual use of such a tractor. In northern Alabama small tractors in 1945 were used twice as many days for custom work as were tractors in the two larger groups. Custom work made up nearly 20 per cent of the annual total for small tractors, but averaged less than 10 per cent for the two larger groups.

Northern Alabama farmers strongly prefer having tractors mounted on rubber tires to those mounted on steel. This study shows that 311 tractors were mounted on rubber and only 26 or 7.7 per cent of the total were on steel. Farmers estimated that the expected life of rubber tires on rear wheels would be 5.2 years and on front wheels 4.2 years. In general, farmers' estimates show that tires on small tractors will last longer than

those on large tractors. Variations in farmers' estimates for different sizes of tractors by areas are shown in Table 9. The variation in the life of tires is dependent both upon the extent of annual use, and on the treatment and care given to proper service, use, and storage of tires on tractors.

TABLE 9.—ESTIMATED LIFE OF RUBBER TIRES ON TRACTORS BY SIZE OF TRACTOR IN SPECIFIED AREAS OF NORTHERN ALABAMA, 1945

Area	Size of tractor						All tractors	
	Small		Medium		Large			
	Rear wheels	Front wheels	Rear wheels	Front wheels	Rear wheels	Front wheels	Rear wheels	Front wheels
	(Yr.)	(Yr.)	(Yr.)	(Yr.)	(Yr.)	(Yr.)	(Yr.)	(Yr.)
Tennessee Valley	5.4	4.1	5.9	4.9	4.8	3.0	5.4	4.0
Highland Rim	4.7	4.6	6.3	5.3	5.0	4.0	5.0	4.7
Sand Mountain	4.8	4.6	3.9	3.2	3.8	3.9	4.4	4.2
Upper Coastal Plain	5.6	5.5	6.2	5.0	6.4	4.0	5.8	5.1
All areas	5.2	4.6	5.7	4.7	4.6	3.4	5.2	4.2

COSTS OF OPERATING TRACTOR-DRAWN EQUIPMENT

Tractor costs make up only a part of the mechanization analysis. To complete the picture requires an appraisal of the costs of operating the equipment used in conjunction with the tractor. The expense for farm machinery upkeep and repairs is usually a substantial item on most tractor farms. In this study, data were obtained and analyzed on the cost of operating individual pieces of farm equipment. The results of this analysis on an annual cost basis are summarized in Table 10.

Tractor-drawn equipment costs per acre covered and per hour used are shown for individual pieces of equipment in Table 11. The usual rates for performing different operations with tractors and with different levels and types of tractor equipment are also given in Table 11. The rates shown are averages. Considerable variation occurs in actual practice, depending upon the size of tractor, the topography of cropland, the experience of the operator, and many other factors. Some of the rates of performance for tractor equipment in Table 11 may change in the future as farmers gain additional experience in handling tractors and tractor equipment. The data shown can be made quite useful by farmers, however, in studying the sizes and types of equipment they may wish to purchase or use, and in making

TABLE 10.—AVERAGE PURCHASE PRICE AND AVERAGE ANNUAL COST OF OPERATING TRACTOR EQUIPMENT ON 309 FARMS IN NORTHERN ALABAMA, 1945

