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# Machinery Use And Investment On Missouri Farms 1951

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RICHARD D. DARLEY AND ROBERT C. SUTER

Operation of an efficient farm business requires continuous adjustment in the allocation of capital among different parts of that business. This is particularly true when technological changes take place or when changes occur in various price-cost relationships. During the last decade both types of changes occurred. They, along with a shortage of labor, gave sharp impetus to the use of machinery on farms.

During World War II farmers began to realize more fully the extent to which modern machinery could be substituted for labor in various processes of agricultural production. At the same time manufacture of farm machinery was curtailed. As a result, a backlog of demand for tractors and power-drawn field equipment developed.<sup>1</sup> Following the war, more machinery became available and the farmer's ability to purchase it increased as a result of the increased purchasing power of farm commodities.

When farm incomes are high, farmers tend to bid up land values and buy more of the productive agents. For example, immediately following World War I farmers dissipated much of their wartime earnings into the purchase of land at extremely high prices. Following World War II there was a tendency to do this again, although a considerable amount of farm earnings were diverted to the purchase of other capital items such as farm machinery, thereby setting the stage for lower production costs. The amount of machinery and equipment on farms as well as the investment in that machinery and equipment has increased tremendously since 1945.<sup>2</sup>

Increased use of the productive agents in farming does not occur uniformly. The extent to which modern machinery and equipment has been applicable to various farm operations differs with the type of farming practiced. The amount of machinery that can be used economically varies with the size of the farm.

Some farms are too small to utilize efficiently some of the larger machines, such as the combine, corn picker, or hay baler. This may mean that

<sup>1</sup>In 1942 and 1943 the manufacture of farm machinery was curtailed to 80 and 40 percent respectively of the 1940 level.

<sup>2</sup>According to the *Agricultural Census; 1950*, there were 125,536 tractors on farms in Missouri in 1949 as compared to 78,398 in 1945 and 45,155 in 1940.

the size (and cost) of these machines needs adjusting to fit technical requirements of the family sized farm. A number of implement companies are now attempting to do this. On the other hand, the fact that some of our farms are too small to use these large machines advantageously may mean that the size of the family farm needs to be increased to take full advantage of these machines. A number of farmers are attempting to do this—either by doing custom work for their neighbors, or by renting more acres. Reducing the size or number of machines is the short-run type of adjustment. Increasing the size of the farm is the long-run type of adjustment.

A detailed study of the capital invested in machinery and equipment, along with the amount of use of various farm machines, has been made in four different areas in Missouri. The objectives were:

(1) To compare the capital invested in farm machinery with the capital invested in other parts of the farm business.

(2) To study the relationship between the size of the farm business and the capital invested in machinery and equipment.

(3) To ascertain the extent to which some of the various farm machines are being used, and to determine, if possible, certain recommended levels of usage.

A number of factors, such as customs or habits of the individual farmer, farm practices found in various areas, weather conditions or growing season of the particular year, and "timeliness" of the various farm operations, enter into decisions of the individual farmer. These factors must be considered along with any of the results presented in this bulletin.

## AREAS STUDIED

**Location:** Four areas representing four different type-of-farming regions and located in four widely separated parts of the state were selected for this study. Areas studied were in Atchison County, a cash-grain livestock region; Linn County, a general livestock region; Greene County, where dairy farming predominates; and Pemiscot County, where cash crops (cotton, soybeans, and corn) are grown almost exclusively (Figure 1).<sup>1</sup>

In selecting the area within each county, the county agricultural agent was contacted and with his help a typical area, homogeneous as to soil type, topography, and type-of-farming, was selected. Farmers in each area were then contacted until at least 50 acceptable records were obtained. A "down-the-road" approach was used in order to obtain complete enumeration in each area. Although heavy rains and floods occurred in 1951, they did not materially affect results obtained in any of the areas studied. Records were

<sup>1</sup>The area in Atchison County was located between Rockport and Tarkio; in Linn County the area extended from Brookfield and Laclede south to the Chariton County line; in Greene County the area was located east and south of the city of Springfield; in Pemiscot County, the area was south and west of Caruthersville.



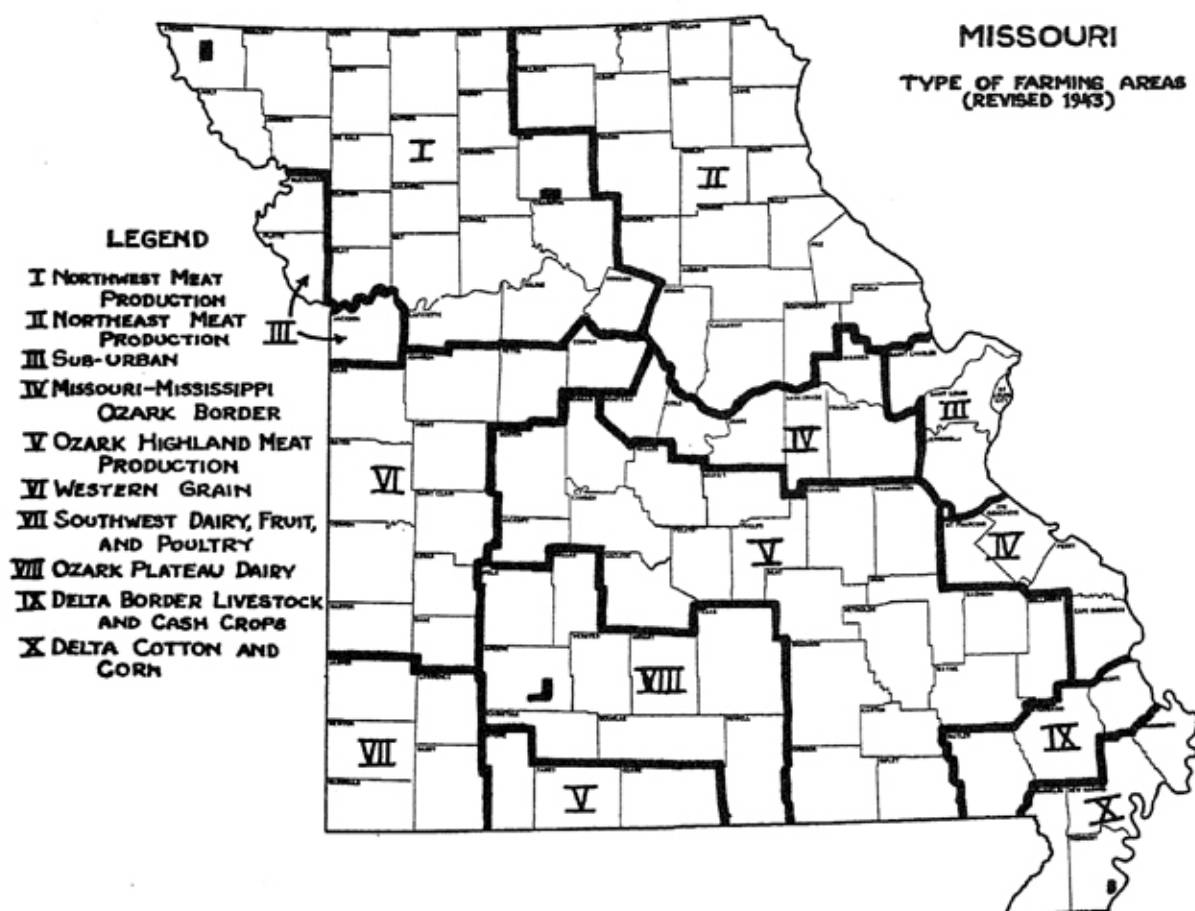


Figure 1—Location of areas studied.

obtained in June, before the rains influenced farming operations. Consequently, the figures obtained were not biased by the 1951 growing season.

In Atchison County, the area studied was 60 square miles in size. The area in Linn County was only 37 square miles. Over 100 square miles were covered in Greene County, while in Pemiscot County, an area of only 45 square miles was used. Size of area varied primarily because of differences in number of farms per square mile. The area in Greene County was especially large because of the many part-time farms and rural homes of city workers surrounding the city of Springfield.

**Climate, Soil, and Topography:** In Atchison County, the average growing season is 171 days (Table 1). Average annual precipitation is 34 inches with 24 inches falling during the growing season. The predominant soil type is Marshall silt loam, a deep and fertile soil. The topography is hilly, and erosion is a serious problem.

In Linn County, the average growing season is 176 days. Average precipitation is 35 inches, with 25 inches falling during the growing season. Predominant soil type is Grundy silt loam, a shallow soil containing much less natural fertility than that found in Atchison County. The topography is gently rolling, and erosion is not serious. In addition to the Grundy soil,

TABLE 1. CLIMATE, SOIL, AND TOPOGRAPHY: Atchison, Linn, Greene, and Pemiscot Counties

County	Length of Growing Season* -days-	Rainfall*		Predominant Soil Type	Topography
		Total -inches-	Growing Season		
Atchison	171	34	24	Marshal	Hilly
Linn	176	35	25	Grundy	Gently rolling
Greene	203	40	27	Crawford	Rolling
Pemiscot	218	48	27	Sarpy	Level

\* 1940 Yearbook of Agriculture: Climate and Man. U. S. D. A.

some Wabash silt loam is located in the creek and river bottoms. Drainage is somewhat of a problem, particularly in these more level areas.

In Greene County the average growing season is 203 days. The average precipitation is 40 inches, with an average of 27 inches falling during the growing season. Predominant soil type is Crawford gravelly loam, a shallow soil containing innumerable stones which hinder cultivation. For this reason, the area is not capable of supporting an intensive cropping system. Topography east of the city of Springfield is rolling, whereas, topography south of the city is fairly level. The latter is referred to as the "Kickapoo Prairie."

The average growing season in Pemiscot County is 218 days. Annual precipitation is 48 inches, with 27 inches falling during the growing season. While this county has a large annual rainfall, it obtains no more rain during the growing season than do the other counties. Yet, with cotton the major crop in this area, distribution of rainfall during the growing season has a considerable influence on cotton chopping and weeding operations. Predominant soil type in the area studied is Sarpy sandy loam, a soil which is easy to work. The topography is level, with some of the land below the level of the Mississippi River. Hence dike construction and drainage are problems on some farms.

**Farm Machinery and Farm Practices Peculiar to Each Area:** Differences in climate, soil, and topography, along with differences in type of farming lead to somewhat different farm machinery needs and slightly different farm practices in each area. This study shows that several types of equipment were being used in one area in the state that were not used in other areas.

In Atchison County, almost all of the major types of machinery and equipment were used, along with two additional machines—listers and go-devils which were peculiar to this area alone. The lister was used with a corn planting attachment to "bed" the ground and plant the corn, all in one operation. The go-devil, or "snakekiller" as it is sometimes called, was used in the early cultivation of corn to either shove the dirt towards, or scrape dirt away from the corn row, thereby covering or chopping the weeds. A

corn picker also was standard equipment in this area; more of them were being used in the Atchison area than in any other studied.

Chief rotations in the Atchison area were corn-corn-oats-red clover, and continuous corn. In preparing the ground for corn, a breaking plow or a disc harrow was used. The number using each was about equal. A disc harrow was used to fit the ground (once over if the ground had been plowed, or twice over if it had not). Corn was planted then with a lister. When the corn came up, it was usually "snaked" twice and cultivated once. Most of the corn was picked mechanically.

In Linn County, the machinery was typical of most general farming regions. Listers were not used in this area because the soil was not as deep or as easy to work as in Atchison County. Fewer corn pickers were found in this area.

The main rotation was corn-oats-red clover, with some continuous corn or soybeans being grown on land adjacent to creeks or rivers. In preparing corn ground, the breaking plow, disc harrow, spike-tooth harrow and spring-tooth harrow were used. Corn was planted with either a regular horse or a tractor planter. It was usually cultivated twice. Compared with the other areas, more of the Linn County corn was picked by hand and much less with a picker. Smaller acreage per farm encouraged custom work and cooperative ownership of some farm machinery, particularly harvesting equipment.

In Greene County, farmers owned several items of machinery not found in other areas. Plowing usually was done with a two- or three-disc plow. Few moldboard plows were found in the area. The spring-tooth harrow and the roller or cultipacker also were peculiar to the area. Milking machines were standard equipment. Cows were hand milked on little more than 10 percent of the farms.

The most common rotation was corn (or sorgo) for silage-winter barley (or oats)-hay. Corn ground was broken with a disc plow. It was usually prepared with a disc harrow, followed with a spring-tooth harrow. The corn was planted with a regular corn planter. In this area, corn was cultivated from two to four times each season. Most of the corn for grain was picked by hand. There were very few corn pickers. On these farms a corn binder and a stationary ensilage cutter usually were used. Only a few field choppers and blowers were found.

In Pemiscot County, farmers owned fewer types of farm machinery. Most of the machinery was bought in sets, with the tractor, middlebuster, disc harrow, cultivator, and planter being purchased as a unit. The middlebuster, which was peculiar to this particular area, was used to "bed" the land. Many stalkcutters were used to break up the cotton stalks. Two-row equipment predominated, although a recent shift to four-row equipment has occurred on some of the larger farms. Most combines were of the two-row type, several of them self-propelled.

