

account primarily for the great intensity of tractors in that area. The large number of tractors in this section of the Piedmont are used primarily for land preparation, grain harvest, and belt work and not for planting and cultivation of intertilled crops.

The Southern Piedmont Area (Area VB) is the principal cotton area, but here also mechanized power is used mostly for land preparation, grain harvest and belt work on general farms. The planting and cultivation of intertilled crops with mechanical power has not been extensive in this area.

Tobacco is predominant in cropping systems of the Northern Piedmont (Area VI) and as a consequence the trend toward complete mechanization has been slower than in either of the other Piedmont Areas.

#### In the Mountains

Extreme variations in topography, together with small farms and small fields, have discouraged the mechanization of agriculture in the Mountain Areas of North Carolina (Areas VIII and VIIIA). However, many tractors are found on small farms with as little as 50 acres of cropland and are used mainly for land preparation.

#### TRACTORS VERSUS WORKSTOCK AS A SOURCE OF POWER

Farmers in selecting the type of power to be used will be influenced by (1) its cost, (2) the amount of labor required to operate it, and (3) the cost of the complementary equipment required by each type of power. These considerations on the part of farmers are interdependent. It is conceivable that the cost of operating a given type of power might be relatively low, yet the labor and complementary equipment cost may be such as to make the total production cost for power, labor, and equipment higher than the alternative type of power.

There are other factors in addition to the cost of operation and the labor required which will affect the choice of power. Farmers must consider the matter of timeliness of performing operations or the time required to get certain critical jobs done. It is frequently the case that the cost of a given type of power may be relatively higher than another, yet the actual cost is secondary to the income derived from getting the job done at the right time.

It is the purpose in this section of the report to compare the cost of tractors and mules in performing various farm operations. The comparative costs presented are the results summarized from the previous publication on the cost of power and production requirements for mechanized and non-mechanized methods of production in the Northern Coastal Plains.

Cost of operating tractors. The average cost of operating 125 tractors in the Northern Coastal Plains in 1943 was 54 cents an hour. This includes the cost of fuel, grease, repairs, service labor, depreciation, and interest. The tractors were operated on an average of 90 ten-hour days in 1943. The average horsepower rating for the 125 tractors was 21.02. The average purchase price was \$1,028 a tractor, and the average life of all tractors was 10 years.

Variations in the cost of operating tractors due to amount of use. The cost of operating tractors per unit of time or per hour varies inversely from \$5.00 a day when the tractor is used 121 days to \$9.51 a day when it is used only 20 days, table 2. There is very little change in operating cost per day to use, especially when the use exceeds 50 days per year. Overhead cost, which includes interest and depreciation, declines rapidly per unit of time as the amount of use increases.

Table 2. Estimated variations in the cost of operating medium-size tractors due to amount of use.

Days used per year	Cost of operation on per 10-hour day		
	Operating	Overhead <sup>1/</sup>	Total
	Dollars	Dollars	Dollars
20	3.45	6.06	9.51
30	3.41	4.36	8.77
40	3.38	3.67	7.03
50	3.33	3.31	6.64
62	3.27	2.86	6.13
91	3.27	2.08	5.35
121	3.27	1.73	5.00

<sup>1/</sup> Does not include a charge for shelter and taxes.

Cost of operating tractor machinery. The average investment in tractor equipment, excluding combines and peanut pickers, per farm for 17 one-tractor farms studied in the Northern Coastal Plains was \$826. For this equipment, depreciation amounted to \$79; repairs, \$97; and interest \$21 per farm annually. Thus the total annual cost per one-tractor farm for tractor equipment, other than the combine and peanut picker, was \$197. The average cost per hour of use was 22 cents.

The average annual cost of operating 49 six-foot power take-off combines in the Northern Coastal Plains in 1943 was \$178.06. This includes repairs, depreciation, and interest. The average six-foot combine harvested 144 acres of grain, soybeans, and lespedeza at a cost of \$1.24 an acre.

The average annual cost of operating 56 peanut pickers was \$115.60. This includes repairs, depreciation, and interest. The average machine was used to pick 124 acres of peanuts at a cost of 93 cents an acre.

Estimated variations in machinery cost with use. Machinery cost per day or per hour varies inversely with the amount of use. The estimated average machinery cost for one-tractor farms, excluding tractors, combines, and peanut pickers, varied from \$1.82 a day when used 121 days to \$5.70 a day when used only 20 days, table 3.

Table 3. Estimated variations in average machinery cost with use <sup>1/</sup>

Days used per year	Cost per 10-hour day of use			
	Repairs Dollars	Depreciation Dollars	Interest Dollars	Total Dollars
20	2.70	1.95	1.05	5.70
30	2.00	1.43	.70	4.13
40	1.65	1.23	.52	3.40
50	1.42	1.10	.42	2.94
62	1.27	1.03	.34	2.64
82	1.06	.88	.26	2.20
90	1.04	.86	.23	2.13
121	.89	.76	.17	1.82

<sup>1/</sup> Estimates for one-tractor farms, excluding tractors, combines, and peanut pickers.

Cost of keeping workstock. The average annual net cost of keeping a mule on 58 large farms in the Northern Coastal Plains in 1943 was \$185.87. This includes the cost of feed, depreciation, chore labor, harness repairs and replacements, interest, veterinary fees, medicine, and shoeing. No charge was included for shelter and taxes. The net cost of mule work per hour based on 800 hours of use per year was 23 cents.