Type of equipment	Av. purchase price[1]	Present age	Total est. useful life	Av. annual cost per machine				
				Repair and upkeep[2]	Depreciation[3]	Interest[4]	Taxes housing ins.[2]	Total
TILLAGE IMPLEMENTS:	(Dol.)	(Yr.)	(Yr.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)
Tandem disk	159	4	12	13.29	11.92	4.37	.36	29.94
Plow, 1-bottom	79	5	18	9.46	3.95	2.17	.41	15.99
Plow, 2-bottom	139	5	15	15.66	8.34	3.82	1.08	28.90
Plow, 3-bottom	244	5	17	26.96	12.92	6.71	1.60	48.19
Plow, 1-disk	123	5	13	4.75	8.52	3.63	.81	17.71
Plow, 2-disk	172	5	13	15.20	11.91	4.73	.92	32.76
Plow, 3-disk	249	4	13	39.81	17.24	6.84	1.24	65.13
Plow, 4-disk	220	4	13	24.81	15.23	6.05	2.12	48.21
Plow, 5-disk	213	3	8	6.67	23.97	5.86	.25	36.75
Harrow, disk	141	5	12	10.06	10.68	3.87	.87	25.48
Harrow, spike tooth	34	6	12	1.39	2.55	.93	.27	5.14
Harrow, spring tooth	27	5	11	3.56	2.21	.74	.06	6.57
Cultipacker	107	6	15	4.72	6.42	2.94	.62	14.70
Drag, home-made	20	4	10	.96	1.80	.55	.25	3.56
Tillage tool	140	4	11	5.98	11.45	3.85	.52	21.80
PLANTING EQUIPMENT:								
Planter, 1-row	98	3	12	2.61	7.35	2.69	.41	13.06
Planter, 2-row	160	5	12	8.27	12.00	4.40	.95	25.62
Grain drill	190	7	16	12.28	10.69	5.22	2.00	30.19
CULTIVATING EQUIPMENT:								
Cultivator, 1-row	84	4	13	7.13	5.82	2.31	.48	15.74
Cultivator, 2-row	157	5	14	14.15	10.09	4.32	1.24	29.80
Cultivator, 4-row	300	7	14	65.00	19.28	8.25	.00	92.53
HARVESTING EQUIPMENT:								
Combine, small	603	4	10	32.06	54.27	16.58	6.70	109.61
Combine, medium	773	4	9	64.13	77.30	21.26	7.17	169.86
Combine, large	865	4	9	74.05	86.50	23.79	2.97	187.31
Corn picker	561	2	9	12.25	56.10	15.43	1.08	84.86
Mower, 4-5 feet	129	5	13	8.76	8.93	3.55	.54	21.78
Mower, 6 feet	144	5	13	11.99	9.97	3.96	1.61	27.53
Mower, 7 feet	160	5	12	18.58	12.00	4.40	.83	35.81
Rake, dump or sulky	74	7	15	2.44	4.44	2.03	.47	9.38
Rake, side delivery	162	3	12	10.99	12.15	4.45	.51	28.10
STATIONARY MACHINES:								
Hay baler	588	6	15	22.30	35.28	16.17	1.17	74.92
Feed grinder, burr	145	8	17	5.00	7.68	3.99	1.92	18.59
Hammer mill	166	5	15	3.07	9.96	4.56	1.55	19.14
Wood saw, portable	36	6	17	1.71	1.91	.99	.56	5.17
VEHICLES AND MISCELLANEOUS EQUIPMENT:								
Trailer, 2-wheel	77	4	13	2.79	5.33	2.12	.37	10.61
Trailer, 4-wheel	146	3	12	11.58	10.95	4.02	.41	26.96
Wagon, 2-horse	115	8	19	3.26	5.45	3.16	.68	12.55
Manure spreader	195	5	13	13.69	13.50	5.36	1.41	33.96
Lime spreader	58	3	10	1.40	5.22	1.60	.39	8.61
Stalk cutter, 2-row	61	4	14	1.92	3.92	1.68	.33	7.85

[1]Based on original new cost.
[2]Based on farmers' estimates of new parts, replacement items, repair costs, and service labor.
[3]Purchase price less 10 per cent (for trade-in value) divided by the estimated total years of useful life.
[4]One-half of the purchase price plus 10 per cent (for trade-in value) multiplied by 5 per cent.

TABLE 11.—AVERAGE ANNUAL USE, RATES OF PERFORMANCE, AND COSTS PER UNIT OF PERFORMANCE FOR SPECIFIED TYPES OF TRACTOR EQUIPMENT ON 309 FARMS IN NORTHERN ALABAMA, 1945

Type of equipment	No. of items	Annual use		Acres per 10-hour day	Hours per acre	Cost per acre	Cost per hour
		Acres cov'd	Hours used				
	(No.)	(Acres)	(Hr.)	(Acres)	(Hr.)	(Dol.)	(Dol.)
TILLAGE IMPLEMENTS:							
Tandem disk	30	205	129	15.9	.63	.15	.24
Plow, 1-bottom	15	61	119	5.1	1.96	.27	.14
Plow, 2-bottom	50	107	157	6.8	1.47	.27	.18
Plow, 3-bottom	5	300	236	12.6	.79	.16	.20
Plow, 1-disk	4	65	144	4.5	2.22	.27	.12
Plow, 2-disk	192	134	220	6.1	1.64	.25	.15
Plow, 3-disk	39	146	172	8.5	1.18	.45	.38
Plow, 4-disk	4	139	133	10.5	.96	.35	.36
Plow, 5-disk	3	155	105	14.7	.68	.24	.35
Harrow, disk	248	175	112	15.7	.64	.15	.23
Harrow, spike tooth	110	158	65	24.1	.41	.04	.08
Harrow, spring tooth	12	154	92	16.6	.60	.04	.07
Cultipacker	51	169	73	23.1	.43	.09	.20
Drag, home-made	16	183	94	19.5	.51	.02	.04
Tillage tool	10	66	48	13.9	.72	.33	.45
PLANTING EQUIPMENT:							
Planter, 1-row	38	53	50	10.6	.94	.25	.26
Planter, 2-row	106	119	70	16.9	.59	.22	.37
Grain drill	43	126	70	17.8	.56	.24	.43
CULTIVATING EQUIPMENT:							
Cultivator, 1-row	64	103	112	9.2	1.09	.15	.14
Cultivator, 2-row	182	228	128	17.8	.56	.13	.23
Cultivator, 4-row	3	533	160	33.3	.30	.17	.58
HARVESTING EQUIPMENT:							
Combine, small	37	55	81	6.8	1.47	1.99	1.35
Combine, medium	45	85	113	7.5	1.33	2.00	1.50
Combine, large	21	83	112	7.4	1.35	2.26	1.67
Corn picker	4	177	221	8.0	1.25	.48	.38
Mower, 4-5 feet	27	71	49	14.4	.69	.31	.44
Mower, 6 feet	29	70	46	15.2	.66	.39	.60
Mower, 7 feet	45	120	66	18.3	.55	.30	.54
Rake, dump or sulky	37	51	29	17.8	.56	.18	.32
Rake, side delivery	10	149	65	23.4	.43	.19	.43
STATIONARY MACHINES:							
Hay baler	21	--	94	--	--	--	.80
Feed grinder, burr	14	--	86	--	--	--	.22
Hammer mill	45	--	97	--	--	--	.20
Wood saw, portable	64	--	52	--	--	--	.10
VEHICLES AND MISCELLANEOUS EQUIPMENT:							
Trailer, 2-wheel	80	--	175	--	--	--	.06
Trailer, 4-wheel	8	--	336	--	--	--	.08
Wagon, 2-horse	42	--	122	--	--	--	.10
Manure spreader	12	65	135	4.8	2.08	.52	.25
Lime spreader	28	46	36	12.7	.79	.19	.24
Stalk cutter, 2-row	18	88	33	26.3	.38	.09	.24