In this area a common rotation was difficult to find. Usually any combination of cotton, soybeans and corn for grain was grown. As far as the farm operations were concerned, plowing with a moldboard plow was called "breaking," using a middlebuster was called "busting" or "bedding," and cultivating was called "plowing." In preparing ground for cotton, soybeans, or corn several different methods were followed. Although the machines were fairly uniform, the sequence in using them varied widely. One of the more typical practices was to run over the ground first with a stalk cutter, then with a disc harrow, a spring-tooth harrow, a middlebuster, and finally with a disc harrow and spring-tooth harrow together. Cotton usually was planted with a general purpose planter. In 1951 it was cultivated eight to ten times and chopped from three to five times. More cultivating and chopping than usual was done in 1951, due to the growing season and rainfall distribution. Almost all of the cotton in this area was picked by hand.

### CHARACTERISTICS OF FARMS

In each of the four areas studied, records were obtained on approximately 50 family-sized commercial farms.<sup>1</sup> The average size of farm was 325 acres in the Atchison area, 240 in the Linn, 205 in the Greene, and 187 in the Pemiscot areas (Table 2).

TABLE 2. TYPE OF OWNERSHIP AND SIZE OF FARM: 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Area Studied and Type of Ownership	Number of Farms	Total Acres per Farm
Atchison		
Full-owners	20	315
Part-owners	8	349
Tenants	25	322
All farms	53	325
Linn		
Full-owners	33	215
Part-owners	13	298
Tenants	6	252
All farms	52	240
Greene		
Full-owners	27	172
Part-owners	22	229
Tenants	4	296
All farms	53	205
Pemiscot		
Full-owners	12	142
Part-owners	12	228
Tenants	30	188
All farms	54	187

<sup>1</sup>A farm was defined as an area of land which required the major portion of one year's labor by at least one person, and/or, one from which the sale of agricultural products was the primary source of income for one farm family.

Farms were divided into three groups, according to ownership of the real estate (land, buildings, and improvements). In the four areas there were 92 full-owners, 55 part-owners, and 65 renters.<sup>1</sup>

In general, the farmers that rented an additional acreage were operating more acres than either full-owners or renters. One exception was in the Greene area. Full-owners, however, usually owned more livestock and did more work per acre. Thus, the size of business on the fully-owned farms was not necessarily smaller than on the partly owned or rented farms, though the latter may have included more acres.

**Land Use:** Farms studied in Atchison County averaged 257 acres of cropland, 48 acres of permanent pasture, and 20 acres in farmstead, waste, and woodlots (Table 3). Of the total acreage of cropland, about one-half

TABLE 3. LAND USE: 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Land Use	Atchison Area		Linn Area		Greene Area		Pemiscot Area	
	Acres	%	Acres	%	Acres	%	Acres	%
Corn for grain	127	49	41	31	17	16	19 <sup>b</sup>	11
Corn for silage <sup>a</sup>	--	--	2	2	10	9	--	--
Cotton	--	--	--	--	--	--	107	60
Small grains	52	20	30	22	40	36	1	1
Soybeans	--	--	16	12	--	--	43	24
Legumes <sup>c</sup>	51	20	27	20	36	33	5	3
Other	27	11	18	13	7	6	2	1
Total acres cropland	(257)	100	(134)	100	(110)	100	(177)	100
Acres permanent pasture	48		78		70		3	
Acres farmstead, waste,	20		28		25		7	
Total farm acres	325		240		205		187	

a. Includes sorgo.

b. This includes 4 acres of corn for grain and 15 acres of corn and soybeans mixed.

c. This includes alfalfa, 2nd year red clover, and lespedeza. First year red clover is not included.

(127 acres) was planted to corn for grain, one-fifth (52 acres) to small grain, and one-fifth (51 acres) in legumes.<sup>2</sup>

In Linn County, the farms averaged 134 acres of cropland, 78 acres of permanent pasture, and 28 acres in farmstead, waste, and woodlots. Of the cropland, 31 percent (41 acres) was in corn for grain, 22 percent (30 acres) in small grains, 12 percent (16 acres) in soybeans, and 20 percent (27 acres) in legumes. Thirteen percent (18 acres) was in other crops, most of this being mixed hay or grass.

<sup>1</sup>Full-owners were farmers who owned all the land they operated; part-owners owned some land and rented additional; renters were those who rented all of the land they worked.

<sup>2</sup>The area studied in Atchison County was not affected by the 1951 flood, and therefore, the areas in corn were not altered during the year.



Farms in Greene County averaged 110 acres of cropland out of 205 total farm acres. This area also had a much lower percent of its cropland in corn for grain, compared to either the Atchison or Linn areas. Only 16 percent of the cropland was in corn. Nine percent (10 acres) was planted to corn (or sorgo) for silage, 36 percent (40 acres) was in small grains, and 33 percent (36 acres) in legumes. This area had the highest percentage of cropland in legumes of any area studied.

In Pemiscot County, 95 percent (177 out of the 187) of the total farm acreage was in cropland. Of this, 11 percent (19 acres) was planted to corn or corn and soybeans mixed, 60 percent (107 acres) to cotton, and 24 percent to soybeans.

**Kinds of Livestock:** Farms in Atchison County kept an average of 9 beef cows, 22 feeder cattle, and 20 sows (Table 4). An average of 185 pigs was raised, along with fattening 28 feeder pigs. In addition, there were 3 milk cows, and an average of 77 hens kept per farm.

In Linn County there were, on an average, 5 milk cows, 10 beef cows, 10 feeder cattle, 4 sows, 5 ewes, and 118 hens per farm. Thus, there were more milk cows, ewes, and hens, and fewer cattle and sows in the Linn area than in the Atchison area.

TABLE 4. NUMBERS OF LIVESTOCK: 212 Farms, Atchison, Linn, Greene and Pemiscot Counties, 1951

Class of Livestock	Atchison Area	Linn Area	Greene Area	Pemiscot Area
-average numbers per farm-				
Work horses and mules	1.1	1.2	1.0	.6
Cows milked	3.1	4.6	24.3	.7
Beef cows	9.2	9.6	1.5	.7
Heifers (yearlings)	2.9	5.2	12.2	.3
Feeder cattle	22.0	9.6	.4	.6
Brood sows	20.5	3.6	2.0	1.8
Pigs raised	184.6	73.1	21.7	11.5
Feeder pigs (purchased)	27.5	16.2	1.8	2.1
Ewes	1.5	5.3	2.4	---
Laying hens	76.7	117.6	41.8	27.3
Pullets raised	106.2	114.2	63.1	23.5
Broilers	66.3	63.3	28.6	16.5
Geese	---	---	---	18.9

The farms in Greene County averaged 24 dairy cows, 12 yearling heifers, 2 brood sows, 42 hens, and 22 pigs raised per farm. In other words, dairy-ing was the major enterprise, and livestock other than dairy cattle were of minor importance.

In the Pemiscot area the average farmer kept 19 geese, and 2 brood sows; he raised 11 pigs, and kept 27 hens. Livestock was a minor part of the farm business.

**The Labor Force:** Labor requirements on the farms studied were calculated in terms of productive man work units, as this is one of the best measures of size of business.<sup>1</sup> The total number of work units in the Atchison area was 590 per farm, whereas, in the Linn area it was only 359 (Table 5). In the Greene area there was an average of 452, and in Pemiscot 1,284 work units per farm.

**TABLE 5. LABOR REQUIREMENTS, LABOR SUPPLY, AND LABOR EFFICIENCY: 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951**

Area Studied	Total Productive Man Work Units	Man Equivalent	Work Units Per Man*
Atchison	590	1.87	316
Linn	359	1.67	215
Greene	452	1.87	242
Pemiscot	1,284	5.30	242

\*Weighted average.

The labor supply available was measured in terms of man equivalent. Except for the Pemiscot area most of the farms were one- or two-man units. Farms in the Pemiscot area had a much larger labor force available (5.3 man equivalents), most of which, however, was seasonal labor required for chopping and picking cotton.

As far as labor efficiency was concerned, farms in the Atchison area were the most efficient with 316 work units per man. They also had a higher investment in machinery and equipment than did the other areas in 1951. Number of work units per man in the Linn area was 215; in the Greene and Pemiscot areas, it was 242.

## PRESENT-DAY CAPITAL REQUIREMENTS

The average amount of capital invested (for all farms) was \$45,378 per farm. This includes the value of land, buildings and improvements, livestock, machinery and equipment, and all feed, grain, and supplies.

**Investment per Farm:** In the Atchison area the capital investment per farm was \$68,771 (Table 6). The investment in real estate was \$41,285

<sup>1</sup>A productive man work unit is the average amount of work done by one man in a 10-hour day. Total work units represent the number of days that would be required, under average conditions, to care for the acreage of crops grown and the number of livestock kept.

<sup>2</sup>Value of land was based on normal market value, or what the land, buildings, and improvements would sell for over a period of years. Investment in livestock was estimated on the basis of present market value; the capital tied up in machinery and equipment was calculated on a cost-less-depreciation basis using the straight-line method of depreciation; the value of feed, grain, and supplies on hand January 1st (1951) was estimated by the farmer at current market prices.



TABLE 6. THE TOTAL CAPITAL INVESTMENT PER FARM (BOTH FARMER AND LANDLORD): 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Type of Farm Property	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
Real estate	\$ 41,285	\$ 17,214	\$ 21,172	\$ 27,668	\$ 26,884
Livestock	14,203	10,570	10,786	979	9,089
Machinery and equipment	7,822	5,189	5,892	7,932	6,722
Feed and supplies	5,461	2,761	1,590	953	2,683
Total	\$ 68,771	\$ 34,734	\$ 39,440	\$ 37,532	\$ 45,378

TABLE 7. PERCENT OF CAPITAL INVESTED IN DIFFERENT PARTS OF FARM BUSINESS: 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Type of Farm Property	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
		-percent-			
Real estate	60	48	54	74	59
Livestock	21	30	27	3	20
Machinery and equipment	11	14	15	21	15
Feed and supplies	8	8	4	2	6
Total	100	100	100	100	100

TABLE 8. LAND VALUES PER ACRE BASED ON FARMERS' ESTIMATES AND COMPUTED ESTIMATES: 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Area Studied	Farmers' Estimates		Values computed from Census Data*	
	Normal Market Value	Present Market Value	1935-39	1951
Atchison	\$ 135	\$ 212	\$ 64	\$ 163
Linn	72	136	31	79
Greene	100	204	50	128
Pemiscot	152	369	87	224

\* The computed values were obtained by adjusting per acre land values for each county given in the 1950 Agricultural Census for Missouri by the real estate index given in *The Farm Real Estate Market*, Bureau of Agricultural Economics, July, 1951. The farmer's estimates of both the normal market value and the present market value were higher than the values obtained by adjusting the land values in the 1950 Agricultural Census. The difference between the farmer's estimates and the computed values can be attributed to several factors. The land values computed by adjusting the census averages were based on all agricultural land in the county, whereas in this study, the areas were undoubtedly located on better than average soil, and the farms were probably representative of slightly better than average farms. A second difference may be due to adjusting the 1950 census land values by use of indices for the state as a whole, rather than indices for each particular county. The latter were not available. Changes in the land value for the state may or may not be representative of any one area. Lastly, farmers tend to forget what is normal, and farmers in the better agricultural areas usually place a high value on their land, especially during or following a period of high prices.

(60 percent of the total), whereas \$14,203 (21 percent) was invested in livestock, \$7,822 (11 percent) in machinery and equipment, and \$5,461 (8 percent) in feed, grain, and supplies (Tables 7 and 8). A large capital investment in this area resulted partly from the large sized farm units and high land values. Other factors were the large amount and high value of livestock on farms in this area and the large amount of corn on inventory at the beginning of the year (1951).

In the Linn area the average capital investment was \$34,734 per farm. The investment in real estate was \$17,214 (48 percent of the total), whereas \$10,570 (30 percent) was invested in livestock, \$5,189 (14 percent) in machinery and equipment, and \$2,761 (8 percent) in feed, grain and supplies. This area had a lower investment in real estate and a smaller amount of capital tied up in machinery than any of the other areas. The low investment in machinery and equipment was partially due to more custom work and more cooperative ownership of machinery. Furthermore, few, if any, farms were specialized to the extent that they had sufficient acreage of any one crop to justify the purchase of special machinery.

Farms studied in Greene County had an average of \$39,440 invested in the farm business. The investment in real estate was \$21,172 (54 percent of the total), whereas \$10,786 (27 percent) was invested in livestock, \$5,892 (15 percent) in machinery and equipment, and \$1,590 (4 percent) in feed, grain and supplies. In this area there was a tendency for land prices to be higher than their true agricultural value. This is because the area is located near Springfield and much of the farmland has a location value.

Farms studied in Pemiscot County had a total investment of \$37,532 per farm. The investment in real estate was \$27,668 (74 percent of the total), whereas \$7,932 (21 percent) was invested in machinery and equipment. Only \$979 was invested in livestock, and \$953 in feed, grain, and supplies. The high per acre value of land offset the smaller farm unit size and resulted in a large amount of capital being tied up in real estate. Very little livestock was kept by farmers in this area. Geese were used to eat the Johnson grass in the cotton fields. Capital invested in machinery and equipment was the highest of any of the areas studied.

In each of the four areas, real estate investment made up the largest part of the total. It amounted to 59 percent for all farms in the four areas. Hence, the capital invested was influenced considerably by land values.<sup>1</sup> Investment in livestock amounted to 20 percent of the total, machinery and equipment 15 percent, and in feed, grain, and supplies 6 percent.

