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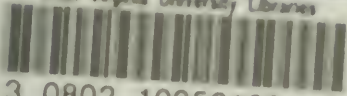
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# POWER ON WEST VIRGINIA FARMS

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# POWER ON WEST VIRGINIA FARMS

by F. D. CORNELL, JR.

## INTRODUCTION

THE DEVELOPMENT of the use of animal and mechanical power for performing farm operations, together with the invention of machines through which this power might be applied more efficiently and effectively, has brought about revolutionary changes in the agricultural industry. The progress made during the past 100 years has eclipsed all success hitherto achieved in the application of power other than human muscle to agricultural production. Since the beginning of the twentieth century the increase in the use of mechanical aid in agriculture has been astoundingly rapid. The result of the adoption of other than hand methods in agriculture is clearly indicated by the fact that while in 1800 it required more than 90% of the population to produce the necessary products of agriculture, less than 25% of the population accomplished that same task in 1930, notwithstanding the great increases in population which came about during the period of 130 years intervening. It should be remembered, however, that some of the work done on the farms in the earlier times such as spinning and weaving, processing and manufacturing of farm products, implement manufacture, and a variety of other operations is now accomplished by the industrial group.

Table 1 shows the ratio of agricultural workers to all persons gainfully employed in the United States from 1820 to 1930.

TABLE 1—*Relation of agricultural workers to all workers gainfully employed in the United States (1820 to 1930)*

Year	All workers gainfully employed	Engaged in agriculture	Ratio of agricultural workers to all workers
1820	2,490,770	2,068,958	83.1
1830	.....	.....	...
1840	4,798,869	3,719,951	77.5
1850	.....	.....	...
1860	.....	.....	...
1870	12,505,923	5,922,471	47.4
1880	17,392,099	7,712,875	44.4
1890	23,318,183	9,148,448	39.2
1900	29,073,233	10,381,765	35.7
1910	38,167,336	12,659,082	33.2
1920	41,614,248	10,953,158	26.3
1930	48,832,589	10,042,323	20.5

## THE DEVELOPMENT OF THE USE OF POWER ON FARMS

During the early part of the nineteenth century, oxen were still the most important source of farm power. Even from 1850 to 1860 the number of oxen in the United States was increased by 554,000. The use of animal power on farms reached its peak in 1919, when the number of farm work animals totaled 26,436,000. By 1930, this total had decreased to approximately 18,500,000. During this same period, however, the number of tractors on farms increased from 246,083 to 920,021; motor trucks on farms increased from 139,169 to 900,385; the number of automobiles on farms increased from 2,146,362 to 4,134,675; and by April 1932 the number of farms obtaining electric power from utility companies totaled 702,963.



Ox teams may still be found in sections of West Virginia

Of the total horsepower load utilized on farms in 1930, approximately 50% was furnished by animals, 24% by tractors, 10% by trucks, 4.9% by electricity, and 4.7% by gasoline engines. With the addition of some 40,000,000 horsepower from 1900 to 1930, agricultural production assumed an entirely new aspect. The result has been the creation of many new problems in production practices and in farm business organization.

### *Choosing New Types of Power*

In adding new types of power on the farm one must recognize the fact that unless the new equipment displaces some of the animal, mechanical or human power heretofore utilized, the result will be

that the power loads of the original equipment will be decreased, but the total power costs increased. Most farms are so organized that there is sufficient power to carry on the farm operations before, let us say, the purchase of a tractor. When a tractor is purchased, therefore, without any increase in the size of the business or decrease in the power previously utilized, the result is an increase in power costs without a corresponding increase in net returns. The problem, then, in purchasing a tractor or any other power unit is so to coordinate the power loads of the various sources of power that the savings brought about through the use of one type of power will not be offset by decreases of the power loads of the other power units retained.

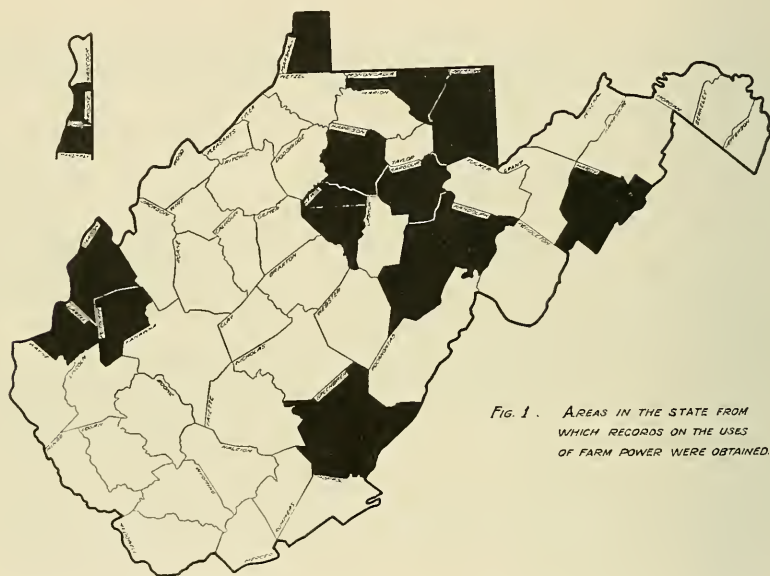


FIG. 1. AREAS IN THE STATE FROM WHICH RECORDS ON THE USES OF FARM POWER WERE OBTAINED

The power problem on the farm is relatively difficult also because of the nature of the business. The industrialist can adopt the power best suited to a particular need and continue operation uninterrupted. However, practically all the work on the farm is seasonal, with peak loads coming at two or three periods throughout the year. Thus the farmer has to provide power to carry on a large number of different operations, each of which requires the use of power for only a few days each year. Because of this combination of circumstances the farmer cannot hope to attain the efficiency per unit of power commonly found in industry. His is a problem of adapting his business and adopting such power as will make for the greatest economy and efficiency in production. Recent economic conditions have added to the difficulty on a large number of farms of adjusting the use of power units.

In considering the use of power on farms two facts should be kept clearly in mind. First, the costs of power constitute a very appreciable part of the costs of crop production. Secondly, power and labor costs are among the more important factors in the management of the farm business over which the farmer may exercise considerable control.

#### PURPOSE OF THE STUDY

The purpose of the study of the use of power on West Virginia farms was to make available information concerning costs and the extent of the use of the various types of farm power. Because of the rapid development of power units adaptable to farm use, and because of the important bearing which power costs have upon net returns from the farming enterprise, it was felt that such information would have definite practical application. In addition the advantages and disadvantages of the various types of power as revealed by farmers from their experience should be of aid in helping individuals adjust their farm power problems.



Typical West Virginia topography, a limiting factor in machine methods of production

#### METHODS EMPLOYED

In order to obtain as accurate information as possible concerning the use of power on farms, the data were obtained by personal visits to a large number of farms in several scattered areas of the state. A complete record was taken on each type of power in use on the farms visited, together with pertinent information about the farms on which the power units were used. The year covered in these records included the crop season of 1932.

Figure 1 shows the areas throughout the state from which records were obtained. The farms included in the study were somewhat larger than the average for the state (see Table 2). The types



of power on which records were obtained were horses, tractors, automobiles, trucks, stationary engines, and electricity. Table 3 shows the approximate horsepower available from these sources on West Virginia farms in 1930.

Complete records on each type of power in use were obtained from 441 farms in the areas of the state indicated in Figure 1.

TABLE 2—*Farms in the survey as compared with averages for the state*

	441 farms included in power survey	All farms in West Virginia 1930
Average total acres per farm .....	253.9	106.5
Average acres in pasture per farm ..	136.2	54.6
Average crop acres per farm .....	57.8	23.1

TABLE 3—*Approximate available horsepower on farms in West Virginia (1930)\**

Source	Number of units	Average horsepower per unit	Total horsepower available
Horses and mules (2 yrs. and older)	120,871	95 <sup>1</sup>	115,177
Tractors .....	2,792	20 <sup>2</sup>	55,840
Stationary gas engines .....	4,314	2.5	10,785
Trucks .....	7,432	2.5	185,800
Electric motors .....	1,269	2.0	2,538
Electric light plants .....	2,486	3.0	7,458
Combined harvester threshers ....	1	25	25
Total .....	.....	....	377,623

<sup>1</sup>Computed from estimated total weight of animals.

<sup>2</sup>Belt horsepower.

\*Power and Machinery in Agriculture, U. S. Department of Agriculture, Miscellaneous Publication 157, p. 16, 1933.

#### TOPOGRAPHY A LIMITING FACTOR IN THE USE OF FARM POWER IN WEST VIRGINIA

West Virginia presents many problems in the matter of farm layout and the use of power machinery in farm operations because of the topography characteristic of the greater portion of the state. Coupled with this condition is the fact that the average size of farms in the state is small, thereby imposing another serious limitation on the efficient use of available power. The average size of farm in West Virginia in 1930 was 106.5 acres, with an average total area of crop land of 23.08 acres per farm and an average pasture acreage per farm of 54.58 acres.

Because of the abundance of pasture in the state and the typically rough topography, livestock production is and will continue to be a major farm enterprise. With the exception of comparatively limited areas along the streams, the crop land on farms in West Virginia is mostly rolling to hilly. This makes difficult a desirable layout of fields and seriously limits the extent to which machine methods may be applied to crop production.

Farmers of West Virginia therefore face a perplexing problem in the choice of the power units and machines which will make for greatest efficiency under definite limitations.

## POWER ON NON-TRACTOR FARMS

For purposes of comparison, the records obtained in the survey were grouped under two classifications — namely, tractor and non-tractor farms. That is, in the non-tractor group the drawbar power was furnished entirely by horses, while in the tractor group the drawbar power was supplied by both horses and tractors.

### FARM ORGANIZATION

#### *Size of Farms*

Two hundred sixty records were obtained from farms on which horses supplied all the drawbar power. These farms ranged in size from 16 to 600 acres, the average size of farm being 203.8 acres.

Of the 260 non-tractor farms, 6.5 percent were smaller than 50 acres and 4.2 percent contained 500 acres or more. The average size of farm in West Virginia in 1930 was 106.5 acres, with 28 percent of the farms less than 50 acres in size and 1.8 percent of the farms larger than 500 acres. The farms included in the survey therefore were considerably larger than the average for the state as a whole, and they represent also the better farms of the state.

The data obtained from the 260 non-tractor farms represent the power used on a total of 52,989 acres, of which 28,756 acres were in pasture and 11,623 acres in crops.