farm plans for adjustments in organization or of shifting from workstock power to tractor power.

The data in Table 11 indicate, in general, that as more work is done with a particular machine its average cost per unit of use declines. These data show that larger machines usually accomplish more work in a given amount of time, that costs per acre are usually lower, and that costs per hour are usually higher than with smaller machines.

Much of the tractor-drawn equipment on northern Alabama farms is used only for a short period each year, and this is usually far below the maximum possible use. If the amount of use of such equipment were increased, the cost per acre would be reduced. On some individual farms it was found that some equipment costs were higher per acre than had the work been hired on a custom basis. This might be due to one of two reasons: Either the farmer desired to be completely independent of others, or he may not have been aware of the true costs per unit of service.

The most effective means of lowering costs per acre and costs per hour is to increase the annual use of implements. This does not suggest increasing the acreage on which the machines are used on the operator's farm, provided the most profitable combination of enterprises already exists on the farm. However, when the acreage on the operator's farm is insufficient, costs may be lowered by cooperative use of machines. Such cooperation may be accomplished (1) by joint ownership and use with others, (2) by renting machines and furnishing his own power, or (3) by hiring the work done on a custom basis where the machine, power, and labor are all furnished.

Some farmers with limited resources and only a small amount of annual need for a machine, may find a profitable opportunity in purchasing dependable second-hand equipment to lower their machinery investment. Such equipment, however, must fit the type and size of power available and the size of enterprises on which it is to be used. Particular care should be taken in buying only serviceable machines.

Since depreciation makes up a large part of the total costs of machinery operation, an attempt to extend the useful life of each machine through better care will often prove to be a worthwhile means of lowering costs. Also, timeliness of making re-

pairs and necessary lubrication are important in keeping down repair and upkeep costs.

What do the total farm machinery operating costs per farm for tractor-drawn machinery amount to each year in this area? Total annual costs per farm (exclusive of power and labor costs) will depend upon: (1) total investment in farm machinery; (2) age, expected useful life, and state of repair of each implement; (3) efficiency with which each implement is operated; (4) annual use of each implement; and (5) care taken in properly servicing, operating, and storing each implement.

TABLE 12.—COST OF OPERATING ALL TRACTOR-DRAWN MACHINERY ON FARMS IN NORTHERN ALABAMA, 1945[1]

Item	On farms operated with tractor power only			On farms operated with both tractors and workstock		
	Annual cost per farm	Cost per hour of tractor use	Cost per acre in crops	Annual cost per farm	Cost per hour of tractor use	Cost per acre in crops
	(Dol.)	(Dol)	(Dol.)	(Dol.)	(Dol.)	(Dol.)
Repairs and upkeep	94	.095	.94	73	.079	.51
Depreciation	112	.113	1.12	87	.094	.61
Interest	38	.038	.38	29	.031	.20
Taxes, housing, insurance	11	.011	.11	8	.009	.06
Total	255	.257	2.55	197	.213	1.38

[1]Excludes tractor and labor costs.

The total farm machinery operating costs for tractor-drawn equipment averaged $255 per farm in northern Alabama in 1945 for farms operated only with tractors, Table 12. Where both tractors and workstock were used, tractor-drawn machinery costs averaged $197 per farm. Average expenses amounted to $2.55 per crop acre, and to 26 cents per hour of tractor use on farms operated only with tractors. But where both tractors and workstock were used, average expenses were $1.38 per crop acre, and 21 cents per hour of tractor use. This reduction in expense per crop acre was due both to a smaller investment in tractor-drawn equipment in the latter group and also to its larger average acreage of cropland per farm.

Costs of Keeping Workstock

Records from 367 farms on 952 head of workstock for the crop year 1945 provide the basic data from which workstock costs for northern Alabama have been determined. Approximately 90 per cent of all records on workstock were on mules. Records were obtained only on workstock that were on the surveyed farms throughout the crop year 1945 and that were used for some type of field work or general farm work during the year. Variations between farms in workstock costs are normally expected to occur from year to year and even within the same year. Such variations might be due to changes in the level of feed prices alone. They may also be due to differences in the age, expected work life and value of workstock, number of days used annually, type of work performed, kind and amount of feed fed, and to many other factors.