<sup>1</sup>Farmers in the Atchison area estimated the normal market value of their land to be \$135 per acre; those in Linn estimated it at \$72; those in Greene \$100; and those in the Pemiscot area \$152 per acre (Table 9). They estimated the present market value per acre to be \$212, \$136, \$204, and \$396, in each of these areas respectively.

**Investment per Farmer:** The capital investment per farmer, or the equity that the farm operator has in his farm business, may be considered as well as the investment per farm. Using the classifications of full-owners, part-owners, and renters, and applying them to each of the four areas studied, a tremendous range was found in the average amount of capital the farm operator alone has invested in his farm business.

For example, renters in the Pemiscot area had an average of only \$8,763 invested in the farm business, 85 percent of which was tied up in machinery and equipment (Table 9). On the other hand, full-owners in the Atchison area had an average farm investment of \$70,283 per farmer. These were the two extremes. While these figures are for two widely different type-of-farming areas and are based on two widely different degrees of farm ownership, they show the wide range in capital investment per farmer. Surprisingly, the average acreage for each of these two groups does not differ significantly from that of all farms in each of the two areas.

TABLE 9. CAPITAL INVESTMENT PER FARMER WITH VARIATIONS IN DEGREE OF FARM OWNERSHIP: 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Item	Groups of Greatest Range		Averages for all Areas		
	Renters	Full-owners	Renters	Part	Full
	Pemiscot Area	Atchison Area		Owners	Owners
Number of farms	30	20	65	55	92
Size of farm (acres)	188	315	252	262	215
Capital investment					
Real estate	\$ ---	\$ 38,833	\$ ---	\$ 15,595	\$ 22,496
Livestock	654	17,720	6,447	8,642	11,224
Machinery and equipment	7,436	9,237	6,545	7,359	6,465
Feed and supplies	673	4,493	2,762	2,913	2,489
Total	\$ 8,763	\$ 70,283	\$ 15,754	\$ 34,509	\$ 42,674

The average capital investment for renters, part-owners, and full-owners was obtained for all four areas combined.<sup>1</sup> Tenants naturally had the lowest capital investment—in this case \$15,754. Part-owners, who operated 262 acres and owned an average of 148 acres, had a \$34,509 investment. Full-owners had \$42,674 invested. Each of the groups, in that order, had a significantly higher investment in livestock (tenants, \$6,447; part-owners, \$8,642; and full-owners, \$11,224). This larger investment by part-owners and still larger investment by full-owners in livestock was, in general, due to better quality—sometimes purebred—livestock rather than to larger numbers. Full-owners had less capital invested in machinery and equipment than part-owners, although the difference was not significant.

<sup>1</sup>Figures for each area also are given in the appendix.

## CHANGES IN THE CAPITAL REQUIREMENTS

Capital requirements for two areas—Atchison and Linn—also were available for 1929 and 1931.<sup>2</sup> Comparing the capital investment per farm in 1951 with that in 1929-31, the amount has doubled during the last two decades.

**Changes in the Dollar Investment:** The average amount of capital farmers in Atchison County had invested in real estate in 1931 was \$18,686 (Table 10). In 1951 the investment was \$18,059.<sup>3</sup> However, the capital in-

TABLE 10. THE CAPITAL INVESTMENT PER FARMER: 314 Farms, Atchison and Linn Counties, Missouri, 1929-31 and 1951

	Atchison		Linn	
	1931	1951	1929	1951
Size of farm (acres):	260	325	243	240
Capital investment:				
Real estate	\$ 18,686	\$ 18,059	\$ 10,612	\$ 13,486
Livestock	2,518	14,203	2,462	10,570
Machinery and equipment	1,368	7,822	610	5,187
Feed and supplies	1,420	5,461	338	2,761
Total	\$ 23,992	\$ 45,545	\$ 14,022	\$ 32,004

vested in livestock increased from \$2,518 in 1931 to \$14,203 in 1951; the capital invested in machinery and equipment increased from \$1,368 to \$7,822, and that in feed, grain, and supplies from \$1,420 to \$5,461. To a large extent, these increases can be attributed to an inflated price level. However, significant changes in the farm business, such as mechanization and an increased amount of livestock, have occurred.

In Linn County the capital invested in real estate changed from \$10,612 in 1929 to \$13,486 in 1951. However, the average acreage remained practically the same. The capital invested in livestock increased from \$2,462 to \$10,570; that in machinery and equipment from \$610 to \$5,187; while that in feed, grain, and supplies jumped from \$338 to \$2,761. Hence, the changes in Linn County were more pronounced than those which occurred in Atchison County.

**Changes in Composition of Farm Capital:** In both counties, composition of the total farm capital changed considerably. In Atchison County the real estate investment decreased from 78 to 40 percent of the total (Table 11). On the other hand, the investment in livestock increased from 10 to 31

<sup>2</sup>From unpublished records of the Department of Agricultural Economics. The records in both periods were from the same community and included only family sized commercial farms.

<sup>3</sup>Real estate values were the farmer's estimate of what the farm would bring at voluntary sale within a period of 6 months to a year (not a forced sale).

TABLE 11. CHANGES IN THE COMPOSITION OF FARM CAPITAL: 314 Farms, Atchison and Linn Counties, 1929-31 and 1951

Type of Farm Property	Atchison		Linn	
	1931	1951	1929	1951
	-percent of total capital investment-			
Real estate	78	40	76	42
Livestock	10	31	18	33
Machinery and equipment	6	17	4	16
Feed and supplies	6	12	2	9
Total	100	100	100	100

percent, that in machinery and equipment from 6 to 17, and the investment in feed, grain, and supplies from 6 to 12 percent.

In Linn County, the real estate investment decreased from 76 to 42 percent of the total. The investment in livestock increased from 18 to 33 percent, the investment in machinery from 4 to 16, and that in feed, grain, and supplies from 2 to 9 percent. Hence, the amount of capital invested in real estate declined in importance, while the capital invested in livestock, machinery and equipment, feed, grain and supplies increased considerably in each of the two areas.

**Changes in Investment in Machinery and Equipment:** In Atchison County, the capital tied up in machinery and equipment increased from \$1,368 in 1931 to \$7,822 in 1951. It increased from \$7 to \$30 per acre of cropland, from \$750 to \$4,206 per man, and from \$313 to \$1,577 per 100 man work units (Table 12).

In Linn County the capital invested in machinery and equipment increased from \$610 to \$5,189 per farm; it increased \$33 per acre of cropland, \$2,783 per man, and \$1,254 per 100 work units.

TABLE 12. MACHINERY INVESTMENT PER FARM, PER ACRE OF CROPLAND, PER MAN EQUIVALENT, AND PER 100 PRODUCTIVE MAN WORK UNITS: 314 Farms, Atchison and Linn Counties, 1929-31 and 1951

Investment in Machinery and Equipment	Atchison		Linn	
	1931	1951	1929	1951
Per farm	\$ 1,368	\$ 7,822	\$ 610	\$ 5,189
Per acre cropland	7	30	6	39
Per man equivalent	750	4,206	400	3,183
Per 100 man work units	\$ 313	\$ 1,577	\$ 192	\$ 1,446

While investment in machinery was larger for farms in Atchison County (both in 1929-31 and in 1951) than for those in Linn, the percentage increase was larger in Linn County. Mechanization undoubtedly started in Atchison County before it began in Linn County. Farm tractors were adapted and used in the cash-grain livestock type-of-farming regions much sooner than they were in the more general livestock farming areas.



Nevertheless, in both counties the importance of farm machinery and equipment has increased greatly in relation to other parts of the farm business. Investment per acre of cropland, per man, and per productive work unit has increased tremendously.

### CAPITAL INVESTED IN VARIOUS TYPES OF MACHINERY

A considerable amount of data was obtained on the number of machines in each area, percent of each type of equipment which was purchased new, original cost, age, and estimated life. The present investment in each machine (or the present value) was obtained by use of the straight-line method of depreciation.<sup>1</sup>

**Farm Tractors:** The average investment in a farm tractor was \$1,118 (Table 13). This amount, of course, varied between areas. In the Atchison area, average investment in a farm tractor was \$972, in Linn it was \$1,005, in Greene \$1,102, and in Pemiscot \$1,333. These differences are due primarily to differences in average age and estimated life of tractors. Tractors in the Atchison area had been used the longest (average age—6.0 years). They also had the longest estimated life (average—13.0 years). Tractors in the Pemiscot area were newer (average age—3.0 years). Their estimated life was shorter (9.6 years). Some of the differences in present value also were due to differences in the original cost. In the Atchison and Linn areas, the average original cost was \$1,570 and \$1,476, respectively. However, in the Pemiscot area it was \$2,018.

TABLE 13. INVESTMENT IN ALL FARM TRACTORS: 209 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Greene Area	Pemiscot Area	All Areas
Number of farms	53	51	51	54	209
Number of tractors	103	69	67	114	356
Tractors per farm	2.0	1.4	1.3	2.1	1.7
Percent of tractors purchased new	76	80	70	71	74
Original cost*	\$ 1,570	\$ 1,476	\$ 1,636	\$ 2,018	\$ 1,696
Age (years)	6.0	4.7	4.1	3.0	4.5
Estimated life (years)	13.0	11.8	11.8	9.6	11.4
Present value	\$ 972	\$ 1,005	\$ 1,102	\$ 1,333	\$ 1,118

\*Averages do not include tractors bought second-hand.

Size of tractor also influenced the investment (Table 14). Detailed figures for each size of tractor are given in the appendix (Tables 5-9).

<sup>1</sup>For discussion of the various methods of calculating depreciation see Murphy, R. G., and Suter, R. C., "Methods of Calculating Depreciation of Farm Machinery", A. E. 729, Dept. of Agr. Econ., Cornell Univ., Apr. 1950.

TABLE 14. CAPITAL INVESTMENT (PRESENT VALUE) IN FARM TRACTORS OF VARYING SIZES: 209 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Size of Tractor	Capital Invested Per Tractor				Average All Areas
	Atchison Area	Linn Area	Greene Area	Pemiscot Area	
One plow ( 8-12 h.p.)	\$ 183	\$ 194	\$ 622	\$ 482	\$ 378
Two plow (13-17 h.p.)	660	957	994	1,007	871
Two plow (18-23 h.p.)	1,027	1,014	1,091	1,210	1,114
Three plow (24-27 h.p.)	1,323	1,366	1,208	1,756	1,458
Three plow (30-38 h.p.)	172	273	2,381	3,949	1,571
average all tractors	\$ 972	\$ 1,005	\$ 1,102	1,333	\$ 1,118

### RELATIONSHIP OF SIZE OF FARM TO INVESTMENT IN MACHINERY AND EQUIPMENT

Whenever the size of the farm business is increased, the investment in machinery and equipment also increases. Rate of the increase in capital investment varies considerably, depending on size of the farm unit, type of farming being followed, and method used to increase size. Size may be increased by adding more acres (the extensive margin), by increasing the amount of work done on a given acreage (the intensive margin), or by a combination of the two. As a result, no single criterion can be used which will accurately measure the over-all change in size of business. Choice of method depends on the type of farming followed in the area being studied. In this study the following measures were used:

**Total farm acres;** or all land being operated as a single farm unit, including both owned and rented land. This measure was used primarily because it is the most common measurement of size of business. Total acres is undoubtedly a poor measure due to variation in intensity of land use.

**Man equivalent;** or the number of full-time men employed throughout the year, including the farm operator, the hired men, all part-time help, and unpaid family labor. This measure is useful when comparing farms of a similar type in different regions, or different types of farming in the same region. A major difficulty is that since men work more efficiently on some farms than on others, the same number of men on two different farms may represent different amounts of business.

**Total productive man work units;** or the number of days required, under average conditions, to care for the acreage of crops grown and the number of livestock kept. This measure is the best single measure of size of business.

**Number of milk cows and number of acres of cotton:** These measures were used in the Greene and Pemiscot areas, respectively. Such measures are used primarily for studying farm size in specialized type-of-farming areas.



**Total Farm Acres**

As total farm acres increased in each of the four areas, investment in machinery also increased (Figures 2-5). Investment in machinery and equipment on farms in the Atchison area with more than 400 acres and the investment on those with more than 200 acres in the Pemiscot area increased quite rapidly with further increases in the size of business.