TABLE 4—Average size of farm, acres in pasture, and acreage in various crops on 260 non-tractor farms

Crops	Number of farms reporting	Average acreage per farm reporting	Average acreage per farm (all farms)
Corn	257	11.10	11.0
Wheat	112	10.05	4.3
Hay	249	22.09	21.1
Oats	163	8.35	5.2
Buckwheat	75	5.18	1.5
Soybeans	47	9.96	1.8
Potatoes	123	1.27	.51
Cowpeas	4	10.25	....
Tobacco	9	1.55	....
Alfalfa	101	1.68	.65
Truck crops	10	2.52	....
Orchard crops	8	6.75	....
Rye	3	12.66	....
Barley	10	7.40	....
Melons	3	1.82	....
Millet	1	1.50	....
Beets	1	1.00	....
Acres in crops	260	46.8	46.8
Acres in pasture	258	111.45	110.6
Acres in farm	260	203.8	203.8

#### *Crop Acreage*

Table 4 shows the average size of farm, acres in crops, and acres in pasture on 260 non-tractor farms. An average acreage of crops per farm of 46.8 and an average of 110.6 acres per farm in pasture was found.

A study of the total acreages in crops on the non-tractor farms revealed that 49.2 percent or nearly one-half of the farms had less than 40 acres in crops, with 32.4 percent cultivating less than 30 acres per farm. Approximately 13 percent had 75 acres or more in crops.

The comparatively large pasture acreage indicates that livestock constituted a major enterprise on these farms.

### *Livestock*

The number of the various classes of livestock found on the farms surveyed, indicated in Table 5, shows the importance of such enterprises in the business organization of these farms. In general a very large percentage of the crops grown was fed on the farm and marketed through livestock or livestock products. In some sections covered by the survey, dairying was the chief livestock enterprise, although on practically all the farms some cows were found. Only six farms reported no cows. In other areas, such as Greenbrier county, the production and finishing of beef cattle was the major project on the farms. It was in such sections as this that the majority of the beef cattle reported were found.

TABLE 5—*Livestock on 260 non-tractor farms*

Kind	Number of farms reporting	Average number per farm reporting	Average number per farm (all farms)
Hogs	237	10.5	9.6
Sheep	127	59.7	29.1
Dairy cows	254	9.3	9.1
Dairy heifers	175	6.2	4.2
Beef cattle	131	17.2	8.6
Horses	257	2.7	2.6
Poultry	249	102.9	98.5

### HORSES

#### *The Horse on the Farm and the Present Outlook in West Virginia*

The horse is still the chief source of power on West Virginia farms. Because of the difficulty of adapting machine methods of farming in the greater portion of the state, horses will continue to furnish the major part of the drawbar power. In view of this fact it is important that farmers have a general understanding of the present situation.

The use of animal power on farms reached the high point in 1919. Then, with the general acceptance of other types of power for some farm operations, there was a gradual decline in the number of horses and mules used. From 1920 to 1930 the number of horses on farms decreased by 6,256,322 and the number of mules used for farm work decreased by 57,374 over the same period. On January 1, 1934, there were only 55 percent as many horses on farms in the United States as on January 1, 1918.

In West Virginia during the period from 1920 to 1934 there was a similar gradual decline in the number of horses on farms as shown in Table 6. The number of horses on farms in the state decreased

89,000 during the fourteen years, or 46.8 percent. In 1934 the number of mules on farms in West Virginia was 1,000 less than in 1920.

It will be some time before colt production in West Virginia reaches annually the ratio of 66 per 1,000 horses, which is the number required for replacement only. In 1929 the ratio in West Virginia was 30 colts to each 1,000 work horses, or less than half the number needed to furnish replacements. In the United States the ratio was 40 colts per 1,000 work horses. Table 7 shows the number of horses or mules two years old or older to each horse or mule colt raised in the United States and in West Virginia.

TABLE 6—Estimated number of horses and mules on farms in West Virginia (1920-1934)\*

Year	HORSES		MULES	
	Number	Value per head	Number	Value per head
1920	190,000	\$104	13,000	\$121
1921	184,000	98	13,000	114
1922	161,000	89	15,000	97
1923	161,000	90	15,000	102
1924	159,000	79	15,000	87
1925	147,000	76	15,000	86
1926	140,000	75	15,000	85
1927	133,000	74	14,000	78
1928	128,000	84	14,000	81
1929	124,000	89	14,000	86
1930	118,000	90	13,000	93
1931	112,000	79	13,000	83
1932	106,000	70	12,000	74
1933	103,000	74	12,000	73
1934	101,000	85	12,000	81

\*Data: U. S. D. A. Yearbook 1921, '22 '23, '24, '28, '31, and 1934.

TABLE 7—Number of horses or mules two years old or older to each horse or mule colt raised\*

Year	UNITED STATES		WEST VIRGINIA	
	Horses	Mules	Horses	Mules
1918-1919	13.6	11.8	20.7	15.6
1923-1924	30.3	28.3	37.2	22.2
1928-1929	25.9	61.6	36.6	68.5

\*The number of colts raised per year was obtained by averaging the number of colts born in 1918 and those born in 1919 as given in census figures. The data for the other years were obtained in like manner.

It is apparent that the number of horses per colt raised has mounted rapidly during the past 10 years and is far beyond the desirable balance for maintenance alone. The number of horse colts raised in the United States in 1928-29 would have furnished replacements for a horse population of about 7,180,000, assuming the average life of the horse to be 15 years. However, there were 12,426,300 horses two years of age and older on farms of the United States in 1930. The number of horse colts raised in West Virginia in 1928-29 was sufficient to maintain a horse population of 44,000 on the same basis. Instead, there were 106,100 horses two years old and more on farms of the state.

This means that the average age of horses on farms is increasing and would indicate that the efficiency of the horse on the farm is declining as a result of the increased average age. In 1920, 12.8 percent of farm horses were less than two years of age. By 1930 this figure had dropped to 7 percent.

It would appear that the demand for good horses on farms will increase during the next few years. The horse possesses the advantage of providing power and also producing colts which maintain the power supply. Thus the horse may be considered as a source of income as well as an expense.



Farming on steep slopes precludes the use of machinery

The tendency on the part of a comparatively few West Virginia farmers to increase colt production seems justified. It is reasonable to assume that unless there is a definite upward swing in the number of colts produced, the total number of horses and mules on farms will continue to decline.

The drawbar power on this group of farms was furnished entirely by horses. As shown in Table 5 the average number of horses per farm was 2.6, which was somewhat higher than the average of 1.28 per farm for the state as a whole in 1930.

A total of 689 horses supplied the major portion of the power utilized for farm operations on the 260 non-tractor farms. It can be

seen from Table 8 that the average age of the horses on this group of farms was fairly high; thereby confirming the statement that there is at present a tendency toward an increased average age of horses on farms due partially to the lack of adequate replacements. The number of mares was slightly greater than the number of geldings, indicating that it would be possible for these farmers to increase colt production if they so desired. However, comparatively few reported colts on hand or mares that had been bred.

TABLE 8—Horses on 257\* non-tractor farms

Average value per horse (dollars) .....	\$100.87
Average weight per horse (pounds) .....	1340.7
Average age per horse (years) .....	11.6
Average number of mares per farm .....	1.4
Average number of geldings per farm .....	1.2
Average number of horses per farm .....	2.6
Average number of hours each horse was used per year .....	520.4
Total number of horses — all farms .....	689

\*On 3 farms no horses were owned. Horses were hired for all team work necessary.

TABLE 9—Distribution showing number of horses in various age groups (667\* horses)

Age groups (years)	Number of horses	Percentage of total
2 to 5 years	61	9.15
5 to 8	112	16.80
8 to 11	137	20.54
11 to 14	127	19.04
14 to 17	109	16.34
17 to 20	43	6.45
20 to 23	48	7.20
23 to 26	21	3.14
26 or more	9	1.34

\*Total number of horses not included because ages of some were not given.

### Age of Horses

The ages of the horses on the non-tractor farms ranged from 2 to 33 years. Their distribution in the various age groups is shown in Table 9.

Thirty-six percent of the horses were more than 14 years of age, and 11.7 percent had passed their twentieth year. Only 26 percent of the horses were younger than eight years. It is evident that a comparatively large percentage of these farm horses have reached an age when their efficiency as work animals is rapidly declining.

Factors such as the large number of aged horses dying each year, low colt production, uneconomic utilization of old, worn-out work animals on farms, and material increases in prices of good horses combine to make this phase of the farm power problem difficult of solution on many farms.

## Cost of Keeping Horses

Careful estimates were obtained on each farm concerning various cost items pertaining to horses in order to arrive at a figure which would represent the cost of keeping a horse according to common methods of feeding and management in the state.

Horses were on pasture an average of 5.5 months per year. Pasture feed of course was supplemented with hay and grain. Taking the year round, including the pasture period, farmers estimated that they fed each horse an average of 20 pounds of hay per day, and 89.5 bushels of grain per year, or an average of 24 ears of corn per horse per day. With very few exceptions, corn was the grain ration fed. In practically every case this was fed as ear corn, averaging about eight ears to the feeding. Farmers estimated that the labor required to care for the horses averaged 15 minutes per day per horse, considering a full year period. Many farmers admitted their horses received little attention other than the time required to feed them and clean the stables.

TABLE 10—Average cost of keeping a horse on non-tractor farms in West Virginia (1932)

Items	Average quantity per year	Average estimated value per unit	Total cost
Interest on investment <sup>1</sup>	.....	.....	\$ 4.20
Depreciation @ 8% <sup>2</sup>	.....	.....	8.40
Pasture	5.5 mo's	\$ 1.00 per mo.	5.50
Hay	3.6 tons	10.50 per T.	37.80
Grain	89.5 bu.	0.398 per bu.	35.62
Bedding	.....	.....	5.00
Labor	91 hrs.	.20 per hr.	18.20
Shoeing & miscellaneous	.....	.....	2.00
Total	.....	.....	116.72
Credit for manure	.....	.....	10.00
Net cost	.....	.....	106.72
Cost per hour <sup>3</sup>	.....	.....	.205

<sup>1</sup>Based on average value of horse in West Virginia (1932).

<sup>2</sup>Based on cost of \$75 for horse and \$30 for harness.

<sup>3</sup>Based on an average of 520 hrs. of use per horse per year on the non-tractor farms.

Table 10 shows the average cost of keeping a horse on the non-tractor farms in 1932. The figures represent the averages of estimates obtained from the owners. No credit for colts is shown in the table because the number of colts being raised on these farms was not significant. The cost per hour as shown was calculated from the actual average number of hours of use per horse during the year covered by the survey.

## Use of Horses on Non-Tractor Farms

Information was obtained relative to the more important farm operations for which horses were used. The instances where more than two horses per team were used for any of the farm work were so few as to be negligible. Because of the comparatively limited crop acreages on most farms and because of the fact that much of the crop land was of rolling to hilly topography, the use of larger



A desirable type of farm team

With but very few exceptions the 12-inch bottom plow, the 5-foot mower, 7-foot binder, 10-foot rake, and the 9-furrow opener grain drill were the sizes of machines used in performing the operations shown in the table.

machines and big teams had not appealed to farmers in West Virginia as economic and practical.