Total annual net cost per head for all workstock surveyed in northern Alabama was $227.06 in 1945. Table 13 shows that feed costs made up $169.54 or nearly 70 per cent of the total. Corn and legume hay were the main sources of feed. The average amount reported fed per head in 1945 was the equivalent of 66 bushels of corn and 2 tons of legume hay.[10] Because feed costs in this area make up three-fourths of the total annual costs, they represent the chief factor in determining cost variations. Workstock costs per acre or per hour of use depend both upon the prices and rates of feeding and on the annual use per head. A sharp change in feed prices (or value) would have a direct influence on workstock costs in the same direction as the price change.

Chore labor, which represents the time spent in caring for workstock, was valued by farmers at $46.91 per head. Farmers estimated they spent an average of 168 hours for chore labor per head in 1945 and estimated its value at 28 cents per hour.

Depreciation amounted to 5 per cent of the annual workstock costs. The average value of workstock in 1945 was estimated by farmers to be $177 per head.[11] The estimated years of useful life was 17, resulting in a depreciation cost of $10.41 per head

[10]This represents farmers' estimates of feed fed. A feed balance sheet was not used in obtaining these estimates. It is likely that these estimates, therefore, are somewhat higher than would normally exist in this area.

[11]Estimated 1945 value was used to eliminate the wide differences in purchase price of workstock that existed between pre-war and war-time prices of workstock.

annually or of 6 per cent of the 1945 value. Harness costs amounted to $5.86 per head annually. Interest at 5 per cent of one-half of the 1945 value amounted to $4.42 per head. All other costs, including taxes, housing, insurance, veterinary fees, medicine, and shoeing, amounted to $9.28 per head annually. Credit for manure[12] amounted to $19.35 per head. Variations in annual workstock costs per head between farms operated with workstock only and those operated with both workstock and tractors are shown in detail in Table 13.

TABLE 13.—WORKSTOCK COSTS PER HEAD IN NORTHERN ALABAMA, 1945

Item	Unit	Av. of all farms operated with		All farms
		Workstock only	Workstock and tractors	
No. of farms	No.	170	197	367
No. of workstock	No.	402	550	952
Present age	Yr.	9	9	9
Est. total work life	Yr.	18	17	17
Average weight	Lb.	1,041	1,095	1,068
Av. value (1945)	Dol.	178	176	177
Annual costs				
Feed[1]				
All grain	Dol.	98.49	89.00	92.85
All hay	Dol.	69.21	68.81	68.99
All pasture	Dol.	7.15	8.16	7.68
Other	Dol.	.03	.01	.02
Total	Dol.	174.88	165.98	169.54
Other costs				
Harness	Dol.	5.79	5.91	5.85
Chore labor	Dol.	47.89	46.09	46.91
Depreciation[2]	Dol.	9.88	10.35	10.41
Interest[3]	Dol.	4.45	4.40	4.42
Taxes, housing, ins.	Dol.	3.78	3.76	3.77
Miscellaneous[4]	Dol.	5.43	5.56	5.51
Total costs	Dol.	252.10	242.05	246.41
Credit for manure[5]	Dol.	19.35	19.35	19.35
Net annual costs	Dol.	232.75	222.70	227.06
10-hour days worked	Days	76	48	61
Cost per 10-hour day worked	Dol.	3.06	4.64	3.72
Cost per hour worked	Dol.	.31	.46	.37

[1]Value as reported by farmers multiplied by farmers' estimates of the amount of each specified feed fed per head.

[2]Average value (1945) divided by estimated total years of work life.

[3]One-half of the average value (1945) multiplied by 5 per cent.

[4]Includes veterinary fees, medicine, cost of shoeing, and other miscellaneous cash expenses.

[5]Represents the N-P-K content of 60 per cent of the annual production from a 1000-pound animal multiplied by current (1945) values of N-P-K as fertilizers.

[12]Represents the current (1945) value of the N-P-K content of 60 per cent of the annual production of a 1,000 pound animal.

This study indicates that workstock were used, on the average, for a total of 61 days or 610 hours per year, including all hauling and other general farm work. Based on 1945 costs and credits, as shown in Table 13, workstock costs per hour of use amounted to 37 cents. On farms operated with workstock only the cost per hour was 31 cents, whereas on farms using both workstock and tractors for power, workstock costs amounted to 46 cents an hour. This difference was due largely to the difference in the number of hours of annual use between the two groups. Farmers who used workstock only reported approximately 60 per cent greater use of workstock per head annually than operators who used both workstock and tractors on their farms. This may mean that some farms using both power sources, have a surplus of power on the farm.

Results of this study indicate that where both tractors and workstock are available on farms, the bulk of the land preparation is done with tractors, while workstock are used for the bulk of the planting and cultivating. This situation may have developed partly because of the shortage of certain types of tractor equipment during the war years. Also, on many farms the use of tractors is relatively new. Farmers are often slow in disposing of their workstock until they are sure they can handle all of their farming operations with tractor power. Some farmers, too, have not fully made the necessary adjustments in their cropping systems and organization of their labor to enable them to dispose of their workstock.