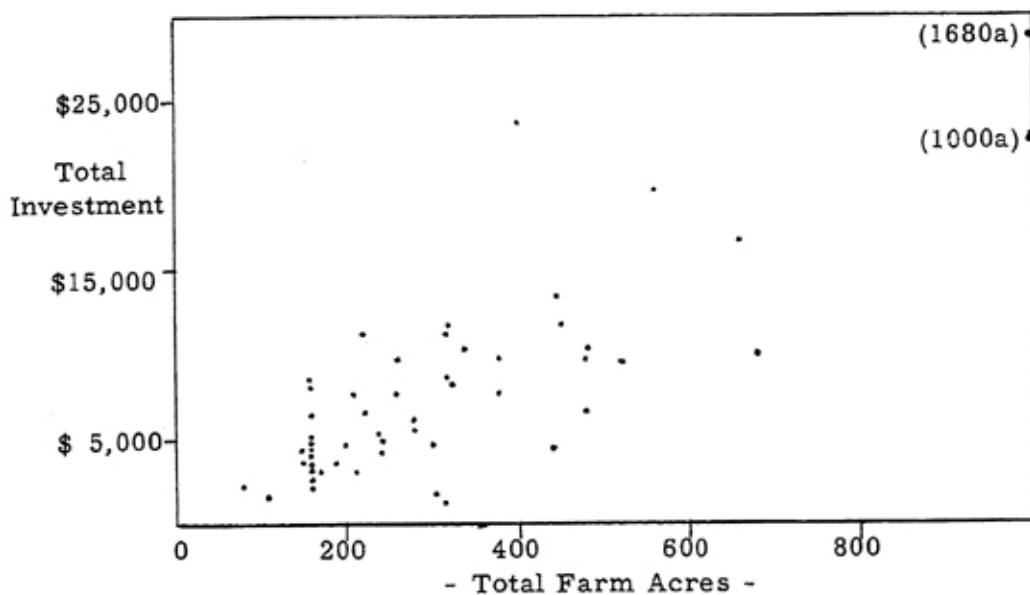


Figure 2—Atchison County. Total farm acres in relation to the investment in machinery and equipment, based on survey of 53 farms, 1951.

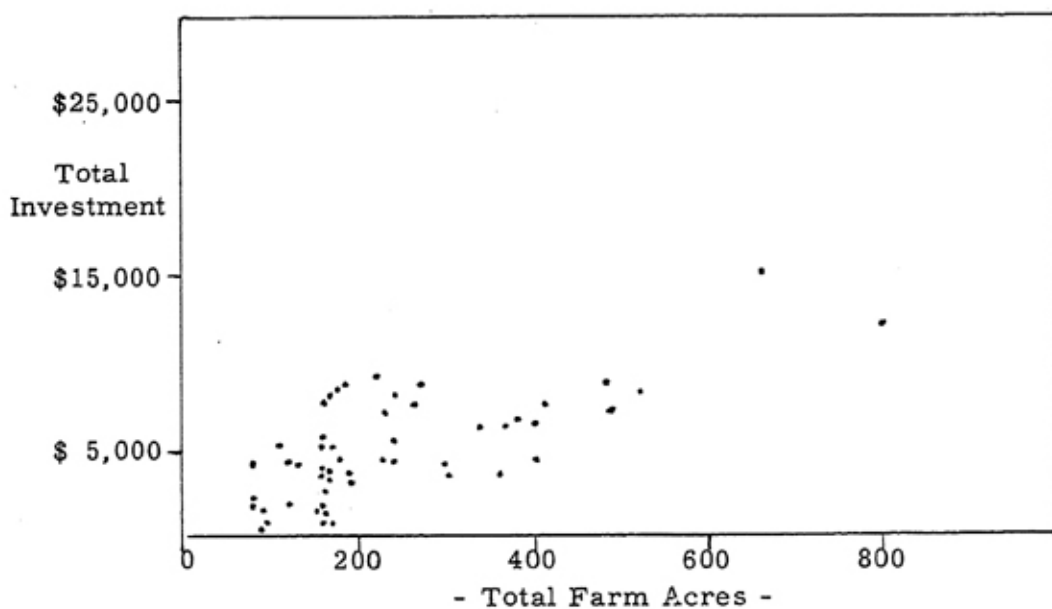


Figure 3—Linn County. Total farm acres in relation to investment in machinery and equipment, based on survey of 52 farms, 1951.

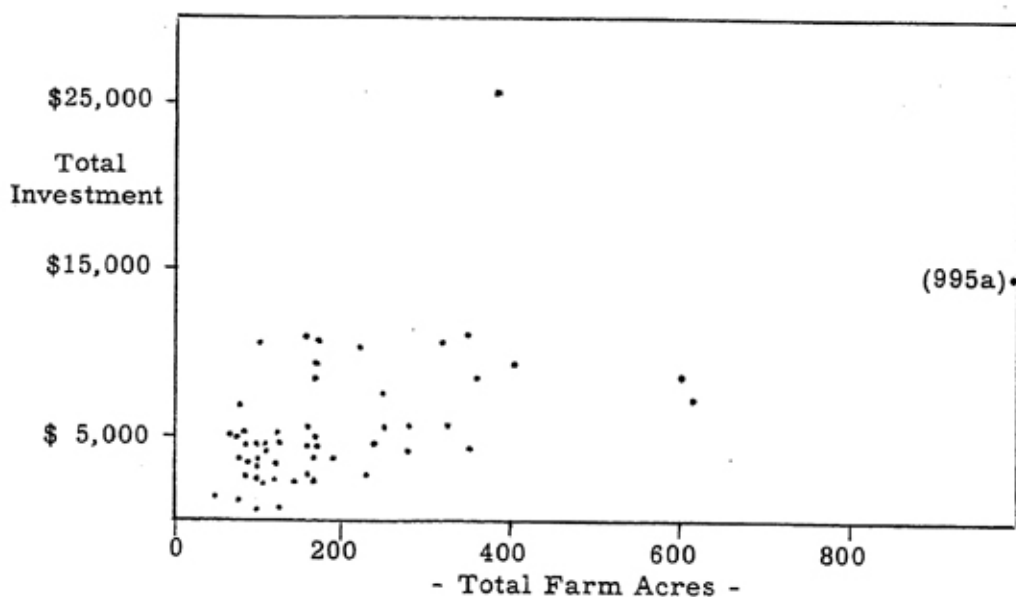


Figure 4—Greene County. Total farm acres in relation to the investment in machinery and equipment, based on survey of 53 farms, 1951.

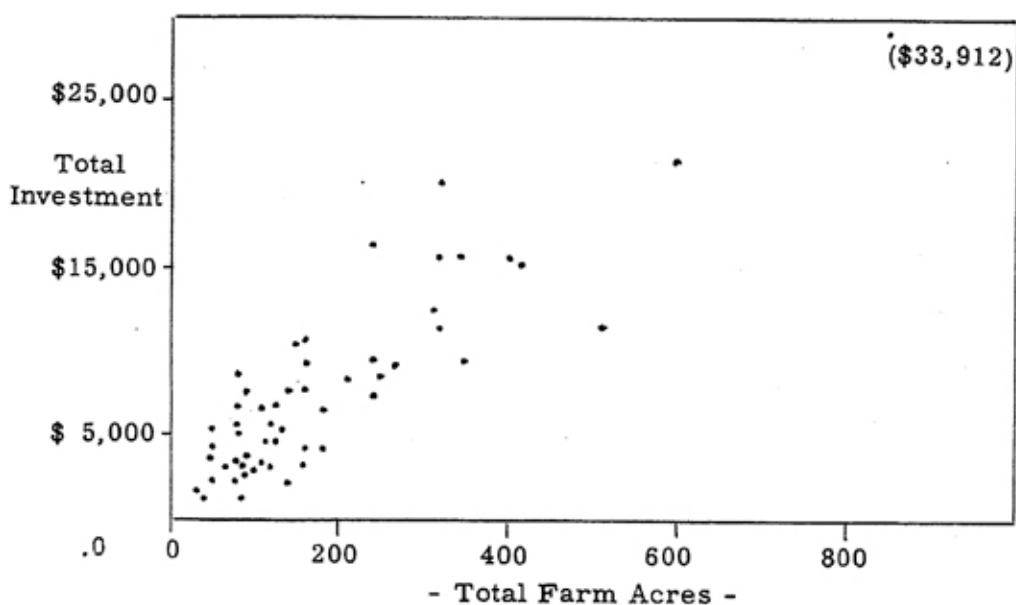


Figure 5—Pemiscot County. Total farm acres in relation to the investment in machinery and equipment, based on survey of 54 farms, 1951.

In Linn and Greene County areas livestock production was more important. This resulted in slower increase in machinery investment than in the Atchison and Pemiscot areas when acreage was expanded. The increase in the Linn area was at a diminishing rate, whereas the increase in Greene was practically a proportional one. In the Linn area, particularly, farms with largest acreage had but little additional investment in machinery and equipment.

### Man Equivalent

Measuring the size of the farm in terms of the number of men employed showed a strong relationship between size of business and investment in machinery. In Atchison and Greene areas, the investment in machinery and equipment rose fairly rapidly when the size of farm went beyond a two-man business (Figures 6 and 8). Investment increased much more slowly in the Linn area than it did in either the Atchison or Greene area (Figure 7). In the Pemiscot area, where a large amount of seasonal labor is used, machinery investment rose slowly to the point where an average of six men were employed (Figure 9).

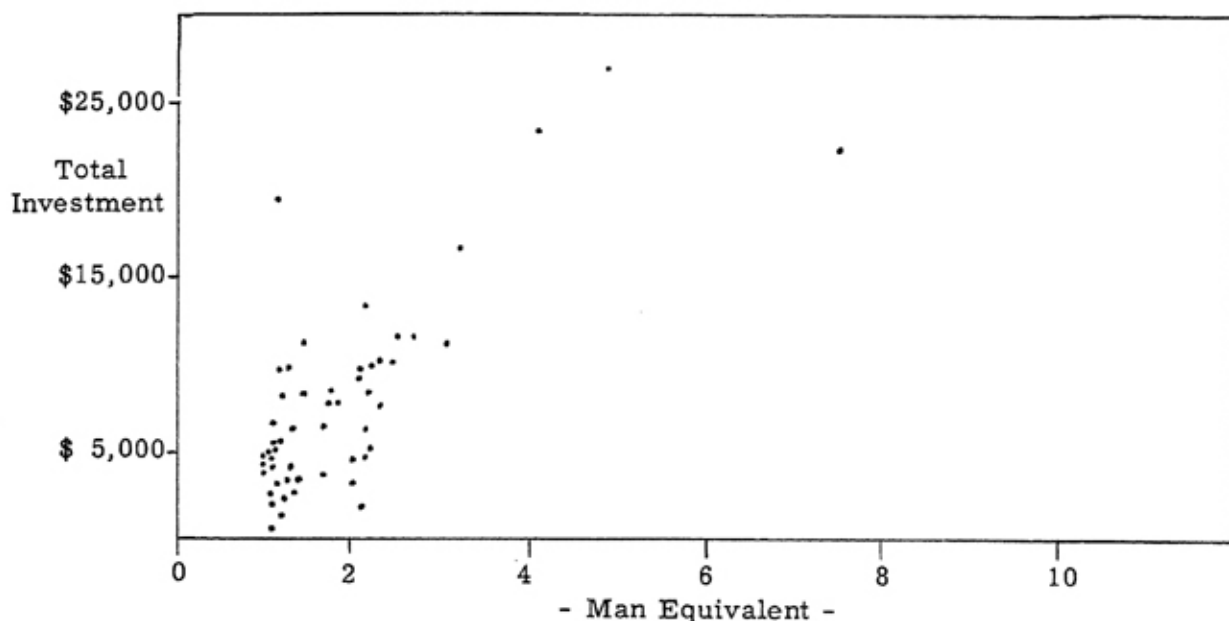


Figure 6—Atchison County. Man equivalent in relation to the investment in machinery and equipment. Survey included 53 farms, 1951.

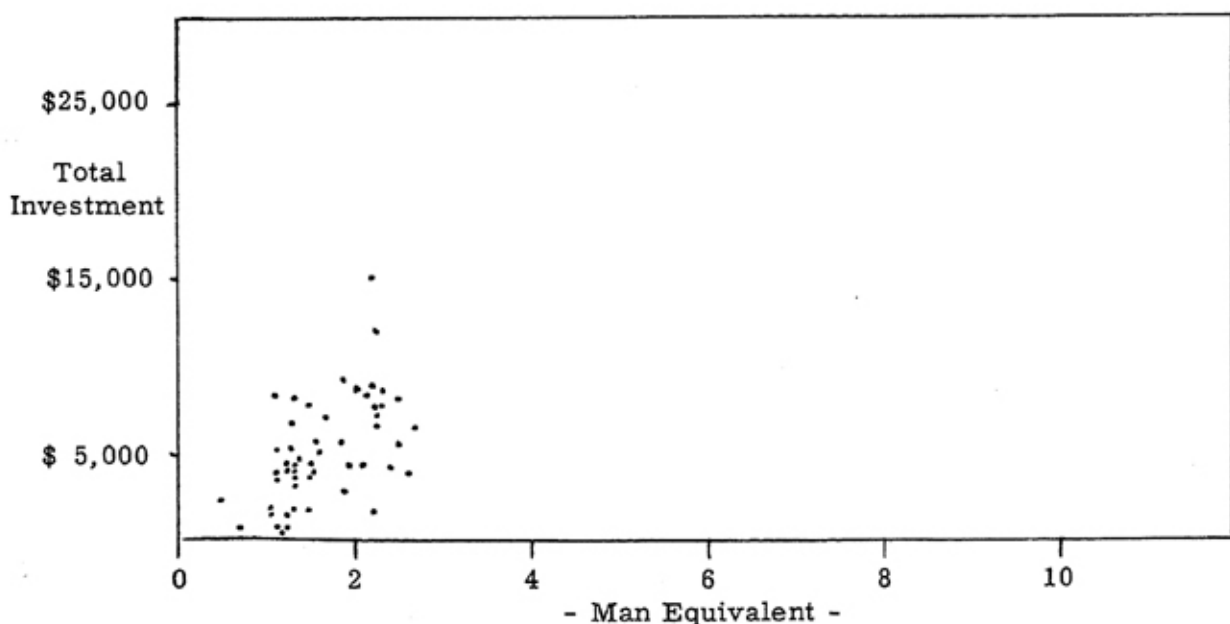


Figure 7—Linn County. Man equivalent in relation to the investment in machinery and equipment. Survey included 52 farms, 1951.