Table 11 shows the operations for which horses were chiefly used on the farms and indicates the extent of their use. There were a few operations such as distributing lime and planting potatoes, where the number of reports was insufficient to warrant inclusion in the table. Jobs such as hauling coal, feed, fertilizer, spray materials, sorghum, logs, etc. were reported so infrequently that they were included under miscellaneous hauling. This item also included the many chore hauling jobs of great variety to be found on any large group of farms.

TABLE 11—Operations performed by horses on 260 non-tractor farms

Operation	Number of farms reporting	Average acreages per farm reporting	Average acres covered per day (10 hrs.) per team
Plowing	257	25.4	1.46
Disking & harrowing <sup>1</sup>	257	61.2	7.07
Reaping	118	17.8	7.71
Mowing	249	27.2	7.30
Cultivation <sup>1</sup>	255	37.6	4.70
Drilling	198	20.5	7.61
Raking	249	22.0	13.50
Dragging	8	31.2	11.10
Spraying	5	16.7	9.20

#### HAULING DONE WITH HORSES

Products hauled	Number of farms reporting	Average number of days per year per farm reporting	Average number of days per year per farm—all farms
Manure	246	10.93	10.34
Hay	249	5.45	5.21
Corn	237	5.46	4.97
Grain	164	2.26	1.42
Miscellaneous	240	18.90	17.44

<sup>1</sup>Figured on basis of total number of times operation was performed year of record.



## AUTOMOBILES

The automobile has become a very important factor in farm life and has made many noteworthy contributions. It has brought the city and rural districts together, has facilitated marketing, extended market areas, aided in fostering neighborliness and community spirit, and has been the chief factor in the development of good roads. It has not only aided the farmer in his business enterprises, but has provided pleasure and recreation for the farm family.

The increase in the use of automobiles on farms during the past few years has been particularly rapid. In 1920 there were 11,127 automobiles on West Virginia farms. By 1930 this total had reached 36,978, or an increase of 232 percent in the ten-year period. The number of farms in the state reporting automobiles increased from 11.9 percent in 1920 to 40.5 percent in 1930.

One hundred sixty-two, or 62 percent, of the non-tractor farms reported ownership of automobiles. Many of these were used cars when bought, only 63.1 percent of the cars having been new at the time of purchase by the farmers. There were nineteen farmers who had purchased no licenses for their cars and were not using them at all at the time of the survey because of economic conditions. Three farmers stated that their cars were not used at all in connection with the farm business.

An examination of the kinds of cars on the farms revealed that farmers preferred the lighter, lower-priced automobiles, two makes constituting 57% of the cars on non-tractor farms. The tendency of many farmers to buy used cars and of all farmers to obtain a maximum use from their cars was indicated by the number of older models of cars in use. Although 36.9 percent of the cars were used cars at the time the farmers bought them, all cars had been in use on the farms an average of 3.86 years. Farmers estimated that their cars would have an average additional useful life of  $3\frac{1}{4}$  years.

### *Extent of Use*

There was no correlation between the size of farm and automobile use as measured by annual mileage. In the matter of the use of the cars, personal preference and desire seemed to be the important determining factor. However, farmers did not use their cars as much as most urban and city dwellers. Cars on this group of farms were driven an average distance of 5,508 miles per year per car. Forty-seven percent of the mileage total of these cars was run in the interests of the farm business. The rest of the mileage was for personal use, including recreation and pleasure.

The distribution of the cars according to the total number of miles driven per year is shown in Table 12.

The percentages of the annual mileage run in the interests of the farm varied from 0 to 79. The higher percentages charged to the farm business were in the groups with the lower total annual

TABLE 12—Distribution of farm cars according to mileage, and percentage of total mileage chargeable to the farm business

Miles driven	Average total	No. of cars	Farm use	
			Average miles	Percentage of total
Less than 1000	477.7	9	377.7	79
1000 to 1999	1350.0	17	979.0	63
2000- 2999	2300.0	16	1721.9	78
3000- 3999	3041.6	12	1812.5	59
4000- 4999	4346.6	15	2275.0	52
5000- 5999	5052.0	24	2322.0	45
6000- 6999	6000.0	8	3037.6	50
7000- 7999	7166.0	6	4183.3	58
8000- 8999	8000.0	9	4602.0	57
9000- 9999	.....	..	.....	..
10000-10999	10000.0	15	5033.3	50
11000-11999	11000.0	2	500.0	4
12000-12999	12000.0	4	4500.0	37
13000-13999	13000.0	1	.....	0
15000-15999	15000.0	2	4750.0	32
18000-18999	18000.0	1	9000.0	50
20000-20999	20000.0	1	.....	0
40000-40999	40000.0	1	5000.0	12
Total or average	5508.3	143	2552.0	47.1

mileages. Forty-eight percent of the cars were run less than 5,000 miles, while only 8 percent were run more than 11,000 miles.

There was no relationship between the average number of crop acres in the various groups and either the total mileage or the mileage for the farm.

#### Cost of Operation

Although only approximately 50 percent of the cost of operating automobiles on these farms was chargeable directly to the farm business, the farm must support the use of cars for recreational and other purposes. The average value of all automobiles on non-tractor farms at the time of the survey was \$609.31.\* The cars which had been purchased as new cars by farmers had an average value of \$771.05, while the values of cars which had been purchased as "used" cars averaged \$421.50.

The costs of operating the automobiles, where figures were obtainable, are shown in Table 13. Only 20 percent of the farmers

\*The values of automobiles as given were obtained by averaging the estimated values as obtained from owners.

TABLE 13—Average annual cost of operating automobiles\* on non-tractor farms

Cost items	Average cost
Insurance .....	\$ 4.15
License .....	15.73
Repairs .....	9.71
Tires and tubes .....	12.10
Gasoline .....	35.76
Oil .....	5.64
Grease .....	1.68
Housing .....	6.94
Depreciation .....	82.32
Interest .....	20.43
Total .....	\$194.46

\*A few incomplete records could not be included in this summary.

carried insurance on their cars. On farms reporting insurance the average cost was \$19.42. The largest cost item in the operation of all the cars was depreciation. Experience proves that on any class of machinery the depreciation is not uniform but is much greater during the first years of use. The fact that many older models were in use, some of them purchased also as used cars, tended to lessen the average depreciation. However, it represented 42 percent of the total annual cost of operation of the automobiles.

#### MOTOR TRUCKS

Forty-six, or 17.7 percent, of the 260 non-tractor farms reported the use of motor trucks. In 1930 there were trucks on 8.4 percent of all farms in the state. This was considerably lower than the percentage on farms included in the survey. (See Fig. 2.)

Of the 47 trucks found on 46 farms, 34 had been purchased new, 12 had been "used" when bought, and one had been built on the farm out of an old car.

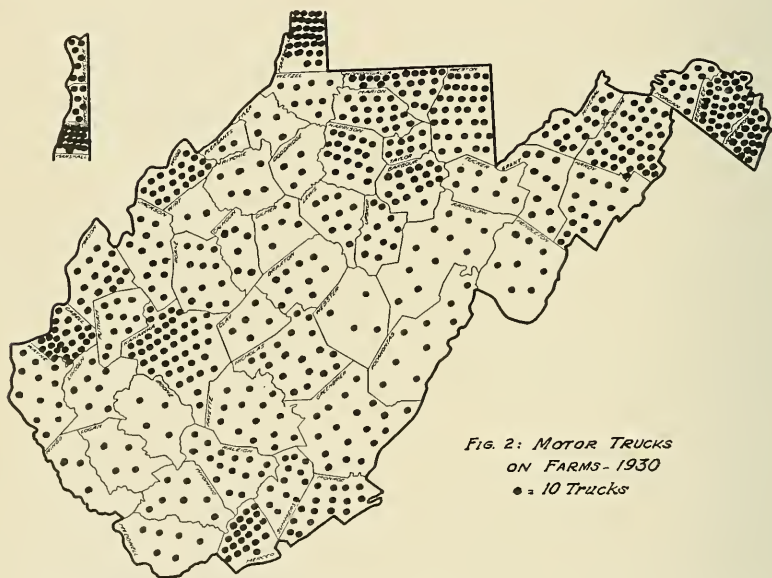


FIG. 2: MOTOR TRUCKS  
ON FARMS - 1930  
● = 10 Trucks

The smaller and lighter trucks seemed to be more popular among farmers. The one-ton truck was most commonly found. These facts may be accounted for by the fact that much of the farm work done with trucks was by short, quick hauls with comparatively light loads. The lighter trucks were preferred, too, because of the condition of many of the rural roads and also because of lower initial cost and the greater opportunities for servicing and repairs. Two makes of trucks comprised 80 percent of all trucks. No trucks larger than 1½-tons capacity were found.

### *Extent of Use and Purposes for Which Trucks Were Used*

The trucks found on the farms had been in use an average of 3.6 years, and owners estimated that the trucks would have an average additional useful life of 2.98 years. The trucks were driven an average distance 6,977 miles during the year. The annual mileage varied considerably, however, ranging from 400 miles to 30,000 miles.

In this connection it is of interest to note that seven farms reported trucks which had not been used at all during the year and for which no license had been purchased. This was due largely to the economic situation.\* The shortage of cash had caused the motor vehicles on these farms to be placed in storage.

TABLE 14—Average cost of operating motor trucks on 47 non-tractor farms

Cost items	Average cost
Insurance .....	\$ 4.40
License .....	25.88
Tires and tubes .....	43.77
Repairs .....	30.83
Gasoline .....	83.24
Oil .....	13.82
Grease .....	2.82
Housing .....	18.81
Depreciation .....	102.57
Interest on investment .....	21.18
Total cost .....	\$347.32

The trucks were used on the farms for hauling hay, grain, feed, wood, hauling between buildings, and a variety of minor hauling jobs. They were used off the farms for hauling feeds, fertilizers, livestock, milk, produce, supplies, and other miscellaneous items.

### *Cost of Operation*

The average value of the trucks at the time of the survey was \$584.67. Trucks which had been new at the time of purchase by farmers had an average value of \$671.02. The values of those bought as used trucks averaged \$176.50.†

Table 14 shows the average cost of operating the trucks for a year. Only 10 of the 46 farmers carried insurance on their trucks. The average cost of insurance on these 10 trucks was \$20.73. Depreciation was the largest cost item, representing 29.5 percent of the total cost of operation.