It is expected, however, that the shift to tractors will continue at an increasing rate as more tractors and tractor-drawn equipment become available. Maintaining farm incomes at a level sufficiently high to encourage more widespread commercial agricultural production will promote the most rapid increase in the adoption of tractors and other labor-saving machinery on northern Alabama farms. In this case, workstock costs would remain high and displacement of workstock would continue at an increasing rate. Farmers in northern Alabama probably will not buy additional workstock if tractors and tractor equipment are available.

Workstock costs per hour of use were highest in the Tennessee Valley and Sand Mountain areas. This was due both to the relatively low number of days used annually and to high annual feed costs. Farmers in these areas reported higher feeding rates

TABLE 14.—WORKSTOCK COSTS PER HEAD IN SPECIFIED AREAS OF NORTHERN ALABAMA, 1945

Item	Unit	Tennessee Valley	Highland Rim	Sand Mountain	Upper Coastal Plain
No. of farms	No.	170	35	107	55
No. of workstock	No.	454	71	281	146
Annual costs					
Feed	Dol.	172.58	170.03	174.01	156.41
Chore labor	Dol.	42.96	33.46	58.55	48.18
Depreciation	Dol.	10.06	8.55	10.33	8.20
Interest	Dol.	4.52	3.85	4.65	4.10
Taxes, housing, ins.	Dol.	3.81	3.54	3.86	3.64
Harness	Dol.	6.05	6.37	5.55	5.91
Miscellaneous	Dol.	6.44	4.80	5.00	4.20
Total	Dol.	246.42	230.60	261.95	230.64
Credit for manure	Dol.	19.35	19.35	19.35	19.35
Net annual costs	Dol.	227.07	211.25	242.60	211.29
10-hour days worked	Days	53	75	62	74
Cost per 10-hour day	Dol.	4.28	2.82	3.91	2.86
Cost per hour worked	Dol.	.43	.28	.39	.29
Feed fed annually					
Corn	Bu.	68	53	71	67
Legume hay	Ton	2.0	2.6	1.8	1.8

per head annually for grain than did farmers in other areas. Total annual costs per head, as shown in Table 14, were highest in the Sand Mountain area. Other than high feed costs, a major factor contributing to this high total cost was chore labor. Farmers in this area devoted an average of 183 hours per head annually to chore labor, and valued such labor at 32 cents an hour. The fact that Sand Mountain farmers devote nearly 10 per cent more time to chore labor for workstock than do other farmers in northern Alabama is probably because it is a usual practice in this area to feed work animals in a dry lot throughout most of the year. Pastures are very poor when available on farms. This may also partly explain the high feeding rates followed by Sand Mountain farmers.

Workstock costs per hour of use decreased as the number of hours worked increased in all areas of northern Alabama, as shown in Table 15. On farms where workstock were used less than 500 hours annually, the costs per hour of use amounted to $1.04. On farms where workstock were used 1,100 hours or more, the costs were only 17 cents per hour. Data in Table 16

TABLE 15.—WORKSTOCK COSTS PER HOUR RELATED TO NUMBER OF HOURS USED IN SPECIFIED AREAS OF NORTHERN ALABAMA, 1945

No. of hours worked	Tennessee Valley	Highland Rim	Sand Mountain	Upper Coastal Plain
	(Dol.)	(Dol.)	(Dol.)	(Dol.)
0- 499	1.06	2.00	.96	.80
500- 699	.39	.32	.44	.35
700- 899	.34	.32	.29	.24
900-1,099	.23	.25	.26	.31
1,100 and over	.14	.18	.19	.18
All farms	.43	.28	.39	.29

TABLE 16.—WORKSTOCK COSTS PER HOUR RELATED TO NUMBER OF HOURS USED BY TYPE OF POWER USED ON FARMS IN NORTHERN ALABAMA, 1945

No. of hours worked	Type of power used on farms		
	Workstock only	Workstock and tractors	All farms
	(Dol.)	(Dol.)	(Dol.)
0- 499	.63	1.15	1.04
500- 699	.39	.38	.39
700- 899	.29	.31	.30
900-1,099	.24	.26	.25
1,100 and over	.18	.15	.17
All farms	.31	.46	.37

show the variations in workstock costs per hour when related to number of hours used by type of power on farms in this area.

COSTS OF OPERATING WORKSTOCK-DRAWN EQUIPMENT

Total annual costs of operating different types and sizes of workstock-drawn equipment on 367 northern Alabama farms in 1945 are summarized for individual pieces of equipment in Table 17.