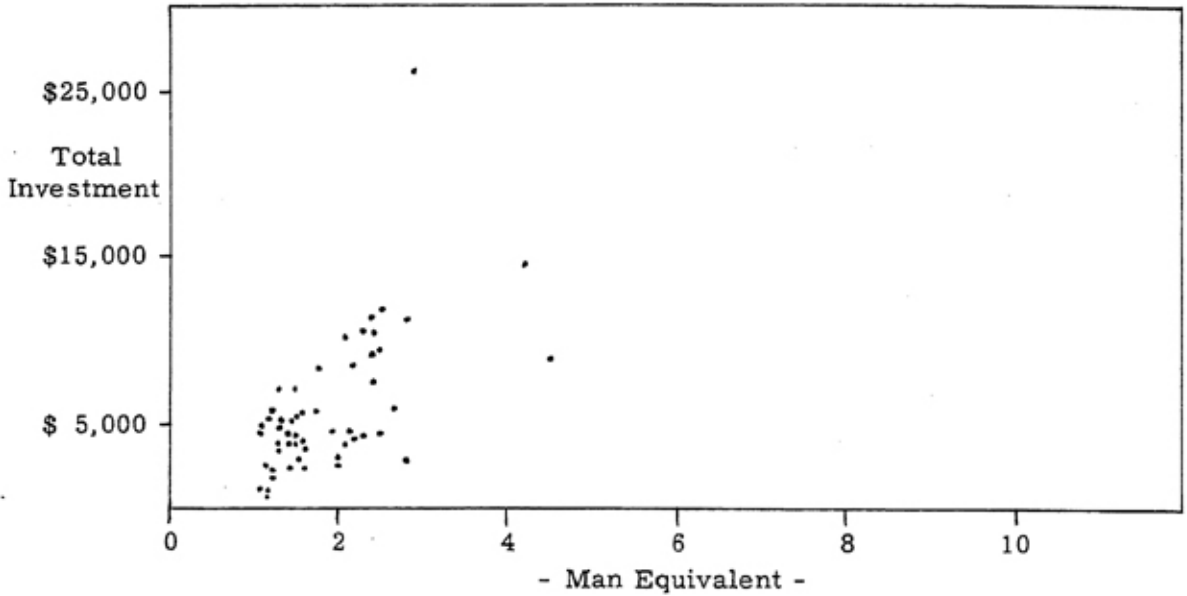


Figure 8—Greene County. Man equivalent in relation to the investment in machinery and equipment. Survey included 53 farms, 1951.

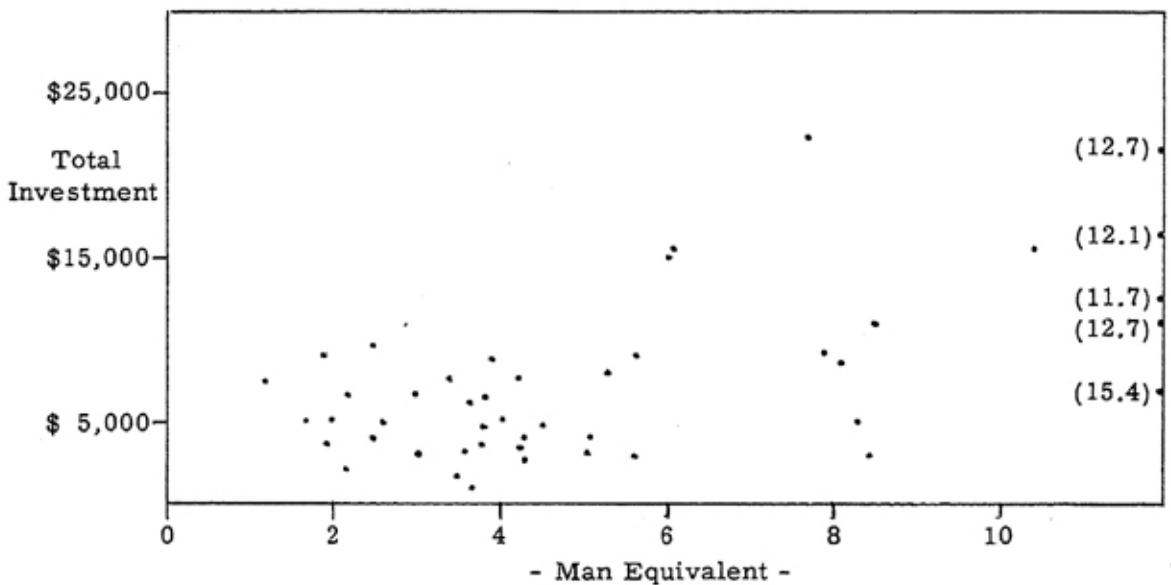


Figure 9—Pemiscot County. Man equivalent in relation to the investment in machinery and equipment. Survey included 47 farms, 1951.

### Productive Man Work Units

Slightly different relationships between size of business and investment in equipment were obtained in terms of changes in total work units.

As total work units per farm increased in the Atchison and Linn areas, investment in machinery increased, but not at a rapid rate (Figures 10 and 11). This was particularly true in the Linn area where a diminishing rate of increase was clearly evident. The investment in machinery practically leveled off when the size of the business went beyond 500 work units in this area.

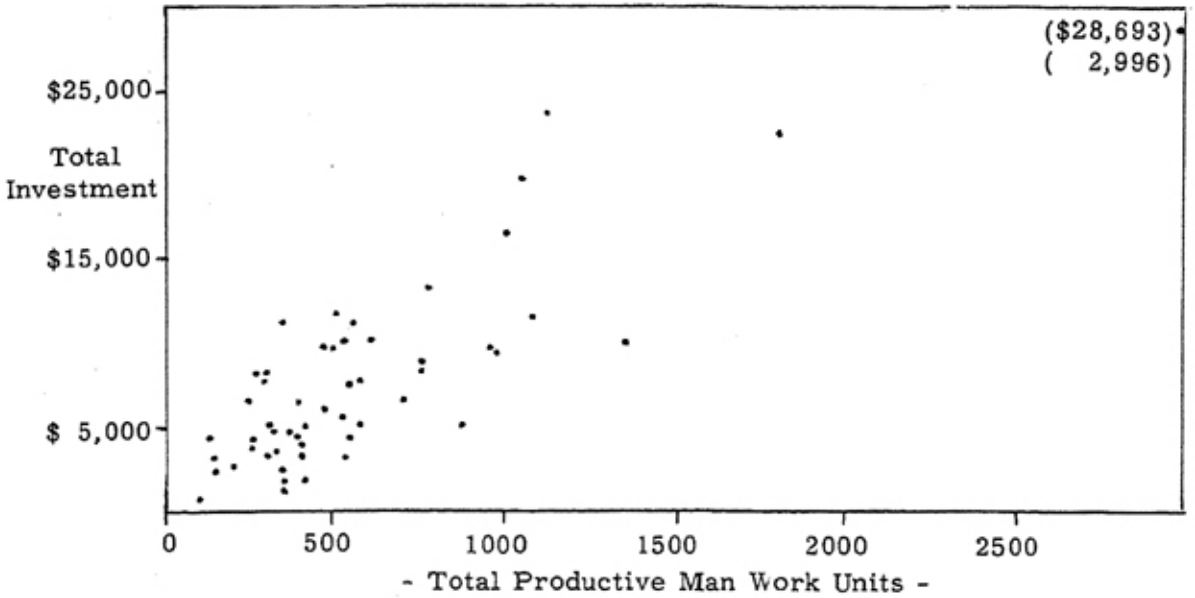


Figure 10—Atchison County. Productive man work units in relation to investment in machinery and equipment. Survey included 53 farms, 1951.

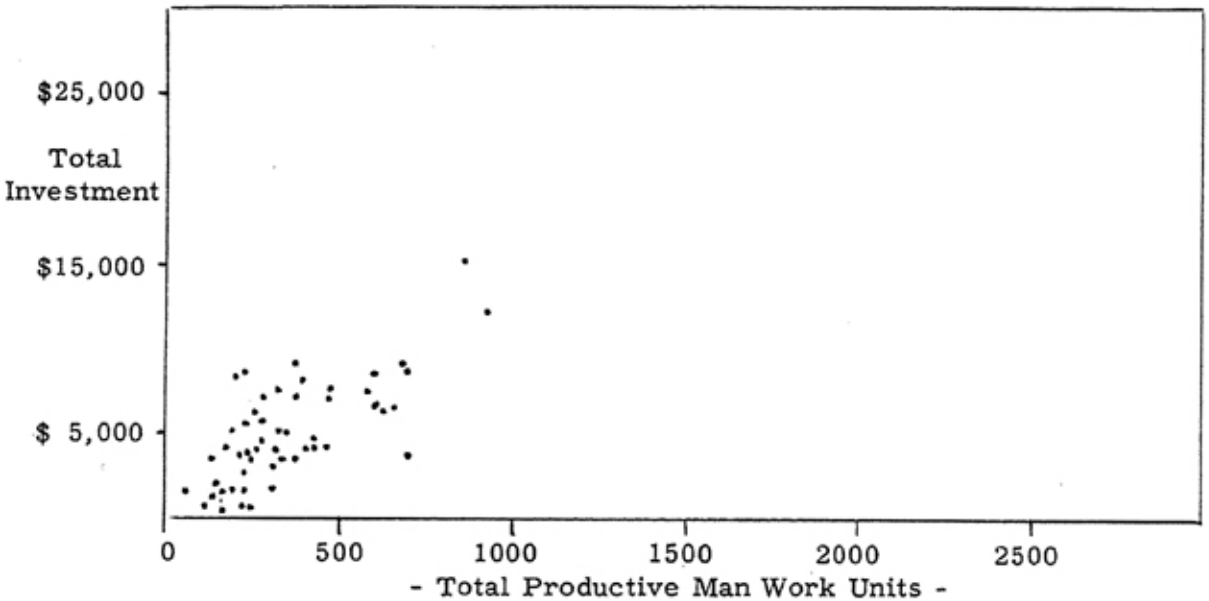


Figure 11—Linn County. Productive man work units in relation to investment in machinery and equipment. Survey included 52 farms, 1951.

In the Greene and Pemiscot areas, investment in machinery increased more rapidly as increases occurred in total work units (Figures 12 and 13). At no point, however, did the investment in machinery and equipment increase at a more rapid rate than the size of business.

**Number of Cows and Acres of Cotton**

Number of cows per farm was used as a measure of size in the Greene area and acres of cotton was used in the Pemiscot region. These were used primarily because of the more specialized type of farming being followed in each of these two areas.

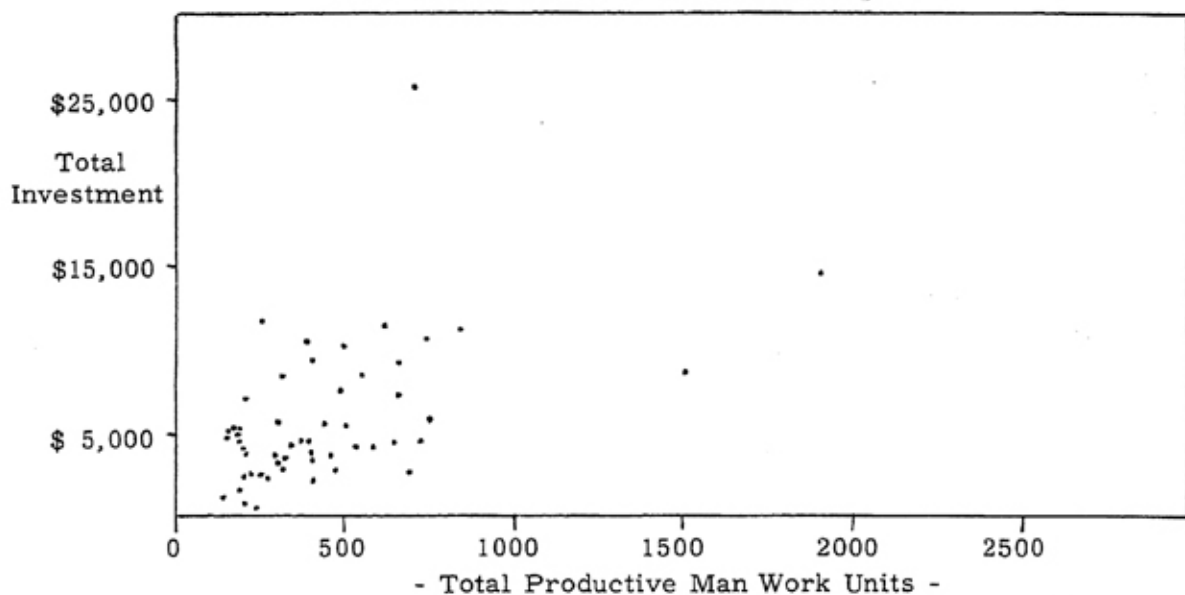


Figure 12—Greene County. Productive man work units in relation to investment in machinery and equipment. Survey included 53 farms, 1951.