### ELECTRICITY

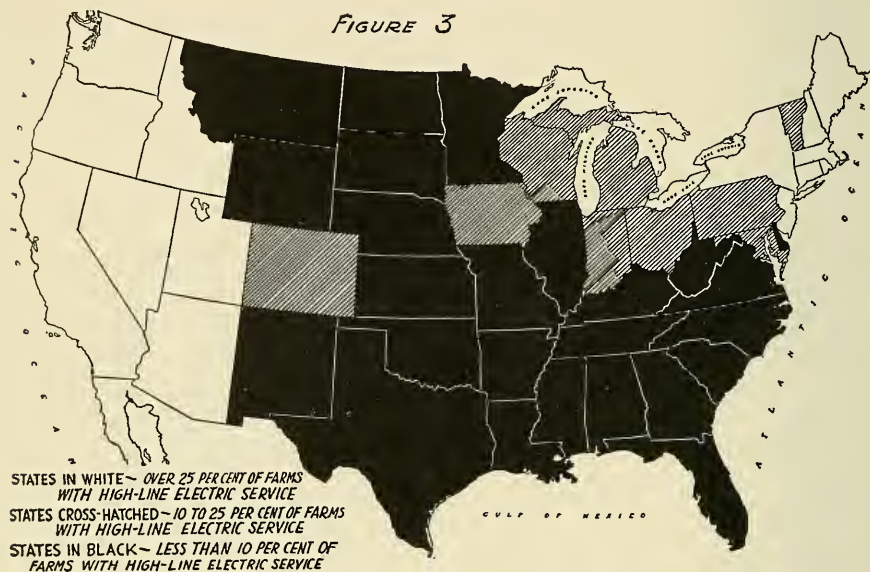
The use of electricity as a source of farm power is comparatively recent. With the extension of rural lines the increase in the use of electricity on farms has been rapid. Probably no other available power is adapted to such a wide variety of uses. Electricity has also played an important part in making home life more comfortable and in eliminating much drudgery. A very large percentage of the electric power used on West Virginia farms is for household purposes.

\*The trucks not in use were not included in the summaries or tables.

†Values obtained by averaging values placed on trucks by owners at the time of the survey.

On January 1, 1924, 166,159 farms in the United States obtained electric energy from central power stations. This represented 2.61 percent of all farms. By January 1, 1931, there were slightly more than 640,000 farms with high-line service, or more than 10 percent of all farms in the United States. According to figures released by the National Electric Light Association, 707,808 farms were connected to power-company lines on June 30, 1932.

Figure 3 shows the extent of the adoption of the use of electric power on farms in the various states in 1931.



Electricity possesses many advantages not found in other types of power. In addition to power it also furnishes light and heat, and all may be obtained from one set of wires. It is easily transported, can be made automatic for many operations, and because it can be used for either power, light, or heat, is adaptable to an extremely wide range of uses on the farm.

Because of its adaptability and convenience, the use of electricity on farms is destined to increase. At present the rate structure in many places has not been such as to encourage farmers to expand their use of electricity much beyond the household. Then too, for many farm uses electrical equipment is still in the developmental stage.

Eighty-three of the 260 non-tractor farms reported the use of electricity. Of this number, 18 had individual light plants.\* The

\*These 18 farms are not included in the summaries, which include only those farms receiving electric energy from power companies.

remaining 65 obtained current from central power stations. In 1930, 6.4 percent of all farm homes in the state were lighted by electricity. Of the non-tractor farms included in the survey, 31.9 percent had electric lights, which was considerably above the average for the state.

A study of the farms obtaining electricity from high-line extensions reveals that the size of farm had little relation to the use of electricity. The important factor governing the use of electricity was the location of the farm with reference to existing power-line extensions.

In 1929 farmers in West Virginia paid utility companies \$154,305 for current used. There were 2,944 farms which reported the use of current from central power stations, or 3.4 percent of all farms in the state. There were 5,330 farm homes in West Virginia lighted by electricity in 1929. This indicates that there were also 2,486 individual light plants on farms in the state.

#### *Use of Electricity a Comparatively Recent Development*

A study of the length of time that electricity had been in use on the farms surveyed confirms the statement that the greatest development of its use on farms has come about within the past few years. Only 6 of the 65 farmers were using electricity before 1920, while 47 had installed electricity since 1928. Sixty-three percent of the installations were made during 1928, 1929, and 1930.

#### *Household Uses of Electricity*

As has been indicated, the chief use of electricity on the farms at the time of the survey was for household purposes. Electricity was used in the homes mainly for lights, washing and ironing, cleaning, and the operation of radios, fans and refrigerators.

On the 65 farms with high-line electric service, all used electricity for lights, 89 percent had electric irons, 65 percent radios, 61 percent washers, 43 percent vacuum cleaners, 29 percent electric fans, 18 percent electric refrigerators, and 9 percent had electric ranges. Electricity was used for other purposes also such as sewing machines, ironers, heaters, etc. but for all such uses the number reporting each was very small, many uses being reported only in individual cases. Electricity was being used little for cooking purposes in the farm homes where current was available. This was due to the common occurrence of natural gas in many areas of the state, the disinclination of farm women to discard good equipment already on hand, the relatively high cost of electric equipment, and the cost of operation of electric equipment as compared with methods in use. Since gas and coal are so plentiful throughout the state, and in many areas so readily obtainable, they will undoubtedly continue to be used as the chief sources of energy for cooking and heating in farm homes.

The common occurrence of radios shows the place this commodity is assuming in farm homes as a source of pleasure, entertainment, and information. It is interesting to note that after providing for lighting the home, electricity was used first to lighten some of the more difficult household tasks such as washing, ironing, and cleaning. Providing running water in the homes also eliminated one of the most irksome tasks of the household—carrying water.

### *Farm Uses of Electricity*

The chief uses of electricity on the farms outside of the house were for lighting the farm buildings and for pumping water. The instances where electric power was used for other farm purposes were rather infrequent. On 22 of the 65 farms electricity was used for pumping water, on 6 it was used for operating milking machines, and on 5 for tool grinding. Three farms reported the use of electricity for cooling milk, 3 for operating bottle washers, and three had electric separators. All other farm uses of electricity (exclusive of lights) were reported in fewer than three instances. Forty-three of the farms reported lights in the barn, 18 in the garage, 17 in the yard, 13 in the poultry house, 6 in the silo, and 39 in other buildings.

There were 48 electric motors in use on the 65 farms. The motors ranged in size from  $\frac{1}{8}$  to 3 horsepower. The most common size of motor was  $\frac{1}{4}$  horsepower, of which 18 were in use. There were nine  $\frac{1}{2}$  H.P. motors, nine  $\frac{3}{4}$  H.P. motors, and five 1 H.P. motors. Other sizes were found only in single instances.

### *Obtaining Electric Current*

Twenty-six of the 65 farmers had aided in the construction of lines in order to obtain electric power. This had been done by donating labor, or materials such as poles, or by paying in cooperation with a group of neighbors an amount sufficient to induce the power companies to extend the service. In all other cases the power companies had built the rural extensions and the only cost to the farmers from the standpoint of line construction had been the necessity in a few instances of setting sufficient poles to carry the wires from the road to the farm buildings.

### *Dependability*

Farmers were asked whether any inconvenience had been suffered due to power being off at any time. Most of the farmers seemed fairly well pleased with the service, although 14 reported that they had had trouble on occasions. Of this number, seven stated that instances when power was off had been very infrequent. Six reported considerable inconvenience due to power being cut off, and one farmer said that power was off very often.

### *Cost of Installation*

Effort was made to obtain figures concerning the cost of wiring the premises for electricity. In many cases it was impossible to separate costs of wiring from other costs such as fixtures. However, costs of wiring were obtained on 47 farms, and the average cost was \$115.57. This figure represented merely the cash outlay for wiring, exclusive of fixtures.

Estimates of the labor furnished by the farmer or members of his family are not included. It was not possible to get reliable estimates on this item. The distance of buildings from the road and from each other, the number of buildings wired, the number of outlets, and the amount of family labor were factors influencing wiring costs.

The average number of light outlets in the various buildings wired for electricity was as follows: house, 15.4; barn, 7.3; garage 1.4; silo, 1.5; poultry house, 3; yard, 1.5; other buildings, 3.

### *Cost of Electric Power*

Because of inadequate records it was impossible to obtain from farmers accurate figures month by month for the year period on energy consumption or the cost thereof. However, reliable estimates were obtained as to total yearly costs of electricity consumed. Computed on a monthly basis the average cost of electricity per month per farm was \$3.66. The chief reason given by farmers for not expanding their use of electricity to include more farm jobs was that it was too expensive. Farmers were not encouraged by the rates in effect to expand their use of electricity greatly. In addition the general economic situation on farms tended to cause farmers to keep all cash expenditures as low as possible.

TABLE 15—*Farms reporting stationary engines, classified according to size, showing the number in each size group together with the number of engines reported*

Acres per farm	Number of farms	Number of engines reported	Average no. of engines per farm
Less than 50 acres	3	3	1.0
50 to 99	17	21	1.2
100 to 149	16	24	1.5
150 to 199	12	18	1.5
More than 200	18	23	1.2
Total or average	66	89	1.3

### STATIONARY ENGINES

Stationary engines have been used rather extensively on farms during the past quarter century. With the advent and general adoption of the tractor, the use of stationary engines for belt-power operations has declined on many farms. One advantage of the stationary engine is the fact that it is obtainable in a wide variety of sizes, thereby making it possible to purchase the size best adapted to the purpose or uses intended.



Sixty-six of the 260 non-tractor farms reported the use of stationary engines. There were 89 such engines in use on these farms, or an average of 1.33 engines per farm reporting.

The chief purposes for which stationary engines were used on the farms were for providing lights, grinding feed, operating washers, pumps, and saws. Eighteen farms had individual light plants operated by small gasoline engines, which provided illumination for the homes and farm buildings. The sizes of engines in use ranged chiefly from  $\frac{1}{2}$  to 8 horsepower, only 16 of the 89 engines being larger than 8 horsepower, while 43 were smaller than 2 horsepower.

These engines were used on all sizes of farms, there being little difference in the average number per farm in the different size groups. Table 15 shows the farms reporting stationary engines grouped according to size of farm, together with the number of farms in each group and the number of engines reported.



One of the more common uses of stationary engines on farms

POWER ON TRACTOR FARMS  
FARM ORGANIZATION

*Size of Farm*

The farms on which tractors were found varied considerably in size and, as might be expected, as a group were decidedly larger than the average farm for the state as a whole. Of the tractor farms included in the survey, 40.8% contained between 50 and 175 acres each, and 60% of the farms were of from 50 to 250 acres in size. Only 15.4 percent of the farms contained 500 acres or more each.

A similar relationship to that found when farms were classified according to size obtained when the farms were classified according to the total crop acres per farm. Nearly 70% of the farms had less than 70 acres in crops. There were 24 farms which had less than 25 acres in crops. It can be seen that the total crop acreage per farm on an appreciable percentage of the farms was not exceptionally large.

*Crop Acreage*

The crops grown on the tractor farms for the most part were fed on the farm and marketed through livestock or livestock products. The crops grown, the average acreage of each crop per farm, and the average pasture and total acreages per farm are shown in Table 16.

Corn, wheat, oats, and hay were the chief crops produced. Because of the fact that 31,329 acres of the 59,008 acres in the 181 tractor farms were in pasture, livestock enterprises were important factors in the organization of these farms. The total crop acreage on the tractor farms was 13,237 acres.