Workstock-drawn equipment costs per acre covered and per hour used in 1945 are shown in Table 18. The usual rates for performing different operations with workstock and different levels of workstock equipment are also given in Table 18. These rates are averages and should be used as such. Considerable variation may occur in these rates and costs from year to year, or even within the same year between different farms. Such variation might be due to topography, soil conditions, amount of use, experience of the operator, and to many other factors. These

TABLE 17.—AVERAGE PURCHASE PRICE AND AVERAGE ANNUAL COST OF OPERATING SPECIFIED TYPES OF WORKSTOCK EQUIPMENT ON 367 FARMS IN NORTHERN ALABAMA, 1945

Type of equipment	Av. purchase price[1]	Present age	Total est. useful life	Av. annual cost per implement				
				Repair and upkeep[2]	Depreciation[3]	Interest[4]	Taxes housing and ins.[2]	Total
	(Dol.)	(Yr.)	(Yr.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)
HARNESS	22.90	5	10	2.74	2.29	.57	.25	5.85
TILLAGE IMPLEMENTS:								
Turn plow, 1-horse	9.14	9	20	2.93	.46	.23	.18	3.80
Turn plow, 2-horse	19.54	8	18	7.19	1.08	.49	.39	9.15
Disk plow	42.81	11	19	5.37	2.25	1.07	.85	9.54
Middlebuster, 1-horse	7.92	14	25	1.96	.31	.20	.16	2.63
Middlebuster, 2-horse	16.36	10	20	2.15	.82	.41	.33	3.71
Harrow, disk	44.93	11	18	3.39	2.50	1.12	.90	7.91
Harrow, section	21.92	9	17	2.31	1.29	.55	.44	4.59
Roller	36.85	4	12	2.49	3.07	.92	.74	7.22
Drag, home-made	9.85	5	10	1.60	.98	.25	.20	3.03
PLANTING EQUIPMENT:								
Planter, 1-row	25.29	8	16	3.14	1.58	.63	.51	5.86
Planter, 2-row	106.39	7	15	6.08	7.09	2.66	2.13	17.96
Fert. dist., 1-row	9.91	6	12	2.85	.83	.25	.20	4.13
Vetch drill	25.83	6	13	2.30	1.99	.65	.52	5.46
Small grain drill	60.10	6	13	3.92	4.62	1.50	1.20	11.24
CULTIVATING EQUIPMENT:								
Gee whiz (scratcher)	7.99	8	16	2.92	.50	.20	.16	3.78
Joe harrow (top)	7.31	11	22	1.69	.33	.18	.15	2.35
Georgia stock (single)	3.76	8	17	3.10	.22	.09	.08	3.49
Weeder	18.78	3	14	2.25	1.34	.47	.37	4.43
Fowler cultivator	15.84	7	17	2.94	.93	.40	.32	4.59
Riding cult., 1-row	86.75	10	18	6.69	4.82	2.17	1.73	15.41
Walking cult., 1-row	59.19	9	17	7.12	3.48	1.48	1.18	13.26
Walking cult., 2-row	63.00	8	15	5.40	4.20	1.57	1.26	12.43
HARVESTING EQUIPMENT:								
Mower, 2-horse	100.51	9	17	8.09	5.91	2.51	2.01	18.52
Rake, dump	46.23	10	19	1.75	2.43	1.16	.93	6.27
VEHICLES AND MISCELLANEOUS EQUIPMENT:								
Hay baler, stat.	143.00	12	21	13.28	6.81	3.57	2.86	26.52
Lime spreader	40.00	3	11	1.01	3.64	1.00	.80	6.45
Wagon, 2-horse	101.10	11	20	10.09	5.05	2.53	2.02	19.69
Stalk cutter, 1-row	38.42	9	16	2.73	2.40	.96	.77	6.86
Stalk cutter, 2-row	28.87	11	19	2.53	1.52	.72	.58	5.35
Slip scoop	6.90	8	16	.77	.43	.17	.14	1.51

[1]Based on original new cost.
[2]Based on farmers' estimates of costs of new parts, replacement items, repair costs, and service labor.
[3]Purchase price divided by estimated total years of useful life.
[4]One-half of the purchase price multiplied by 5 per cent.

TABLE 18.—AVERAGE ANNUAL USE, RATES OF PERFORMANCE, AND COSTS PER UNIT OF PERFORMANCE FOR SPECIFIED TYPES OF WORKSTOCK EQUIPMENT ON 367 FARMS IN NORTHERN ALABAMA, 1945