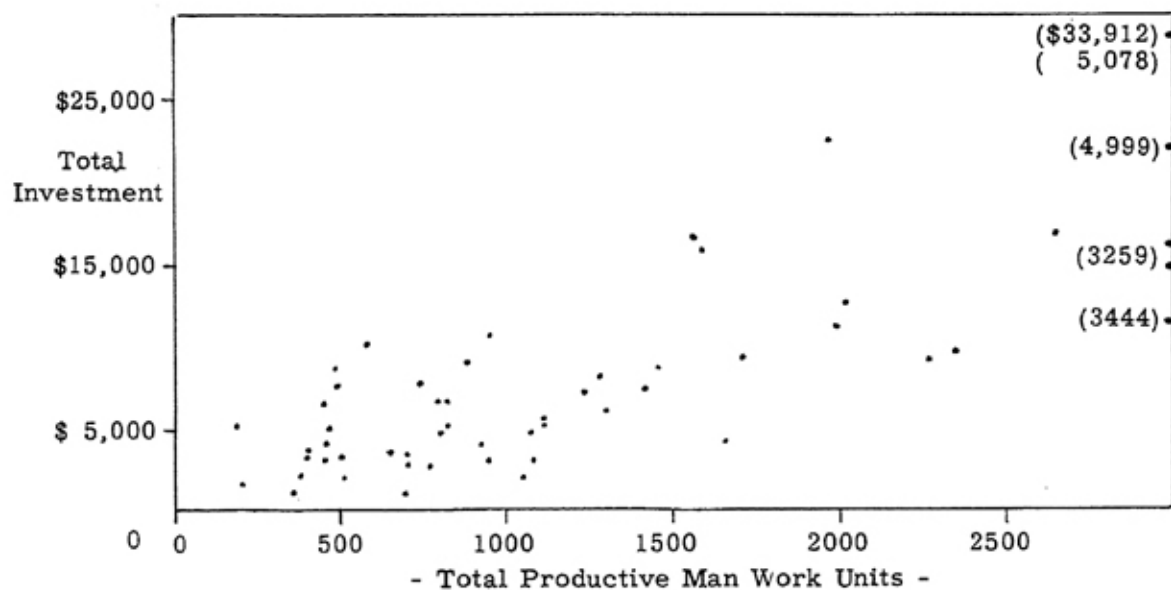


Figure 13—Pemiscot County. Productive man work units in relation to investment in machinery and equipment. Survey included 54 farms, 1951.

As the number of cows per farm increased in the Greene area, investment in machinery and equipment slowly increased (Figure 14). This seemed to be true regardless of the number of cows kept. As the acreage of

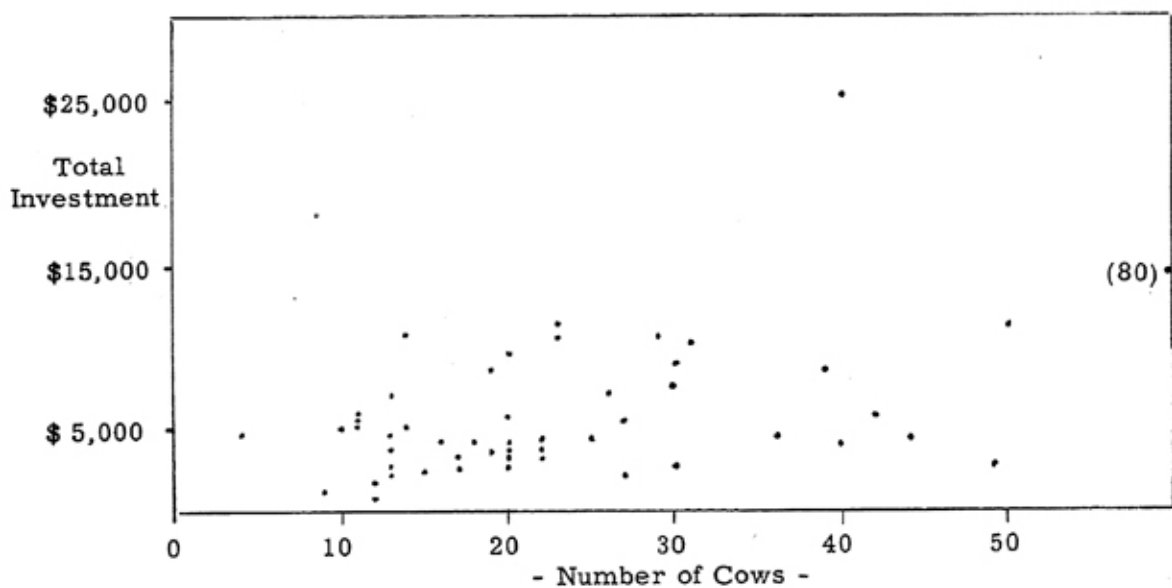


Figure 14—Greene County. Number of cows in relation to the investment in machinery and equipment. Survey included 53 farms, 1951.

cotton was increased in the Pemiscot area, investment in machinery and equipment increased slowly up to 100 to 200 acres, then increased much more rapidly (Figure 15).

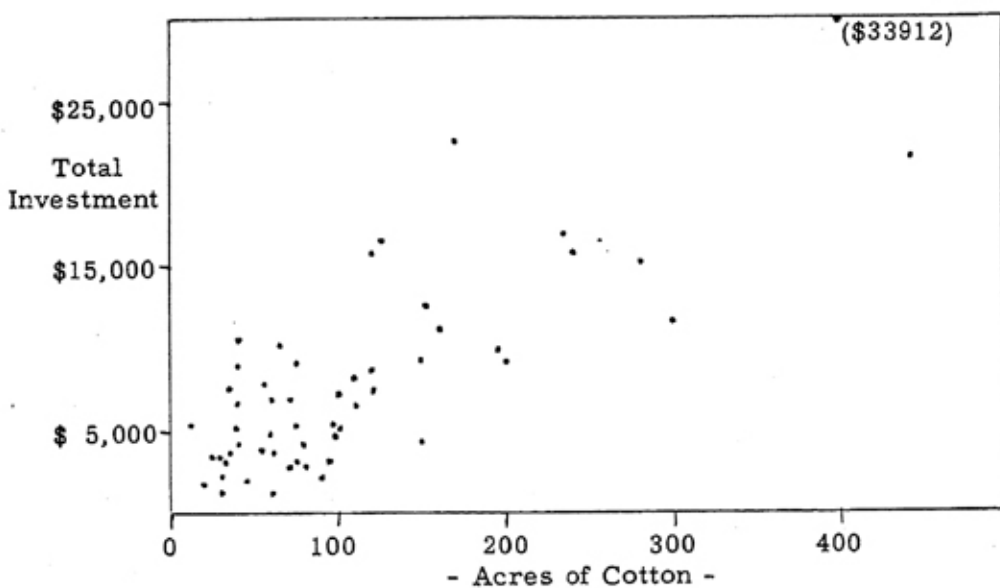


Figure 15—Pemiscot County. Number of acres of cotton in relation to the investment in machinery and equipment. Survey included 54 farms, 1951.



## USE MADE OF VARIOUS MACHINES

One of the objectives of this study was to ascertain the extent to which various types of machinery and equipment were being used.<sup>1</sup>

**Farm Tractors:** In 1951, records of use were obtained on 337 tractors which were being used on 207 farms. Average annual use was 750 hours per tractor, with 1,232 tractor hours per farm (Table 15).

In the Atchison area there were 25 farms with one tractor, 19 farms with two tractors, 5 farms with three, and 3 farms with four or more tractors. In the Linn area 36 farms had one tractor, 13 had two, while only one farm had three tractors. There were 35 one-tractor farms and 16 two-tractor farms in the Greene area. In the Pemiscot area 19 farms had one tractor, 21 had two, 9 had three, and 5 had four or more tractors. The one-tractor farms were predominant in Atchison, Linn, and Greene areas.

One-tractor farms used their tractors an average of 902 hours, farms with two tractors used them 1,390 hours, farms with three 1,878, while farms with four or more averaged 3,401 hours of use.

Farms in the Atchison, Linn, and Greene areas had approximately the same average number of hours of tractor use per farm. In these areas the one-tractor farms averaged 1,006; 917; and 931 hours of use respectively, whereas two-tractor farms in the same three areas averaged 1,608; 1,510; and 1,438 hours of use. Farms with three tractors were few in number.

In Pemiscot County, tractors were used much less than in the other three areas. Farms with one tractor used them an average of only 686 hours, farms with two tractors 1,083 hours, and farms with three averaged 1,617 hours of use. Chief cause of reduced tractor use in this area was the seasonal pattern of farm work. Tractors in this area were used only for crop production, whereas in the other three areas there was more of a tendency to use a farm tractor the year round.

Classifying tractors in terms of number of plows they could pull effectively, 10 classified as one-plow tractors, 230 as two-plow, and 97 as three-plow tractors. One-plow tractors were used an average of 401 hours, two-plow tractors 745 hours, and three-plow 798 hours.

In general, the three-plow tractors were used more than the one or two-plow tractors, regardless of the number of tractors per farm. In the Atchison area, three-plow tractors were used more than two-plow tractors on farms with only one tractor. The use per tractor for three-plow tractors was also

<sup>1</sup>The amount of use was ascertained for each type of farm machine in terms of acres and hours. Acreage figures were based on 1951 crops, along with the number of times each machine was used in preparing the ground, planting, and harvesting the crops. The number of hours was obtained by multiplying the acreage by rate of use. The latter was obtained in terms of the average number of acres plowed, disced, mowed, etc. during a 10-hour day. With some of the special equipment, usage was ascertained in terms of tons, bales, or loads.

TABLE 15. AMOUNT OF USE OF FARM TRACTORS: 207 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Area Studied and Number of Tractors per Farm	Number of Farms	Hours of Use per Farm	Size of Tractor	Number of Tractors	Hours of Use per Tractor
<b>Atchison Area</b>					
One	25	1,006	two-plov	19	939
			three-plov	6	1,217
Two	19	1,608	one-plov	2	296
			two-plov	20	814
			three-plov	16	855
Three	5	2,276	two-plov	9	593
			three-plov	6	1,005
Four	3	4,797	two-plov	9	861
			three-plov	6	1,106
Average	52	1,567		93	876
<b>Linn Area</b>					
One	36	917	one-plov	2	297
			two-plov	29	945
			three-plov	5	776
Two	13	1,510	one-plov	1	178
			two-plov	17	738
			three-plov	5	864
Three	1	2,235	two-plov	2	726
			three-plov	1	784
Average	50	1,098		62	825
<b>Greene Area</b>					
One	35	931	two-plov	30	936
			three-plov	5	901
Two	16	1,438	one-plov	3	732
			two-plov	19	719
			three-plov	10	757
Average	51	1,090		67	836
<b>Pemiscot Area</b>					
One	19	686	one-plov	1	424
			two-plov	13	677
			three-plov	5	762
Two	21	1,083	one-plov	1	324
			two-plov	32	554
			three-plov	9	521
Three	9	1,617	two-plov	18	466
			three-plov	9	561
Four or more	5	2,564	two-plov	13	480
			three-plov	11	599
Average	54	1,169		112	554
<b>All Four Areas</b>					
One	115	902	one-plov	3	240
			two-plov	91	902
			three-plov	21	928
Two	69	1,390	one-plov	7	470
			two-plov	88	684
			three-plov	43	764
Three	15	1,878	two-plov	29	523
			three-plov	16	741
Four or more	8	3,401	two-plov	22	636
			three-plov	17	778
Average	207	1,232		337	750

high on the large farms or those with three or four tractors. Yet, there was little difference in use between the two and three-plow tractors on those farms with only two tractors. In the Linn area, two-plow tractors were used the most on one-tractor farms, while on two-tractor farms three-plow tractors were used the most. In the Greene area each size of tractor was used approximately the same number of hours. Differences were not significant in the Pemiscot area.

**Number of tractors per farm in relation to size of business:** As the amount of work to be done per farm increased, the number of tractors increased considerably (Table 16). For all areas the average work units per farm on farms with two tractors were more than double those on farms with one tractor. However, the man equivalent on these same farms increased only around 65 percent.

TABLE 16. NUMBER OF TRACTORS PER FARM AS RELATED TO SIZE OF FARM: 207 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Area Studied and Number of Tractors per Farm	Number of Farms	Investment in Machinery Equipment	Man Equivalent	Productive Man Work Units	Hours of Tractor Use	Acres of Crop-land	Total Farm Acres
<b>Atchison Area</b>							
One	25	\$ 4,659	1.33	360	1,006	163	196
Two	19	8,854	1.87	608	1,608	270	345
Three	5	13,642	2.82	894	2,276	344	438
Four or more	3	20,428	4.84	2,053	4,797	910	1,120
<b>Linn Area</b>							
One	36	\$ 4,362	1.54	289	917	116	203
Two	13	7,668	1.89	526	1,510	169	315
Three	1	12,064	2.21	925	2,235	180	800
<b>Greene Area</b>							
One	35	\$ 4,324	1.61	350	931	78	156
Two	16	9,962	2.54	689	1,438	185	315
<b>Pemiscot Area</b>							
One	19	\$ 3,909	3.56	527	686	70	76
Two	21	6,535	5.24	1,025	1,083	145	155
Three	9	12,279	7.56	2,331	1,617	305	319
Four or more	5	21,974	11.03	3,279	2,564	486	504
<b>All Four Areas</b>							
One	115	\$ 4,340	1.85	362	902	106	166
Two	69	8,182	3.05	738	1,390	193	275
Three	15	12,719	5.62	1,758	1,878	310	391
Four or more	8	21,394	8.71	2,819	3,401	645	735

As the farms increased from a one-tractor to a two-tractor operation in the Atchison area, the capital invested in machinery and equipment almost doubled (from \$4,659 to \$8,854). Total productive man work units per farm increased from 360 to 608, whereas the man equivalent increased from 1.33 to 1.87. Hence, the amount of machinery used on the two-tractor farms led to a sizable increase in productive work accomplished by the labor force.