TABLE 16—Crops on 181 tractor farms together with number of farms reporting, average acreages of each per farm, average total acres per farm, and acreages in crops and pasture

Crops	Number of farms reporting	Average acres per farm reporting	Average acres per farm all farms
Corn	181	20.82	20.82
Wheat	101	18.23	10.01
Hay	150	32.65	27.06
Oats	111	10.13	6.21
Buckwheat	28	7.75	1.19
Soy beans	35	11.15	2.15
Potatoes <sup>1</sup>	89	1.80	.88
Alfalfa	23	13.76	1.74
Tobacco	9	1.50	....
Truck crops	6	5.25	....
Orchard <sup>2</sup>	5	13.40	.37
Rye	5	7.80	.21
Barley	8	6.50	.28
Total crop acres	181	73.13	73.13
Total pasture acres	179	175.02	173.04
Total acres per farm	181	325.83	325.83

<sup>1</sup>Garden plots not included.

<sup>2</sup>Commercial orchards only.

## Livestock

Because the records were taken in many sections of the state, the emphasis on various livestock enterprises changed considerably with the location. In some areas dairying received major emphasis; in others beef cattle and sheep constituted the chief livestock enterprises. With an average pasture area of 173 acres per farm, it is apparent why livestock projects were important in the organization of these farms. Table 17 shows the average number of each of the various classes of livestock on the tractor farms.

TABLE 17—*Livestock on 181 tractor farms*

Kind	Number of farms reporting	Average number per farm reporting	Average number per farm (all farms)
Hogs	165	15.94	14.53
Sheep	79	69.05	30.13
Dairy cows	168	12.99	12.06
Dairy heifers	144	6.47	5.15
Beef cattle	99	32.63	12.32
Horses	176	3.21	3.13
Poultry	175	123.39	119.30

## THE FARM TRACTOR

The internal combustion traction engine was developed about 1892 and became commercially successful by 1903. Since that time, its history has been one of rapid development and adoption, particularly during the period since 1920. The development of its use has been so rapid in the United States that the tractor is now one of the most important sources of farm power.

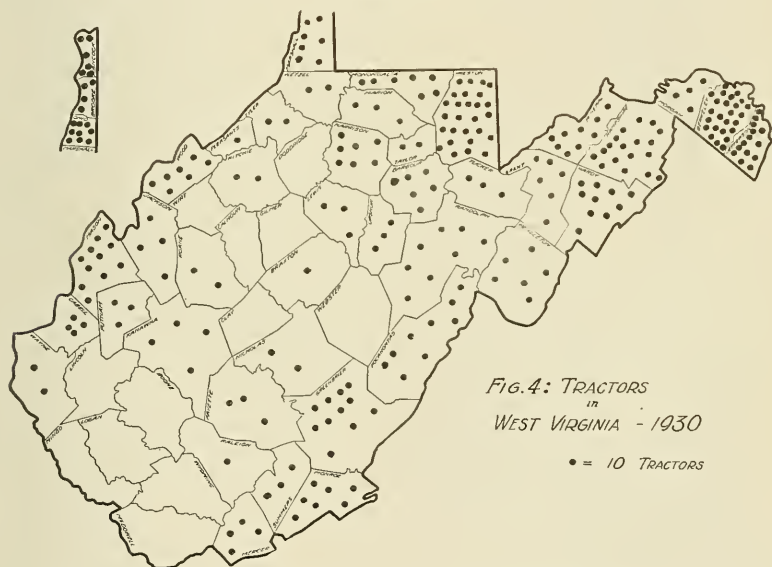
It is estimated that in West Virginia, a state not particularly adapted to power farming and machine methods of production, there were about 100 farm tractors in use in 1918. By 1920 the number had increased to 572, by 1925 to 1,860 and in 1930 there were 2,792 tractors reported in use on West Virginia farms. The increase in the use of tractors in other states with more favorable topography for tractor farming was even more pronounced. In 1930 there was one tractor to every 686 acres of crop land in West Virginia, in which respect the state ranked thirty-fourth in comparison with all of the states in the union.

Figure 4 shows the number and distribution of tractors in West Virginia in 1930. There were three counties in the state in which no tractors were reported, and in nine additional counties less than 10 tractors each were reported. There were tractors on 3.3 percent of the farms in the state in 1930, or one tractor to each 30 farms.

The fact that 181 of the 441 farms from which farm power records were obtained had tractors, indicates that the areas of the state chosen for the power study were those better adapted to the development of power farming.

### *The Farm Power Situation and the Tractor in West Virginia*

Because of the unusually low level of farm prices during 1932 and 1933, farmers in West Virginia were finding it increasingly difficult to meet any costs of production and marketing which required cash outlay. This was shown by the fact that most of the tractor owners visited revealed that they were using their tractors considerably less than formerly, and were using horses for many operations ordinarily performed by the tractor. The reason cited for this situation was that they had the horses and also feed for which there was practically no market. For the products which they sold the returns were so limited that the supply of cash to carry on their business operations was reduced to the point where it would cover only such out-of-pocket payments as were absolutely necessary. Since fuel for the operation of tractors was an item requiring cash payment, the farmers were tending toward using their horses more; using the tractor, in a few instances, merely as reserve power to supplement the horses when the pressure of work required it.



This situation was responsible in considerable measure for the low number of days of use per tractor on these farms in 1932. The tendency toward increased use of horses on tractor farms will undoubtedly continue until the general farm situation improves materially.

#### *Mechanization of Agriculture not Halted*

Few farmers have purchased equipment in the past few years except where absolutely necessary. Consequently the machinery on West Virginia farms is reaching the point where much of it has little

value. With so few colts coming on, and horses on farms reaching an age of questionable usefulness, there will probably be an increase in tractor use to replace the gradual falling off in the horse population during the next few years. The mechanization of agriculture will continue but not so rapidly as during the several years just passed. The rate of development will depend largely on the economic situation and the result of inventive effort in the field of farm equipment.

### *Effect of the Tractor on Farm Organization*

Effort was made to determine to what extent changes had been made in the business organization of farms, and what some of the more important of these changes had been, as a result of adding a tractor to the power equipment.

Twenty-seven of the 181 tractor farmers reported an increase in the size of their farms since buying a tractor. The average increase per farm for those reporting was 97.48 acres. Only one farmer reported a decrease since owning a tractor. On the rest of the farms no change in total acreages had been made. However, changes in farm layout on many of the farms had been brought about as a result of the use of tractor equipment. On 42 farms the size of the fields had been increased for greater economy and convenience in handling the power equipment, and 39 farmers reported that they had changed the shape of the fields, with this same objective in mind.

Thirty-eight owners stated that more land had been brought under cultivation since buying a tractor. This had been done in two ways: (1) by buying additional land and (2) by putting under cultivation some land formerly in pasture. Conversely, on 16 farms some land had been removed from cultivation. These were such areas as were unsuited to the use of power equipment.

Twenty-six farmers felt that their tractors had definitely been instrumental in helping them to obtain increased crop yields, while 3 felt that their crop yields had been decreased. On the remaining farms the operators could not see that the use of a tractor had had any effect on yields.

The effect of the tractor on the length of the working day was indicated by the fact that 26 farmers reported that they worked shorter days since buying a tractor. However, 34 farmers stated that the length of their working day had increased. In all other cases there had been no change. Sixty-two farmers had hired less labor since owning a tractor. Nine farmers had hired more labor than formerly, while on the 110 remaining farms the amount of hired labor had not changed. On 26 farms more family labor was being used since buying the tractor and on 19 farms less family labor was in use than formerly. With these exceptions there had been no changes in the amounts of family labor. The changes in the labor situation on the farms explain to some degree why, on many farms,



It was in such farming areas as this that the majority of tractors were found

the length of the working day had increased since purchasing a tractor. In many cases the farmer and his family with the tractor were doing work formerly performed with hired help.

#### *Number of Horses on Farms as Affected by the Tractor*

By comparing the number of horses on farms at the time of the survey with the number of horses on these same farms before buying a tractor it was possible to attain a measure of the number of horses displaced by the tractors. This information was not obtainable for all farms because on many, the farmers had owned tractors when they moved in and, consequently, had never farmed those particular farms without a tractor. However, these data were complete for 140 farms. On 71 of these farms the number of horses had been decreased; on 10 farms the number had been increased and on 59 there had been no change in the numbers kept. There were 602 horses on the farms before the tractors were purchased and 437 at the time of the survey. In other words, the tractors on these farms had displaced only an average of 1.18 horses per farm.

The result of this situation was that on 65 of the 140 farms, owners reported that the horses were idle part of the time while the tractors were in use. The percentage of the time the horses were idle while the tractors worked, varied from 5 to 100. Forty-eight of the 65 farms reported that horses were idle 50% of the time or more while the tractors were in use. This indicates what takes place when new power units are added without changes being made in the size of the business or in the original power units retained. The result is a decrease in the power loads of the units retained without a corresponding increase in the net returns. In adjusting new types of power on the farm, this consideration is of primary importance because of its direct bearing on the returns from the farming enterprise.

In Minnesota a tractor displaced 1.9 horses in 1918 (1), and in 1929 the average number of horses displaced per farm was 2 (2). Myers reported that in a study of 220 tractor farms in New York in 1919, a tractor displaced 2.4 horses per farm (3), and Gilbert in a study of 175 tractor farms in New York in 1926 found that on the average 1.8 horses less per farm were needed after the purchase of a tractor (4).

#### *Number of Tractors in Use*

There were 193 tractors on the 181 farms from which records were obtained. Of this number the products of two tractor manufacturing companies constituted 91.2 percent. One of the reasons for the popularity of these makes at the time of purchase was the possibility of obtaining service on, and parts for, the tractors quickly in case of emergency.

Although there were 193 tractors owned on these farms, there were 11 which had not been used at all during the year of the record. Thirty-one additional tractors had been used less than five days each

during the year. These facts substantiate the statement that a noticeable tendency prevailed among farmers at the time of the survey, to curtail the use of their tractors in order to reduce cash expenditures. As a result it was impossible to obtain a complete record of tractor operation on several farms where tractors were owned.

Fifty of 189 tractors on the farms (4 records were incomplete) had been purchased as used machines, while 139 had been new when acquired. It was possible to determine accurately the year of manufacture on only 177 of the tractors. The average estimated life of all tractors was 11.45 years.

#### *Annual Hours of Tractor Use*

Eleven of the 193 tractors on the farms covered by the survey had not been used at all during the year, as a result chiefly of the economic situation. One tractor was reported as "worn out." Only the records of tractors actually in use in performing farm work were used in compiling the following summaries and averages.

Thirty-seven percent of these had been used less than 100 hours during the year, and the total annual hours of tractor use in 66% of the cases was less than 200. The total annual hours of use per tractor ranged from 3 to 1070 hours, the average for all units being 198.57 hours. Only 10% of the tractors were used more than 500 hours each during the year.