Type of equipment	No. of items	Annual use		Acres per 10-hour day	Hours per acre	Cost per acre	Cost per hour
		Acres cov'd	Hours used				
	(No.)	(Acres)	(Hr.)	(Acres)	(Hr.)	(Dol.)	(Dol.)
TILLAGE IMPLEMENTS:							
Turn plow, 1-horse	171	11	55	2.0	5.00	.34	.07
Turn plow, 2-horse	520	28	127	2.2	4.54	.33	.07
Disk plow	16	27	79	3.4	2.94	.35	.12
Middlebuster, 1-horse	20	13	32	4.0	2.50	.20	.08
Middlebuster, 2-horse	85	19	30	6.3	1.59	.20	.12
Harrow, disk	76	26	46	5.6	1.78	.30	.17
Harrow, section	220	53	48	11.0	.91	.09	.10
Roller	6	38	44	8.7	1.15	.19	.16
Drag, home-made	37	45	40	11.3	.88	.07	.08
PLANTING EQUIPMENT:							
Planter, 1-row	289	39	63	6.2	1.61	.15	.09
Planter, 2-row	97	74	60	12.3	.81	.24	.30
Fert. dist., 1-row	214	38	65	5.8	1.72	.11	.06
Vetch drill	93	26	43	6.1	1.64	.21	.13
Small grain drill	13	46	74	6.2	1.61	.24	.15
CULTIVATING EQUIPMENT:							
Gee whiz (scratcher)	339	27	55	4.9	2.04	.14	.07
Joe harrow (top)	98	24	39	6.1	1.64	.10	.06
Georgia stock (single)	433	37	73	5.1	1.96	.09	.05
Weeder	19	43	32	13.6	.74	.10	.14
Fowler cultivator	27	23	38	6.0	1.67	.20	.12
Riding cult., 1-row	27	67	98	6.8	1.47	.23	.16
Walking cult., 1-row	283	77	117	6.6	1.52	.17	.11
Walking cult., 2-row	9	60	80	7.5	1.33	.21	.16
HARVESTING EQUIPMENT:							
Mower, 2-horse	164	31	40	7.8	1.28	.60	.46
Rake, dump	158	30	21	14.1	.71	.21	.30
VEHICLES AND MISCELLANEOUS EQUIPMENT:							
Hay baler, stat.	13	--	116	--	--	--	.23
Lime spreader	8	30	17	17.5	.57	.21	.38
Wagon, 2-horse	276	--	217	--	--	--	.09
Stalk cutter, 1-row	25	44	54	8.2	1.22	.16	.13
Stalk cutter, 2-row	53	38	49	7.7	1.30	.14	.11
Slip scoop	20	--	21	--	--	--	.07

data, however, can be useful to farmers particularly in farm planning, such as making needed adjustments in organization, evaluating the relative merits of tractor and workstock power on a given farm, and in planning a farming system to combat the influences of high farm wages, labor shortages, and high production costs.

The data in Table 18 indicate, in general, that as more work

is done with a particular implement its average cost per unit of use declines. These data show that larger implements usually accomplish more work in a given amount of time, that costs per acre are usually lower, and that costs per hour are usually higher than when using smaller implements.

The most effective means of lowering costs per acre and costs per hour is to increase the amount of annual use of implements. Annual depreciation costs might be lowered by extending the life of implements through better care. Timeliness of making adjustments and repairs and the necessary lubrication are also important in keeping down annual repair and upkeep costs.

What do the total farm machinery operating costs per farm for workstock-drawn machinery amount to each year in this area? Total costs (exclusive of workstock and labor costs) will depend upon: (1) total investment in such machinery; (2) age, expected useful life, and state of repair of each implement; (3) efficiency with which each implement is operated; (4) annual use of each implement; and (5) care taken in properly servicing, operating, and storing each implement.

Total annual expenses for operating workstock-drawn equipment in northern Alabama averaged less than $100 per farm in 1945. It was slightly higher on farms where both tractors and workstock were used than on farms operated only with workstock. Average expenses amounted to $2.07 per crop acre, and to 5 cents per hour of workstock use on farms operated only with workstock. Where both tractors and workstock were used, average expenses amounted to 68 cents per crop acre, and to 7 cents per hour of workstock use, Table 19.

TABLE 19.—COST OF OPERATING ALL WORKSTOCK-DRAWN MACHINERY ON FARMS IN NORTHERN ALABAMA, 1945[1]

Item	On farms operated with workstock power only			On farms operated with workstock and tractors		
	Annual cost per farm	Cost per hour of W/S use	Cost per acre in crops	Annual cost per farm	Cost per hour of W/S use	Cost per acre in crops
	(Dol.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)	(Dol.)
Repairs and upkeep	39	.021	.89	42	.031	.29
Depreciation	30	.016	.68	33	.025	.23
Interest	12	.007	.27	12	.009	.09
Taxes, housing, ins.	10	.006	.23	10	.007	.07
Total	91	.050	2.07	97	.072	.68

[1]Excludes workstock and labor costs.

SUMMARY

Maximum economies made possible through mechanization can be realized only when all available equipment is used at near capacity. For this reason, larger farms are usually the first to mechanize. In northern Alabama, cropland acreage per farm averaged more than twice as much for tractor-operated farms as it did for workstock-operated farms in 1945. In addition, cropland acreage handled per family was nearly twice as great on tractor farms as on workstock farms.

The 1945 inventory value of farm power and equipment on northern Alabama farms averaged $1,447 per farm for tractor farms, $2,094 per farm on farms using both tractors and workstock, and $603 per farm for workstock farms. This represented an average investment of $14.47, $14.65, and $13.70 per crop acre for the respective groups.

The average cost of operating all farm tractors in this area in 1945 was 52 cents per hour of use. This does not include the wages of the tractor driver. Costs per hour varied by size of tractor, type of power used on farms, type of work performed, and the amount of annual use.