In comparing the three-tractor farms in this area with two-tractor farms, the investment in machinery and equipment, the man equivalent, and the total work units each increased proportionately.

In the Linn area the one-tractor farms averaged \$4,362 invested in machinery and equipment, 1.54 man equivalent, and 289 man work units. Two-tractor farms averaged \$7,668 in machinery, 1.89 man equivalent, and 526 work units.

In the Greene area the one-tractor farms averaged \$4,324 invested in machinery and equipment, 1.61 man equivalent, and 350 man work units. The two-tractor farms averaged \$9,962 in machinery, 2.54 man equivalent, and 689 work units.

In the Pemiscot region there was a constant relationship between the number of tractors per farm and all measures of size except man equivalent. The two-tractor farms were twice as large as the one-tractor farms, and the three-tractor farms were twice as large as the two. In neither case, however, did the man equivalent double. Furthermore, comparing the eight farms with four or more tractors in this area to those with only three, the increase in size of business was not as rapid as it was on the smaller sized units; also the increase in the man equivalent on these farms was practically the same (proportionate) as the increase in the other measures of size.

Considering the four areas together, two relationships seemed significant. First, there was about \$4,000 invested in machinery and equipment per tractor. The one-tractor farms had \$4,340 invested, the two-tractor farms \$8,182, and the three-tractor farms \$12,719. Secondly, each tractor handled about 100 acres of cropland. The one-tractor farms averaged 106 acres of cropland, the two-tractor farms, 193 acres, and the three-tractor farms, 310. The levels for both of these relationships were slightly higher for farms in Atchison County and slightly lower for the smaller farms in Greene and in Pemiscot County.

TABLE 17. AMOUNT OF USE OF MOLDBOARD PLOWS: 128 Farms, Atchison, Linn, Pemiscot Counties, 1951

Area Studied and Number of Plows per Farm	Number of Farms	Acres Plowed		Hours of Use per Plow
		Total	per Plow	
Atchison area				
One	34	72	72	67
Two	11	108	54	49
Linn area				
One	41	76	76	78
Two	5	134	67	38
Pemiscot area				
One	24	61	61	70
Two	13	98	49	52
All Three areas				
One	99	71	71	72
Two	29	108	54	48

**Moldboard Plows:** Moldboard plows were used in Atchison, Linn, and Pemiscot counties. Farms with one moldboard plow used them to plow an average of 71 acres (Table 17). Farms with two plows used them to turn over 108 acres, or an average of 54 acres per plow. In terms of the number of hours of use, farms with one plow used them an average of 72 hours; farms with two used them an average of 48 hours each.

The larger plows were used the most, both in terms of acres and in terms of hours of use (Table 18). They also accomplished more per day except in Pemiscot County. There was no apparent reason for this.

**TABLE 18. AMOUNT AND RATE OF USE OF DIFFERENT SIZED MOLDBOARD PLOWS: 99 Farms With Only One Plow, Atchison, Linn, Greene, and Pemiscot Counties, 1951**

Area Studied and Size of Plow	Number of Farms	Acres Plowed	Hours Use	Acres per Day
Atchison area				
2-14 "	17	55	68	8.6
2-16 "	7	85	78	12.1
3-14 "	9	91	63	14.1
Linn Area				
2-12 "	13	45	51	8.8
2-14 "	26	80	82	9.7
3-14 "	3	172	92	18.7
Pemiscot area				
2-12 "	6	64	57	13.7
2-14 "	18	59	74	8.3
All three areas				
2-12 "	19	51	53	10.0
2-14 "	61	67	76	9.0
2-16 "	7	85	78	12.1
3-14 "	12	111	70	15.2

**Disc Plows:** Disc plows were used primarily in Greene County. Farms with a two-disc plow used them to plow 48 acres, while those with a three-disc plow used them on 67 acres (Table 19). The two-disc plow turned 7.5 acres per day and the three-disc 8.4 acres per day.

**TABLE 19. AMOUNT AND RATE OF USE OF DIFFERENT SIZED DISC PLOWS: 42 Farms, Greene County, 1951**

Size of Plow	Number of Farms	Acres Plowed	Hours Use	Acres per Day
2-disc	18	48	64	7.5
3-disc	24	67	80	8.4
Average	42	59	75	8.0

**Middlebusters:** Middlebusters were used primarily in Pemiscot County. The 36 farms with one middlebuster used them an average of 188

acres (Table 20). This amounted to 76 hours of use. There were few farms in this area with more than one middlebuster. Those having two used them slightly more than the farms with one and at a slightly faster rate.

TABLE 20. AMOUNT OF USE OF MIDDLEBUSTER: 42 Farms, Pemiscot County, 1951

Number of Middlebusters per Farm	Number of Farms	Acres "Busted"		Hours of Use per Middlebuster
		Total	per Middlebuster	
One	36	188	188	76
Two	4	430	215	60
Three	2	564	188	65

A comparison of three-row middlebusters with two-row showed that the three-row machines were used on twice as many acres (Table 21). However, the hours of use were only 50 percent more, as the rate of use increased from 20.0 to 30.8 acres per day.

TABLE 21. AMOUNT AND RATE OF USE OF DIFFERENT SIZED MIDDLEBUSTERS: 36 Farms With One Middlebuster, Pemiscot County 1951

Size of Middlebuster	Number of Farms	Acres Busted	Hours Use	Acres per Day
2 row	19	118	60	20.0
3 row	17	250	88	30.8
Average	36	188	76	24.7

**Disc Harrows:** Disc Harrows were used in all four areas. Most farms (142 out of 174) had but one disc. This disc was used on an average of 196 acres, or for 72 hours (Table 22). The 26 farms with two discs used them on a total of 470 acres or 235 acres per disc and 80 hours per disc. When a second disc was used in the Atchison and Linn areas the total acreage discing was not quite doubled. In the Pemiscot area the acreage more than doubled. Four farms in the Pemiscot area had three discs each. These were used on a total of 681 acres or 227 acres each.

Single discs were used almost entirely in Atchison County, whereas only tandem discs were used in Pemiscot County. In the other two areas there seemed to be more tandem discs than single discs, with tandem discs being used the most. Only in the Linn area was there a sufficient number of each to compare the rate of use. Here the tandem discs were used on an average of 26.3 acres per day while the single discs averaged only 21.1 acres per day (Table 23).\*



TABLE 22. AMOUNT OF USE OF DISC HARROWS: 174 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Area Studied and Number of Harrows per Farm	Number of Farms	Acres Harrowed		Hours of Use per Harrow
		Total	per Harrow	
Atchison Area				
One	34	289	289	72
Two	12	544	272	77
Three	1	270	90	17
Linn Area				
One	49	173	173	64
Two	3	314	157	52
Greene Area				
One	31	140	140	60
Three	1	855	285	140
Pemiscot Area				
One	28	188	188	97
Two	11	432	216	91
Three	4	681	227	87
All Four Areas				
One	142	196	196	72
Two	26	470	235	80
Three	6	630	210	85

TABLE 23. AMOUNT AND RATE OF USE OF DIFFERENT TYPES OF DISC HARROWS: 141 Farms With Only One Disc Harrow, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Area Studied and Type of Disc Harrow	Number of Farms	Acres Harrowed	Hours Use	Acres per Day
Atchison Area				
tandem	1	200	50	40.0
simple	33	318	73	43.8
Linn Area				
tandem	31	177	68	26.3
simple	17	127	40	21.1
Greene Area				
tandem	24	153	66	23.3
simple	7	97	40	24.2
Pemiscot Area				
tandem	28	188	97	19.3
One	36	188	76	
Two	4	430	60	
Three	2	564	65	

**Stalkcutters:** Thirty-two farms in the Pemiscot area used a stalkcutter (Table 24). These were used on an average of 251 acres, at an average rate of 27.9 acres per day. Twenty-eight farms had one stalkcutter and four farms had two. Those with one used them on an average of 217 acres; those



with two used them on a total of 982 acres or 491 acres per machine. The latter farms used stalkcutters more often and at a much faster rate.

TABLE 24. AMOUNT AND RATE OF USE OF STALKCUTTERS: 32 Farms, Pemiscot County, 1951

Number of Stalkcutters per Farm	Number of Farms	Acres of Stalks Cut		Hours of Use per Stalkcutter	Acres per Day
		Total	per Stalkcutter		
One	28	217	217	83	26.1
Two	4	982	491	122	40.2
Average	32	313	251	88	27.9

Width of the machine was not revealed in the records, which limits the significance of the data.

**Grain Drills:** Grain drills were used primarily in the Atchison, Linn, and Greene areas. This implement was used on an average of 55 acres and at an average rate of 20.1 acres per day (Table 25). Grain drills were used on an average of 58 acres in the Greene area, 53 acres in the Atchison area, and 44 acres in the Linn area. The rate of use was somewhat less in Linn County than in Atchison, and still less in Greene County. The difference was probably due to the more rocky nature and smaller size of fields in the latter area.

TABLE 25. AMOUNT AND RATE OF USE OF GRAIN DRILLS: 88 Farms, Atchison, Linn, and Greene Counties, 1951

Area Studied	Number of Farms	Acres Drilled	Hours of Use per Grain Drill	Acres per Day
Atchison	20	53	23	23.0
Linn	28	44	21	20.9
Greene	40	58	35	18.3
All three areas	88	55	28	20.1

**Listers:** Listers were used primarily in Atchison County. Farmers with one lister used it to plant an average of 100 acres of corn. Farmers with two listers used each on an average of 72 acres (Table 26). The average working rate was 19.7 acres per day.

TABLE 26. AMOUNT AND RATE OF USE OF LISTERS: 50 Farms, Atchison County, 1951

Number of Listers per Farm	Number of Farms	Acres Planted		Hours of Use per Lister	Acres per Day
		Total	per Lister		
One	41	100	100	51	19.6
Two	9	144	72	36	20.0
Average	50	108	91	46	19.7

**Corn Planters:** Corn planters were used in Linn County. Some farmers had a two-row horse planter and some a two-row tractor planter. Horse planters were used to plant an average of 46 acres. Tractor planters were used to plant an average of 89 acres (Table 27). The rate of use for the horse planters was 13.9 acres per day, compared with 24.1 acres per day for tractor planters. Thus, tractor power enabled farmers to plant approximately twice as much corn a day as could be done with horse power.

TABLE 27. AMOUNT AND RATE OF USE OF DIFFERENT TYPES OF CORN PLANTERS: 48 Farms, Linn County, 1951

Type of Planter	Number of Farms	Acres Planted	Hours of Use per Planter	Acres per Day
2-row horse	24	46	33	13.9
2-row tractor	24	89	37	24.1

**General Purpose Planter:** Four farms in the Pemiscot area had two-row horse planters, 22 of them had two-row tractor planters, and 15 had four-row tractor planters (Table 28). Two-row horse planters were used to plant an average of 109 acres. Two-row tractor planters averaged 136 acres and four-row tractor planters 267 acres. Two-row implements were used at a rate of 16.7 acres per day, two-row tractor planters at 23.0 acres per day, and the four-row tractor planters at 46.0 acres per day. As expected, four-row tractor planters were used just twice as fast as two-row tractor planters.

TABLE 28. AMOUNT AND RATE OF USE OF DIFFERENT TYPES AND SIZES OF GENERAL PURPOSE PLANTERS: 41 Farms, Pemiscot County, 1951

Type and Size of Planter	Number of Farms	Acres Planted	Hours of Use per Planter	Acres per Day
Horse planter				
2-row	4	109	65	16.7
Tractor planters				
2-row	22	136	59	23.0
4-row	15	267	58	46.0

TABLE 29. AMOUNT AND RATE OF USE OF GO-DEVILS: 39 Farms, Atchison County, 1951

Number of "Go-Devils" per Farm	Number of Farms	Acres "Go'ed"		Hours Use per "Go-Devil"	Acres per Day
		Total	per "Go-Devil"		
One	31	116	116	47	24.7
Two	8	192	96	52	18.5
Average	39	132	112	48	23.4

**Go-devils:** Go-devils were used in Atchison County for the first or second cultivation of corn. Thirty-one farms with one go-devil used it on the average of 116 acres, while eight farms with two go-devils used each on an average of 96 acres (Table 29). Average rate of use was 23.4 acres per day.

**Two-row Tractor Cultivators:** Two-row tractor cultivators were used in Atchison, Linn, and Pemiscot counties. Ninety-three farms had one cultivator, 40 had two, 10 had three, and 4 farms had four (Table 30). Farms with only one cultivator used them on 190 acres in the Atchison area, 169 acres in the Linn area and 611 acres in the Pemiscot area. The extremely heavy use in the Pemiscot area was due in part to an exceptionally weedy 1951 season. Farms with two cultivators used them on a total of 264 acres in the Atchison area, 354 acres in Linn, and 1,024 acres in the Pemiscot region.