In a survey of 60 tractor farms in West Virginia in 1921 (5) the average number of days each tractor worked was 41.66, which was more than twice the average number of hours per tractor in 1932. Their average estimated life in the earlier study was 9.5 years as compared with 11.45 years in 1932. The fact that tractors were being used only half as many hours in 1932 as formerly, together with the fact that great improvements had come about in tractor construction and design during the interval, undoubtedly account for the increase in the estimated average life. The tractors included in the study had been on the farms an average of 5.56 years. Twenty-five percent had been purchased prior to 1925. In the period from 1925 to 1929, 47.76% had been acquired and the percentage of all tractors on farms included in the survey that had been bought between 1929 and 1932 was 26.96. These figures indicate that during the depression years 1929 to 1932 inclusive slightly more than one-half as many tractors had been purchased by farmers from whom records were obtained as in the four years immediately preceding.

#### *Drawbar Work Done by Tractors*

From 167 complete records of tractor operation it was found that plowing, disking, harvesting, and harrowing were the chief drawbar operations performed by tractors. Other drawbar operations were performed with the tractors but in a very much smaller percentage of cases. Table 18 shows the drawbar work done by tractors on the farms, the number of farms reporting the various operations, the



TABLE 18—*Drawbar work done by tractors on 167 farms*

Kind of work	Number of farms reporting	Average acres per farm reporting	Average tractor hours per farm reporting	Average acres covered per tractor per day (10 hrs.)
Plowing	90	41.3	73.7	5.60
Disking	93	58.1	37.8	15.30
Harrowing	58	58.7	40.0	14.60
Seeding	7	38.0	15.0	24.40
Harvesting	68	33.6	23.2	14.46
Cultivating	10	69.1	48.2	14.33
Mowing filth	3	130.0	58.0	22.41
Loading hay	4	62.0	130.0	4.76
Hauling manure	5	...	132.0	...
Subsoiling	1	40.0	50.0	8.00
Spreading lime	1	200.0	150.0	13.33
Hauling corn	2	65.0	80.0	8.12

average acreage covered, the tractor hours per farm, and the average rate of doing the work.

The tractors were used in a few instances in performing drawbar tasks off the farms, sometimes on a labor-exchange basis for neighboring farmers. The drawbar operations performed off the farms were chiefly plowing, disking, and binding, the number reporting each operation being 8, 7, and 6 respectively. Not more than three farms reported any other custom drawbar work. It is apparent that the number of farmers using tractors for such work was comparatively small.

#### *Belt Work Performed by Tractors*

The records of tractor use on the 167 farms showed that silo-filling, feed-grinding, wood-sawing, and threshing were the chief operations for which tractor belt-power was used on these farms. The custom belt-work done with the tractors lay chiefly in the filling of silos. The instances where the tractors were used for belt-power operations other than those mentioned, either on or off the farms, were few (see Table 19).

TABLE 19—*Belt work done by tractors on 167 farms*

Kind of work	ON THE FARMS		CUSTOM WORK	
	Number of farms reporting	Average number of tractor hours per farm reporting	Number reporting	Average number of hours reported per tractor
Filling silo	96	21.5	21	33.0
Grinding feed	74	81.3	3	130.0
Sawing wood	42	28.4	4	67.5
Threshing	22	51.3	2	179.5
Husking corn	6	9.3	..	...
Crushing lime	3	125.0	1	84.0
Bailing hay	2	8.5	1	80.0
Pumping water	1	520.0	..	...

### Operations for which Tractors were Preferred to Horses

Farmers were asked for which operations they felt tractors were preferable to horses. As Table 18 shows, the operations for which tractors were used chiefly were the heavier jobs of tillage and harvesting. The answers to the foregoing query indicated that it was for these operations that farmers considered the tractor best suited. Seven farmers stated that they preferred the tractor to horses for all operations, while three said they preferred it for none.

TABLE 20—Operations for which tractors were preferred to horses, and vice versa, on tractor farms, and number of farmers who expressed such preference

Operations	Number of farmers who preferred tractors to horses	Operations	Number of farmers who preferred horses to tractors
Plowing .....	53	Planting .....	27
Disking .....	82	Cultivating .....	69
Harrowing .....	51	Plowing .....	44
Binding .....	29	Mowing .....	31
Mowing .....	9	Raking .....	12
Cultivating .....	4	Harrowing .....	7
Loading hay .....	4	Hauling .....	24
Belt work .....	24	Spreading manure ..	6
Hauling .....	3	All except belt work	7
All operations .....	7	All operations .....	3
No operations .....	3	No operations .....	7

The number of farmers who expressed a preference for the tractor for certain operations, together with those operations most frequently mentioned, is shown in Table 20. It is apparent from these figures that farmers considered that the chief value of the tractor lay in performing those tasks on the farm which required the greatest drawbar power. Of course, the tractor possesses an advantage over horses in that it can be used for belt-power operations, and 24 farmers suggested this in answer to the question stated, although it is not an operation on which the merits of tractors and horses can be directly compared. That the majority of farmers realized this fact in formulating their answers to the inquiry undoubtedly accounts for the fact that belt power was not mentioned much more frequently. Other operations than those shown in the table were mentioned by farmers but only in single instances, therefore not warranting their inclusion in the table.

### Operations for which Horses were Preferred to Tractors

In order to obtain a complete cross-section of opinion the farmers were asked also to state for which operations they preferred to use horses rather than tractors. As might be expected, horses were preferred for the lighter drawbar operations such as cultivating, planting, mowing, and hauling. There were many exceptions, however, showing that the farmers were not unanimous in their opinions concerning tractor operation. Three farmers preferred horses for all operations, seven preferred horses for all except belt work, and 44

preferred horses to tractors for plowing. It should be remembered that all farmers had both types of power available.

Table 20 shows also the operations for which horses were preferred to tractors together with the number of farmers stating such preference. In obtaining this information no listing or suggesting of operations was done. In formulating their replies, therefore, it is not unlikely that farmers overlooked many operations which they might otherwise have mentioned. However, the table indicates a diversity of opinion regarding the comparative merits of horses and tractors for farm work, and indicates that the problem of adjusting the power units on the individual farms was far from being solved.



Livestock on the way to market. Livestock production is an important enterprise on both tractor and non-tractor farms

### *Advantages and Disadvantages*

Farmers seemed to consider the speed with which work could be done, or the time-saving element, the chief advantage of the tractor. Ninety-seven of the tractor farmers mentioned this factor. Ten felt that the tractor saved labor, 24 thought it was easier to handle, and 6 farmers felt that tractors were cheaper in the long run. Other advantages mentioned were convenience, savings on winter feed, better work, horses saved, more power, deeper plowing, better moisture retention, and no care needed when not working. One farmer felt that the tractor had no advantages.

The chief disadvantage of tractors mentioned was fuel cost. The fact that 74 farmers gave this as a disadvantage emphasizes the fact that under economic conditions on farms at the time of the survey, operating costs requiring cash expenditures affected farmers seriously. Other disadvantages mentioned were the use of tractors

on hillsides, on small fields, and on wet ground. Five farmers felt that the tractor had no disadvantages.

In answer to the question, "If you had no tractor would you buy one?", 65 of the tractor farmers answered "No;" and of these 39 said they did not consider a tractor a profitable investment. Many of the 65 farmers answered "No" simply because under changed economic conditions they could not afford to buy another tractor. However the 39 farmers who did not consider a tractor an economic investment indicated that on these farms either the necessary load adjustments between power units had not been made, or, their individual farm business had not justified the purchase of a tractor in the first place.

### *Care and Repair of Tractors*

With eight exceptions, all the tractors on the farms were housed when not in use. The type and kind of shelter provided varied considerably but in all cases was ample to protect the machines against the vicissitudes of the weather.

The chief items of repair were general overhauling, replacing timer, new bearings, and minor miscellaneous repairs. The list of repairs as reported was rather all-inclusive, but in a large number of cases certain items were reported in only single instances. The availability of repair parts for the tractors is shown by the fact that the tractor farmers were an average distance of 25.9 miles from the nearest source of repair parts. Twenty-eight farmers reported that they had been delayed during the busy season due to breakdown of the tractors. The extent of the delays occasioned averaged four days each for this group of farms, or .62 days per farm for the season for all tractor farms.

According to records obtained, it required an average of forty minutes of man labor per day to care for and service the tractor when it was in use. Since the tractors were used an average of 192 hours per year, this labor item amounted to 12.8 hours per year per farm.

### *Cost of Operating a Tractor*

The average value of the tractors on the farms at the time of the survey was \$315.33. Based on averages of figures obtained relative to various cost items, the cost of operating the tractors is summed up in simplified form in Table 21. Had the tractors been used a greater average number of hours per year, the cost of use per hour would have been reduced since the fixed charges such as interest, depreciation, and housing would have remained unchanged.

It is an accepted fact that the depreciation on a machine such as a tractor is heaviest during the first few years of service.

The average value used in figuring interest and depreciation is somewhat lower than might be expected since an appreciable number of the machines were bought as used tractors. Practically all of the tractors were operated by owners or members of their families.

TABLE 21—Approximate cost of operating tractors on West Virginia farms (1932)  
(exclusive of operator)

Cost items	Cost per year
Depreciation @ 12% <sup>1</sup> .....	\$ 84.00
Interest @ 6% on average investment <sup>1</sup> .....	21.00
Labor @ 25c per hr. <sup>2</sup> .....	3.20
Repairs .....	6.52
Grease .....	3.80
Oil .....	11.52
Fuel — av. 1.5 gal. per hr. for 192 hrs. @ 10c per gal. ....	28.80
Housing .....	10.00
Total .....	\$168.84
Cost per hour of use .....	0.875

<sup>1</sup>Based on first cost of \$700, many tractors having been purchased as used machines. (The actual average cost of tractors at time of purchase was \$678.63.)

<sup>2</sup>Based on an average of estimates of 40 min. per day when tractor was in use.

### HORSES

There were 566 horses on the 181 tractor farms. Five of the farmers, however, reported no horses owned. Although it might be expected that tractor farmers used lighter or older horses than were used on non-tractor farms, since the tractors were available for the heavy drawbar work, this was not the case. The average age of horses on tractor farms was 10 years as compared with 11.6 for the horses on the non-tractor group of farms. The horses on the tractor farms averaged slightly heavier (13 pounds) and their average value was approximately \$7 greater than on the non-tractor farms. The average number of horses per farm was greater on the tractor farms also, but this can be accounted for, to some extent at least, by the much larger total acreage and crop acreage per farm for this group. There was little variation between the two classes of farms in the



One of the important hauling jobs performed with horses on tractor farms

TABLE 22—Average value, age, weight, and number of horses on 176 tractor farms

Average value per horse (dollars) .....	\$107.76
Average weight per horse (pounds) .....	1354
Average age of horses (years) .....	10.02
Average number of mares per farm .....	1.63
Average number of geldings per farm .....	1.58
Average number of horses per farm .....	3.21
Average number hrs. each horse worked per yr. ....	537.7
Total number of horses (all farms) .....	566

\*On 5 farms no horses were owned.

number of days of use per horse per year, the advantage here again, however, being on the side of the tractor farms.