Average costs of operating small tractors were 44 cents per hour, medium tractors 54 cents per hour, and large tractors 62 cents per hour. Small tractors were used in 1945 an average of 681 hours, medium tractors 842 hours, and large tractors 907 hours.

Operating costs for tractors on farms operated with tractor power only averaged 46 cents per hour. On farms where both tractors and workstock were used, tractor costs averaged 56 cents per hour. The average hours of use were 825 and 772 for the respective groups.

Variation in tractor costs by type of work performed is indicated by fuel requirements per 10-hour day for different types of work. Fuel consumption averaged 17.1 gallons per 10-hour day for heavy drawbar work, 12.4 gallons for light drawbar work, and 11.7 gallons for belt work.

Tractors used less than 400 hours annually were operated at a cost of 95 cents per hour; from 400 to 800 hours, 64 cents;

from 800 to 1,200 hours, 51 cents; and over 1,200 hours, 37 cents an hour.

The average annual cost of operating tractor-drawn machinery was $255 per farm in northern Alabama in 1945 for farms operated with tractors only, and was $197 per farm for those operated with both tractors and workstock. This represented a cost of $2.55 and $1.38 per crop acre for the respective groups.

More than one-third of the useful years of life of all tractor-drawn equipment on northern Alabama farms have been spent. The average age of all tractor equipment was 4.6 years, while the average total years of useful life was estimated to be 12.7 years.

Net annual workstock costs averaged $227.06 per head in northern Alabama in 1945. Feed charges, including pasture, comprised nearly 70 per cent of the total costs, excluding credit for manure. Costs varied widely by type of power used on farms, and by the amount of annual use. Average costs for all workstock in the area amounted to 37 cents per hour of use in 1945.

On farms operated with workstock only, workstock costs averaged 31 cents per hour. On farms where both workstock and tractors were used, workstock costs averaged 46 cents per hour. The average hours of use were 760 and 480 for the respective groups.

Workstock that were used less than 500 hours annually cost an average of $1.04 per hour of use; from 500 to 700 hours, 39 cents; from 700 to 900 hours, 30 cents; from 900 to 1,100 hours, 25 cents; and over 1,100 hours, 17 cents per hour.

The average annual cost of operating workstock-drawn equipment was less than $100 per farm in northern Alabama in 1945. This represented a cost of $2.07 per acre in crops on farms operated with workstock only and 68 cents per acre in crops on farms operated with both tractors and workstock.

More than half of the useful years of life of all workstock-drawn equipment on northern Alabama farms have been spent. The average age of all workstock equipment was 9.1 years, and the average total years of useful life was estimated to be 17.3 years.

In northern Alabama, this study indicates that, on the average, each tractor in this area has replaced an average of 4.5 head of workstock. It indicates that, on the basis of average amounts of work performed in 1945, each tractor should have replaced

approximately 5 head of workstock. It indicates that, on the basis of potential capacity of power and equipment on farms in 1945, each tractor could have replaced approximately 6 head of workstock.

Data on rates of performance for both tractor-drawn and workstock-drawn equipment indicate, in general that:

1) Cost per unit of performance declines as the amount of annual use increases.
2) Larger equipment usually accomplishes more work in a given amount of time than smaller equipment.
3) Costs per acre covered are usually lower when using larger equipment than when using smaller equipment.
4) Costs per hour of use are usually higher when using larger equipment than when using smaller equipment.

APPENDIX TABLE A.—DISTRIBUTION OF MAKES AND MODELS OF TRACTORS BY SIZE AS FOUND IN OPERATION ON FARMS IN NORTHERN ALABAMA, 1945[1]

Small tractors (Rated less than 18 h.p. on drawbar)			Medium tractors (Rated 18-24 h.p. on drawbar)			Large tractors (Rated over 24 h.p. on drawbar)		
Make	Model	Drawbar h.p. rated	Make	Model	Drawbar h.p. rated	Make	Model	Drawbar h.p. rated
John Deere	L	9	John Deere	B	18	John Deere	A	26
John Deere	H	12				John Deere	AR	26
John Deere	LA	13				John Deere	G	28
						John Deere	D	28
McC-D Farmall	–	13	McC-D Farmall	H	21	McC-D Farmall	M	31
McC-D Farmall	A	15				McC-D Farmall	MD	31
McC-D Farmall	B	15						
McC-Deering	F12	12	McC-Deering	F20	21	McC-Deering	F30	25
McC-Deering	F14	15						
Allis-Chalmers	B	13	Allis-Chalmers	WC	20	Allis-Chalmers	H	26
Allis-Chalmers	C	16						
Allis-Chalmers	RC	15						
Oliver	60	17	Oliver	70	20	Oliver	80	30
			Case	VC	19	Case	D	31
			Case	SC	19	Case	DC	33
Ford	–	17						
			Fordson	–	19			
						Caterpillar	D2	25
			M-Moline	–	20	M-Moline	–	33
						M-Moline	GT	48
B. F. Avery	–	16						
Ford-Ferguson	–	17						

[1]Based on official Nebraska Tractor Tests, as reported in "The Tractor Field Book," Farm Implement News Company, Chicago, Illinois, 1946.