Cost of operating workstock equipment. The estimated average investment in mule equipment on farms working four mules in 1943 was \$457.00 or an average of \$114.25 a mule. The annual equipment cost per mule for depreciation, interest, and repairs was \$17.72. Based on 800 hours of use per year, workstock equipment cost on an average amounted to 2.2 cents an hour.

Rates of performance for tractors and mules. The average rates of performing some of the more important field operations with tractors and mules in the Northern Coastal Plains are shown in table 4.

The rate of performance varied with the kind and amount of power and size of implement used. The average rates of performance shown in table 4 may be used in calculating power requirements for crops in this area of the State.

Table 4. Time required to perform specific operations with tractor and mule power per 10-hour day in the Northern Coastal Plain.

Operation	Tractor 1/			Mule 2/		
	Size of Imple- ment	Hours per acre	Acres cov- ered per 10 hour day	Size of Imple- ment	Hours per acre	Acres per 10-hour day per mule
Breaking	5 disc. (tiller)	0.8	12.5	1-mule	7.1	1.4
Breaking	-	-	-	2-mule	10.6	0.9
Disking	6 ft.	0.5	20.0	2-mule	5.0	2.0
Harrowing (spike tooth)	12 ft.	0.3	33.3	2-mule	2.0	5.0
Running rows	-	-	-	1-mule	1.7	5.9
Distributing fertilizer	-	-	-	1-mule	1.9	5.3
Ridging or listing (cotton)	-	-	-	1-mule	3.5	2.9
Ridging or listing (peanuts)	-	-	-	1-mule	2.0	5.0
Planting (average all crops)	-	-	-	1-mule	1.6	6.2
Planting (corn & soybeans)	2-row	0.7	14.3	-	-	-
Planting (cotton & peanuts)	2-row	0.8	12.5	-	-	-
Cultivating (all crops)	2-row	0.6	16.7	1-mule	2.8	3.6
Cultivating (all crops)	-	-	-	2-mule	2.9	3.4
Drilling grain	8 ft.	0.5	20.0	-	-	-
Combining (grain & beans)	6 ft.	0.8	12.5	-	-	-
Cutting hay (lespedeza)	7 ft.	0.7	14.3	-	-	-
Digging peanuts	2-row	0.8	12.5	1-row	2.5	4.0

1/ Average for 61 mechanized farms, 1943.

2/ Average for 128 farms operated with mules, 1941.

Labor and power requirements for specified crops. Labor and power requirements by type of power used are shown in table 5 for five crops commonly grown in the Northern Coastal Plains.

The comparison in table 5 is made for tractor power and mule power methods of production. Both types of power were available on most of the farms studied, and it is obvious that both sources of power were used in performing various production tasks. Tractors are normally used for combining and peanut picking on farms where mules are the main source of power, while mules are normally used for hauling corn and cotton from the fields on farms where tractors are the chief source of power.

Table 5. Labor and power required to produce an acre of crops with tractor power and mule power, Northern Coastal Plains.

Crop	Tractor power Hours per acre			Mule power Hours per acre		
	Man	Mule	Tractor	Man	Mule	Tractor
Cotton	107.9	2.0	7.1	134.5	42.4	-
Peanuts	51.0	7.5	10.3	67.0	44.5	1.6
Corn	16.4	3.0	4.7	34.5	27.8	-
Soybeans	7.2	-	5.5	20.0	25.6	0.8
Small grains	6.1	-	3.1	14.3	20.6	0.8

Mechanized methods of farming required fewer hours of man labor to produce the principal field crops, table 5. The largest relative reduction in labor requirements was obtained for soybeans, small grains, corn, peanuts, and cotton in the order enumerated. The largest absolute reduction in labor required per acre was for cotton, followed by corn, peanuts, soybeans, and small grains.

Summary of operating expenses by different methods of production for specified crops. The comparison of operating expense by type of power used is made with the idea of further exploring the economy of the two methods of production and not for the purpose of determining the cost of producing crops. The comparisons include only operating expenses for labor, power, seed, fertilizer, and supplies used in the production of the various crops, but do not include the cost of land and management. The operating expense for producing five of the crops commonly grown in the Northern Coastal Plains is shown in table 6.

Crops were produced with less expense per acre where tractor power was used. The percentage reduction in operating expense was largest for soybeans, followed by small grains, corn, peanuts, and cotton. The largest absolute difference in operating expense was for peanuts, where the difference amounted to \$11.65 an acre.

Table 6. Gross operating expense per acre with tractor power and mule power for specified crops, Northern Coastal Plains, 1943

Crop	Gross operating expense	
	Tractor power	Mule power
	Dollars	Dollars
Cotton	38.45	47.07
Peanuts	32.71	44.36
Corn	11.96	17.30
Soybeans	8.71	16.56
Small grains	10.51	17.07

Significant variations in expense items for different methods of production.

Labor and power costs were larger where mules were used as the chief source of power. Equipment costs were less where mules were used. Other expenses were approximately the same for both methods of production with the exception of contract work. Where mules were used, combining grains or soybeans and peanut picking were usually hired at contract rates. The cost per acre of combining small grains and soybeans and of picking peanuts was larger where it was performed on a contract rate basis.

EFFECTS OF SUBSTITUTING MECHANICAL FOR ANIMAL POWER  
ON FARMING SYSTEMS

The mechanization of farming raises many different problems in the organization of the farm. It must be remembered, however, that in the area to which this study applies, the substitution of tractors for animal power is only one of several causal factors that have influenced production patterns. For instance, during the past decade the program of the Agricultural Adjustment Agencies has had a pronounced effect on production of intensive row crops. Since 1941 the wartime food production program has encouraged adjustments in crop and livestock production in such a way as to most effectively meet national needs. Nevertheless, the