Table 22 shows the average value, weight, age, and number of horses on the 176 tractor farms where horses were owned. As this table indicates, the number of geldings and mares was divided about equally. The number of colts being raised on the tractor farms was practically negligible, only 5 under two years of age having been reported.

### Age of Horses

Only 22% of the horses on the tractor farms were less than 8 years of age and 10% were more than 20 years old. The average age of all horses was 10.03 years. Although this figure is not quite as high as the average age of horses on non-tractor farms, it shows that the average age of farm horses is tending upward. There were not enough colts in sight to furnish replacements. Table 23 shows the horses on tractor farms distributed according to age.

It is apparent after studying this table that many of the horses had passed their peak of economic usefulness. Larger numbers of aged horses die each year. They must be replaced with either tractors or other horses. Few colts have been raised in the past several years, good horses are scarce, and prices of horses have tended upward as a result. With this situation prevailing and with economic conditions affecting his income and his use of tractors, it is

TABLE 23—Distribution of horses on tractor farms in various age groups (558 horses)\*

Age (years)	Number of horses	Percent of total
Less than 2 .....	5	0.90
2-4 .....	26	4.66
4-6 .....	47	8.42
6-8 .....	47	8.42
8-10 .....	94	16.85
10-12 .....	81	14.52
12-14 .....	66	11.83
14-16 .....	64	11.47
16-18 .....	42	7.52
18-20 .....	29	5.20
20-22 .....	21	3.76
22-24 .....	15	2.69
More than 24 .....	21	3.76

\*Ages of all (566) horses were not obtained.

apparent that the solution of his power problems is not an easy one for the average farmer.

### *Cost of Keeping Horses*

There was no great variation in the hay, grain, and pasture items between tractor and non-tractor farms. The impression that ownership of a tractor makes it possible to keep horses with less feed and labor was not borne out by the records. The greatest variation between the costs of keeping horses on the two groups of farms was in the labor item. On the tractor farms the average number of hours of chore labor per horse was much higher than on the non-tractor farms, this item alone accounting for most of the difference in the total average costs on the two classes of farms. There was little difference in the average number of hours each horse was used per year. This figure for the tractor farms was 537 and for the non-tractor farms 520 hours.

TABLE 24—*Cost of keeping a horse on tractor farms in West Virginia (1932)*

Items	Average quantity per year	Average estimated value per unit	Total cost
Interest on investment <sup>1</sup>	.....	.....	\$ 4.20
Depreciation @ 8% <sup>2</sup>	.....	.....	8.40
Pasture	5.9 mos.	1.00 per mo.	5.90
Hay	3.85 tons	\$10.88 per T.	41.89
Grain	96.30 bu.	0.39 per bu.	37.56
Bedding	.....	.....	5.00
Labor	141 hrs.	.20	28.20
Shoeing & miscellaneous	.....	.....	2.00
Total	.....	.....	133.15
Credit for manure	.....	.....	10.00
Net cost	.....	.....	123.15
Cost per hour <sup>3</sup>	.....	.....	0.23

<sup>1</sup>Based on average value of horse in West Virginia (1932).

<sup>2</sup>Based on cost of \$75 for horse and \$30 for harness.

<sup>3</sup>Based on average of 537 hours of use per horse per year on the tractor farms.

The various items of cost of keeping a horse on the tractor farms in 1932 are shown in Table 24.

### *Work Performed by Horses on Tractor Farms*

In spite of the fact that tractors were owned on these farms, an appreciable amount of plowing, harrowing, and reaping was done with horses. The fact that horses were used for much of this work also helps to explain the rather low number of hours of use per tractor during the year covered by the records. The data in Table 25 tend to substantiate the statement that tractor farmers were using horses more than usual and their tractors less, for the economic reasons previously outlined.

Table 25 shows the chief operations performed with horses on Tractor farms in 1932. The machines most commonly in use in performing the operations shown in the table were the 12-inch bottom

plow, the 5-foot mower, the 9-furrow-opener drill, and the 1-row cultivator. The chief variation in the average rates of doing the work on the tractor and non-tractor farms was in cultivating, the result largely of a greater use of 1-horse cultivators on the non-tractor farms.

TABLE 25—*Work done with horses on tractor farms*

Items	Number of farms reporting	Average acres per farm reporting	Acres covered per team per day (10 hrs.)
Plowing	144	25.9	1.48
Harrowing*	111	66.4	7.4
Reaping	57	17.6	7.7
Mowing	161	38.2	7.2
Cultivating*	173	62.5	5.7
Drilling & planting	150	28.4	8.3

HAULING DONE WITH HORSES

Items	Number of farms reporting	Average number days per year per farm reporting	Average number days per year per farm (all farms)
Manure	163	15.8	14.3
Hay	163	6.8	6.1
Corn	150	7.2	6.0
Grain	119	2.7	1.8
Miscellaneous	31	21.1	3.6

\*Total acres figured on basis of number of times operation was performed during season.

AUTOMOBILES

One hundred thirty-one or 72.3% of the 181 tractor farms reported the use of automobiles. Sixty-two percent of the non-tractor farmers had automobiles, and in 1930, 40.5% of all farms in the state reported automobiles. Thus it can be seen that the percentage of farms on which automobiles were found was much higher in the tractor group than on non-tractor farms, or on the farms of the state as a whole.

As was the case on the non-tractor farms, farmers preferred the smaller, lighter, and less expensive types of cars. Three makes of cars constituted 61.8% of all cars on the tractor farms. Figure 5 shows the distribution of automobiles on farms in West Virginia in 1930.

*Extent of Use of Automobiles*

Of the automobiles on tractor farms on which complete information could be obtained, each was driven an average distance of 6020 miles during the year, of which 46.5% was run in the interest of the farm business, a figure almost identical with that for non-tractor farms. The amount of use for the farm varied considerably, running as high as 87.5%. As can be seen from Table 26 there was a wide range in the total annual miles driven, but little variation



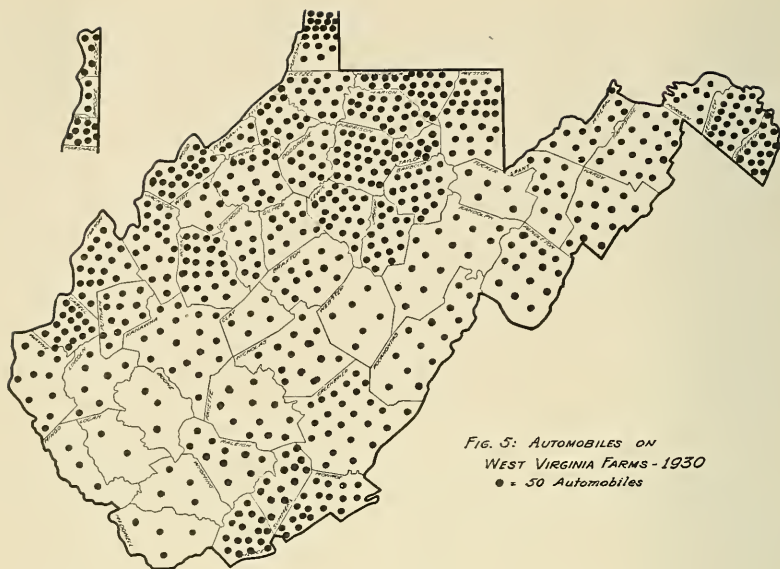


FIG. 5: AUTOMOBILES ON  
WEST VIRGINIA FARMS - 1930  
● = 50 Automobiles

from that for non-tractor farms. On tractor farms the average mileage per car during the year of the record was 6020 and on non-tractor farms, 5508 miles. The extent of use of cars for social and recreational purposes was extremely variable and depended to a large extent on the personal factor.

TABLE 26—Distribution of automobiles on tractor farms according to total miles driven, together with the number of cars in each group, and the mileage driven in the interests of the farm business

Miles driven	Number of cars	Average crop acres per farm	MILES DRIVEN		Percentage of total for farm use
			Average total miles	Average miles for farm use	
Less than 1000	3	61.0	466.6	275	80.3
1000-1999	12	53.6	1125.0	702.7	62.4
2000-2999	14	44.4	2178.5	1323	60.7
3000-3999	13	76.0	3076.9	2032	66.0
4000-4999	10	52.9	4050.0	2103	51.9
5000-5999	13	68.7	5000	2056.7	41.1
6000-6999	11	79.8	6045	2636	43.6
7000-7999	7	63.2	7000	2519.7	35.9
8000-8999	8	54.7	8000	3766.6	47.1
9000-9999	2	63.0	9000	4500	50.0
10000-10999	13	100.0	10000	3653.8	36.5
12000-12999	3	32.6	12000	5333.3	44.4
13000-13999	1	57.0	13000	10450	85.0
14000-14999	2	120.5	14000	12250	87.5
15000-15999	4	70.0	15000	6062.5	40.4
20000-20999	1	33.0	20000	2000	10.0
36000-36999	1	207.0	36000	18000	50.0
total or ave.	118	67.5	6020	2802.9	46.5

The distribution of the automobiles on tractor farms for which complete data were available, according to total miles driven, the number of cars in each group, and the mileage driven in the interest of the farm business is shown in Table 26.

### *Cost of Operation of Automobiles*

The average value of all automobiles on tractor farms was \$744.74. Only 48 of the 131 farmers owning cars carried insurance on them. The average cost of such insurance was \$20.54.

The average costs of operating the automobiles on tractor farms were as shown in Table 27.

TABLE 27—Average cost of operating automobiles on 131 tractor farms

Cost items	Average cost per farm
Insurance .....	\$ 5.20
License .....	16.39
Repairs .....	5.00
Tires and tubes .....	19.73
Gasoline .....	39.08
Oil and grease .....	8.17
Depreciation .....	109.52
Interest .....	26.02
Housing .....	8.92
Total .....	\$238.03

TABLE 28—Average cost of operating automobile trucks on 75 tractor farms

Cost items	Average cost
Insurance .....	\$ 4.35
Depreciation .....	79.75
Housing .....	17.15
License .....	22.90
Tires and tubes .....	25.08
Oil and grease .....	7.86
Gasoline .....	72.15
Interest .....	20.44
Repairs .....	10.01
Total .....	\$259.69

### TRUCKS

Seventy-five of the 181 tractor farms (or 41.4%) reported the use of automobile trucks. None of the trucks reported had a rated capacity greater than two tons. Sixty-eight percent were of one-ton capacity or less. There were 79 trucks in use on the 75 farms, representing several different makes. However, two makes constituted 70% of the trucks.

As on non-tractor farms, the data obtained on tractor farms indicate that farmers preferred the lighter, speedier trucks in their work. This was due no doubt to the greater flexibility of the lighter unit making it better adapted to the wide variety of tasks for which a

truck may be used on the average farm. Twenty three of the 79 trucks on tractor farms had been purchased as used machines and these had an average value at the time of the survey of \$207. The remaining trucks had been purchased new and were valued at \$748. The average value of all trucks was \$582. The average estimated life of all trucks was 7.3 years.

### *Cost of Operation*

The costs of operating the trucks on the tractor farms as obtained from owners are shown in Table 28. Insurance was carried on only 17 of the 79 trucks at an average cost of \$20.22. Repairs had been necessary on only 51 of the 79 trucks. The average cost of repairs on the 51 trucks was \$15.50.

## ELECTRICITY

Eighty-three or 45.8% of the 181 tractor farms were obtaining electricity from central distributing plants. On the other hand, of the non-tractor farms only 25% had high-line electric service, showing that tractor farms were much more completely "electrified" than the non-tractor farms. As was the case on non-tractor farms, most of the installations of electricity on the tractor farms had been made within the five years period immediately preceding the year of the record, showing that the greatest expansion of the use of electricity in rural areas has come about comparatively recently. (See Fig. 6.)

Seventy-five percent of all installations were made in 1928, 1929, 1930, and 1931. Only 7.2% of the farms used electricity before 1920. In other words, in 1920 only 3% of the 181 tractor farms were using electricity as compared with 45.8% in 1932.

### *Size of Farm and Use of Electricity*

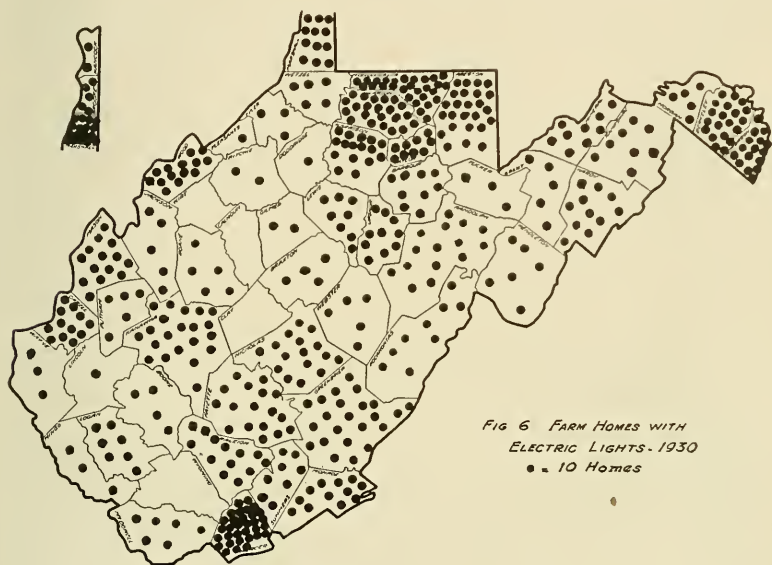
The size of farm was not the important determining factor in the use of electricity, since the tractor farms in all size groups were using electricity to a considerable extent. It was apparent that the farmers in general appreciated the advantages of electricity, particularly in the home, and were not backward in installing it where line extensions were such as to afford reasonable opportunity.

### *Household Uses of Electricity*

Electricity was used for purposes other than lights to greater extent in the homes on tractor farms than in those on non-tractor farms. With the exception of the radio, the more important of these uses were those which helped to lighten the more difficult of the household tasks, particularly washing, ironing, and cleaning.

All 83 farmers used electricity for light, 69 for electric iron, 65 for washing, 60 for radio operation, 43 for cleaning, 28 for refrigeration, 13 for fans, 10 for cooking, 10 for sewing, and 8 for operating a mangle. Many other uses of electricity in the household were reported, but nearly all these in only single instances.

The summaries of the household uses of electricity on both tractor and non-tractor farms show that where electric current was available, the possibilities for expanding its use within the homes were great. This development comes gradually and it must be borne in mind that in most of the homes electricity had been installed comparatively recently.



### *Farm Uses of Electricity*

The chief uses of electricity outside the household, on the tractor farms as on the non-tractor, were for lights, pumping water, and operating various types of dairy equipment. Practically all electric installations on farms in West Virginia have been made with the primary purpose of obtaining lights. The development of its use for other purposes under present economic conditions undoubtedly will come about slowly.

Sixty-two of the tractor farmers had lights in the barn, 39 in the garage, 28 in the yard, 23 in the poultry house, 13 in the silo, and 42 in other buildings. Twenty-one used electricity to pump water, 12 to operate bottle washers, 11 to run separators, 8 for cooling, and 6 to operate milking machines. All other farm uses were reported in no more than two instances. Twenty-seven percent of the electric motors in use on tractor farms were 1 horsepower or less, and 55 percent of the motors did not exceed 2 HP in size.

TABLE 29—Use of stationary engines as reported by 67 tractor farms grouped according to size, together with the number of engines reported in each group

Acres per farm	Number of farms	Number of engines	Average number of engines per farm
Less than 50	1	1	1.00
50-99	8	10	1.25
100-149	7	10	1.42
150-199	12	14	1.16
200 or more	39	50	1.28
Totals	67	85	1.27

### STATIONARY ENGINES

Sixty-seven of the tractor farms reported the use of stationary engines. There were 85 engines in use on these farms. The farms on which engines were found, grouped according to size, together with the number of engines reported are shown in Table 29. The engines were used for a diversity of purposes. Twenty-two farmers used stationary engines to operate individual light plants, 19 for operating washing machines, 11 for spraying, 7 for grinding feed, 4 for pumping water, 4 for operating a saw, 3 for separating milk, and 3 for operating milking machines. All other uses of stationary engines were reported by no more than two farms.

### SUMMARY

The study here reported involves the use of power on 441 West Virginia farms, on 260 of which horses furnished all the drawbar power. Tractors were employed on 181 farms. A summary of the power units on both tractor and non-tractor farms as shown in Table 30 gives the number of each type of power unit found, the number of farms on which each was used, and the percentage of all farms using each type of power. The average size of all farms included in the study was 254 acres.

There was an increasing tendency on the part of tractor farmers to use horses in drawbar operations. This tendency undoubtedly will prevail until there is a marked and sustained upward swing in prices of farm commodities.

TABLE 30—Power units on 441 West Virginia farms (1932)

Units	Total number	Number of farms reporting	Average number per farm reporting	Average number per farm (all farms)	Percentage of all farms
Horses	1255	433	2.9	2.84	98.18 %
Tractors	193	181	1.07	0.44	41.04
Automobiles	277*	274*	1.01	0.6	62.13
Trucks	126	121	1.04	0.28	27.43
Stationary engines	174	133	1.31	0.39	30.15
Electricity	148	148	...	...	33.56

\*19 cars not in use not included.

Farmers should consider seriously the relation between the organization of their business enterprises and the power available. Much of the power now available is utilized very inefficiently, as the number of days of use per horse or per tractor will indicate.

Unquestionably, many farmers owning tractors have failed to make the adjustments necessary before a tractor can become a profitable investment.

The records indicate that in many instances the business was not sufficiently large a unit to warrant the purchase of a tractor.

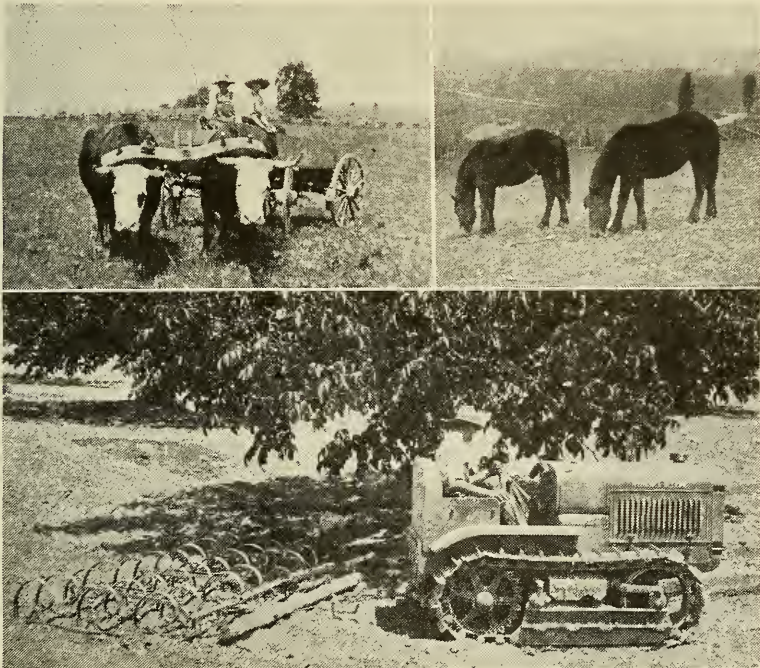
Practically all tractors in West Virginia are of the smaller type, designed to pull two bottoms.

Tractors displaced 1.18 horses per farm.

The use of tractors has had considerable effect on the layout and the size of the farm.

In many cases no changes were made in the power units on the farm or in the business organization after a tractor was added to the equipment.

The horses on farms are of the heavier draft type, since lighter road horses are no longer required.



A wide variety of power units may be found on West Virginia farms

Not enough colts are being raised in West Virginia to meet the demand for replacements. The average age of farm horses in the state is high. Many aged horses die each year and the productive utility of an appreciable percentage of the horses on farms is declining rapidly.

The use of more than two horses per team in West Virginia for farm operations is infrequent. The use of more horses per team and larger machines, where conditions warrant, might aid in more efficient utilization of man labor.

The cost of keeping a horse on tractor farms was as great as on farms not using tractors. Neither were tractor farmers using older, lighter, or cheaper horses than were those farmers who used horses exclusively.

The number of horses in West Virginia has declined by 89,000 since 1920. The number of tractors, however, has increased greatly during this period.

The cars and trucks on farms were chiefly of the lighter, less expensive makes.

Nearly half of the total use of automobiles was in the interests of the farm business.

The number of automobiles idle because of lack of cash for operation indicated that perhaps in many instances a more careful consideration of the problem from an economic standpoint before purchase would have resulted in worth-while savings.

The use of electricity in rural districts has increased rapidly since 1928, and farmers appear glad to avail themselves of the use of electric power whenever it can be made available at reasonable cost.

The chief uses of electricity on farms to date have been within the homes.

The development of the use of tractors and electricity has had a decided effect in limiting the extent to which stationary engines are being used on farms.

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#### LITERATURE CITED

- (1) Patterson, C. D., Mowry J. L., & Cavert W. L.  
Shall I Buy A Tractor? Minn. Agr. Ext. Div. Special Bull. 31, p. 5. 1918.
- (2) Cavert, W. L.  
Sources of Power on Minnesota Farms. Minn. Agr. Exp. Sta. Bull. 262, p. 45. 1930.
- (3) Myers, W. I.  
An Economic Study of Tractors in New York. Cornell Bull. 405, p. 105. 1921.
- (4) Gilbert, C. W.  
An Economic Study of Tractors on New York Farms. Cornell Bull. 506, p. 58. 1930.
- (5) Dadisman, A. J., Shaffer, J. H., Cornell, F. D.  
The Farm Tractor in Mason and Berkeley Counties. W. Va. Agr. Exp. Sta. Bull. 180, p. 9. 1922.