TABLE 30. AMOUNT AND RATE OF USE OF TWO-ROW TRACTOR CULTIVATORS: 147 Farms, Atchison, Linn, and Pemiscot Counties, 1951  
(No two row tractor cultivator records were obtained from Greene Co.)

Area Studied and Number of Cultivators per Farm	Number of Farms	Area Cultivated		Hours of Use per Cultivator	Acres per Day
		Total	per Cultivator		
<b>Atchison Area</b>					
One	31	190	190	88	21.6
Two	15	264	132	65	20.3
Three	3	357	119	46	25.9
Four	1	800	200	133	15.0
<b>Linn Area</b>					
One	40	169	169	85	19.9
Two	5	354	177	92	19.2
<b>Pemiscot Area</b>					
One	22	611	611	317	19.3
Two	20	1,024	512	199	25.7
Three	7	1,686	562	190	29.6
Four	3	2,860	715	192	37.2
<b>All Three Areas</b>					
One	93	280	280	141	19.9
Two	40	656	328	135	24.3
Three	10	1,287	429	147	29.2
Four	4	2,344	586	177	33.1

The more cultivators per farm the more rapid was the rate of use. Farms with one cultivator used them at a rate of 19.9 acres per day, farms with two cultivators at a rate of 24.3 acres per day, farms with three cultivators at 29.1 acres per day, and farms with four cultivators an average of 33.1 acres per day. In the Linn area the average rate of use did not change between farms with one and two cultivators. Yet in the Pemiscot region the acres cultivated per day increased rapidly with increases in the number of cultivators per farm.

**Mowing Machines:** Twenty-two horse-drawn mowing machines and 113 tractor mowers were being used in the Atchison, Linn, and Greene areas. The horse-drawn mowers were used to cut an average of 58 acres at an average rate of 11.6 acres per day (Table 31). The tractor mowers were used to cut an average of 137 acres at a rate of 20.3 acres per day. Hence, the tractor mower cut hay almost twice as fast as the horse-drawn machines. (Most of the horse mowers were 5-foot machines while most tractor mowers were 7-foot machines.)

**TABLE 31. AMOUNT AND RATE OF USE OF DIFFERENT TYPES OF MOWING MACHINES: 135 Farms With Only One Mower, Atchison, Linn, and Greene Counties, 1951**

Area Studied and Type of Mower	Number of Farms	Acres Mowed	Hours of Use per Mower	Acres per Day
<b>Atchison Area</b>				
Horse	7	48	47	10.6
Tractor	39	113	64	17.6
<b>Linn Area</b>				
Horse	10	52	41	13.7
Tractor	32	125	60	22.1
<b>Greene Area</b>				
Horse	5	85	97	9.0
Tractor	42	145	70	21.5
<b>All Three Areas</b>				
Horse	22	58	56	11.6
Tractor	113	137	65	20.3

Mowers in the Greene area were used more for cutting hay and pasture than those in the other two areas. Mowers in the Atchison and Linn areas were used to cut approximately the same acreage, although the rate was faster in Linn County where the topography is not as hilly.

**Side-delivery Rakes:** Side-delivery rakes were used in the Atchison, Linn, and Greene areas to rake an average of 98 acres per farm at an average rate of 22.3 acres per day (Table 32). In the Atchison area the implement was used on an average of 105 acres per farm. It was used on 86 acres in Linn and 99 acres in the Greene area. Rate of use was fastest in the Atchison area (25.0 acres per day) and slowest in the Greene area (19.8 per day).

**TABLE 32. AMOUNT AND RATE OF USE OF SIDE-DELIVERY RAKES: 78 Farms With Only One Side-Delivery Rake, Atchison, Linn, and Greene Counties, 1951**

Area Studied	Number of Farms	Acres Raked	Hours of Use per Rake	Acres per Day
Atchison	30	105	42	25.0
Linn	18	86	39	22.1
Greene	30	99	50	19.8
Average	78	98	44	22.3

**Hay Balers:** Thirty-seven farmers in these same three areas owned a hay baler. These machines were used to bale an average of 10,254 bales (Table 33). The machine was used the most in the Greene area and the least in Atchison County. Average rate of operation was 697 bales per 10 hours in the Atchison area, 1,014 bales per 10 hours in Linn, and 1,350 per 10 hours in Greene County.

TABLE 33. AMOUNT AND RATE OF USE OF HAY BALERS: 37 Farms, Atchison, Linn, and Greene Counties, 1951

Area Studied	Number of Farms	Bales	Hours of Use per Baler	Bales per 10 Hours
Atchison	10	5,639	82	697
Linn	12	8,314	82	1,014
Greene	15	14,883	110	1,350
Average	37	10,254	93	1,062

**Combines:** There were 24 five-foot combines and 16 six-foot combines in the Atchison and Linn areas (Table 34). Five-foot machines were used on an average of 98 acres in the Atchison area and 127 acres in Linn. Six-foot machines were used on 89 acres in Atchison and 123 acres in Linn. Average rate of operation, however, differed more between areas than it did between different sized machines. In the Atchison area, 5- and 6-foot machines were used to combine 14.2 and 15.1 acres per day, respectively. The same sized machines combined only 11.1 and 11.4 acres per day in the Linn area.

TABLE 34. AMOUNT AND RATE OF USE OF DIFFERENT SIZED (AND TYPE) COMBINES: 53 Farms, Atchison, Linn, and Pemiscot Counties, 1951

Area Studied and Size and Type of Combine	Number of Farms	Acres Combined	Hours of Use per Combine	Acres per Day
Atchison Area				
5 ft.-tractor	7	98	69	14.2
6 ft.-tractor	7	89	59	15.1
Linn Area				
5 ft.-tractor	17	127	114	11.1
6 ft.-tractor	9	123	108	11.4
Pemiscot Area				
2-row-tractor*	8	91	80	11.4
3-row-self-propelled	5	198	125	15.8

\* These combines are similar to the 5 and 6 foot combines in Atchison and Linn Counties, but are designed as row combines because they are used primarily to harvest soybeans.

Two-row tractor combines were used in the Pemiscot area on an average of 91 acres; whereas, the three-row self-propelled combines were used to combine an average of 198 acres. Rate of operation was 11.4 acres per day for the tractor-drawn machines and 15.8 acres for the self-propelled.

**Corn Pickers:** A total of 20 one-row corn pickers were being used in the Atchison and Linn areas. They were used to pick an average of 69 acres of corn (Table 35). There were 33 two-row pickers and these were used to pick an average of 157 acres of corn. The one-row pickers were used about the same amount in each area, but two-row pickers were used more in the Atchison area than in Linn.

TABLE 35. AMOUNT AND RATE OF USE OF DIFFERENT SIZED CORN PICKERS:  
53 Farms, Atchinson and Linn Counties, 1951

Area Studied and Size of Picker	Number of Farms	Acres Picked	Hours of Use per Picker	Acres Per Day
Atchinson Area				
One-row	13	69	82	9.5
Two-row	24	173	141	13.2
Linn Area				
One-row	7	70	118	6.2
Two-row	9	111	126	11.2
Both Areas Combined				
One-row	20	69	95	8.3
Two-row	33	157	137	12.7

Rate of operation for one-row pickers was 8.3 acres per day, compared to 12.7 acres for the two-row pickers. Similar to hay balers, the rate of use in the Atchison area was faster than in the Linn area.

**Silage Harvesting Equipment:** Nine corn binders were found in the Greene area. They were used to harvest an average of 15 acres (Table 36). The average rate of operation was 9.4 acres per day. Twelve farmers owned stationary silage cutters and ran through them an average of 203 tons of silage. The average rate was 48.6 tons per day.

TABLE 36. AMOUNT AND RATE OF USE OF SILAGE HARVESTING EQUIPMENT:  
26 Farms, Greene County, 1951

Type of Equipment	Number of Farms	Acres of Use	Tons	Hours of Use	Usage per 10 Hours
Corn binders	9	15	---	16	9.4 acres
Ensilage cutters	12	---	203	42	48.6 tons
Field choppers	5	---	130	45	28.9 tons



Five farmers in this area owned field choppers. However, they used them to harvest an average of only 130 tons (total) at the rate of 28.9 tons per day. This does not represent the true capacity of these machines. Farmers in this area often used them for one-half to three-fourths of an hour, then let the machines sit still while ensilage was hauled to the barn and blown into the silo.

**Manure Spreaders:** There were 107 manure spreaders in the Atchison, Linn, and Greene areas (Table 37). The spreaders were used to haul an average of 162 loads apiece at a rate of 17.8 loads per day. Spreaders in the Greene area were used the most (219 loads), while spreaders in the Atchison area were used the least (127 loads). There was little difference in rate of use among the three areas.

TABLE 37. AMOUNT AND RATE OF USE OF MANURE SPREADERS:  
107 Farms, Atchison, Linn, and Greene Counties, 1951

Area Studied	Number of Farms	Total Loads	Hours of Use per Spreader	Loads per 10 Hours
Atchison	36	127	74	17.2
Linn	35	139	82	16.9
Greene	36	219	114	19.2
All three areas	107	162	90	17.8

### AMOUNT OF OFF-FARM WORK

Heretofore all usage figures have referred to the total use of the machines. Some of the machinery and equipment, particularly that used in harvesting operations, was used occasionally off the farm. This was especially true in the Linn area. In this area 68 percent of the hay baling, 36 percent of the corn picking, and 13 percent of the combining (Table 38) was off-farm.

TABLE 38. RELATIVE AMOUNT OF OFF-FARM USE OF VARIOUS MACHINES:  
212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Type of Equipment	Percent of Total That Equipment Was Used Off-Farm			
	Atchison Area	Linn Area	Greene Area	Pemiscot Area
Grain drill	0	0	10	-
Corn planter	-	10	-	-
General purpose planter	-	-	-	3
Tractor mower	0	7	5	-
Side delivery rakes	0	10	3	-
Hay balers	49	68	55	-
Combines	10	13	-	8
Corn pickers	14	36	-	-
Corn binders	-	-	33	-
Ensilage cutters	-	-	31	-
Field choppers	-	-	3	-

In the Atchison area the hay baler was used off-farm 49 percent of the time, the corn picker 14 percent, and the combine 10 percent. In the Greene area the hay baler was used off-farm 55 percent of the time and the corn binder and ensilage cutter about one-third of the time.

With the exception of harvesting equipment, however, very little exchange work or custom work was done.

## SUMMARY AND CONCLUSIONS

1. During the last decade the farmer's investment in machinery and equipment has increased considerably. Increased investment has led to the need for a continuous adjustment of factors of production in order to maintain an efficient utilization of the farm's resources.

2. In order to ascertain the capital invested in machinery and equipment, along with the amount that this machinery was used, four areas—located in Atchison, Linn, Greene, and Pemiscot counties—were studied. These areas represent four different type-of-farming regions—cash-grain livestock, general livestock, dairy, and a cash crop region. Records were obtained on approximately 50 family-sized commercial farms in each area.

3. In 1951 the total capital investment amounted to \$45,378 per farm. Of this amount, real estate investment made up 59 percent, livestock investment 20 percent, investment in machinery and equipment 15 percent, and investment in feed, grain, and supplies 6 percent.

The total farm capital for 53 farms in the Atchison area amounted to \$68,771 per farm; the average for 52 farms in the Linn area was \$35,734; average for 53 farms in the Greene area was \$39,440; and the average capital investment for 54 farms in the Pemiscot area was \$37,532.

4. Farmers in all four areas were classified into renters, part-owners, and full-owners. The average investment per farmer was \$15,754 for renters, \$34,509 for part-owners, and \$42,674 for full-owners.

Renters in the Pemiscot area had the lowest total investment per farmer—\$8,763. Of this 85 percent was in machinery and equipment. At the other extreme, full-owners in the Atchison area had the highest capital investment—\$70,282 per farmer. While these figures are for two widely different type-of-farming areas and are based on two different degrees of farm ownership, they show the wide range which occurs in capital investment per farmer.

5. A comparison of the capital investment for the 1929-31 period with that in 1951 was available for two areas—Atchison and Linn. In the Atchison area the total farm capital rose from \$23,992 in 1931 to \$45,545 in 1951; in Linn it rose from \$14,022 in 1929 to \$32,004 in 1951.

In 1929 and 1931 investment in machinery and equipment in Atchison and Linn, respectively, amounted to 6 and 4 percent of the total investment. In 1951 it amounted to 17 and 16 percent of the total.

6. The average investment in a farm tractor in 1951 was \$1,118. The average in the Atchison area was \$972, the average in Linn was \$1,005, that in Greene was \$1,102, whereas the average investment in a tractor in the Pemiscot area was \$1,333. The tractor's age and estimated life have considerable influence on the value or average investment so these factors should be considered in final analysis.

For example, in the Atchison area where tractor investment averaged \$972, the average age of all farm tractors was 6.0 years and the average estimated life was 13.0. In the Pemiscot region, the average age was 3.0 years and the average estimated life was 9.6.

7. As the size of the farm business increased, average investment in machinery and equipment increased. This was true of all areas, although the degree of relationship varied from one area to another, depending on the size of farm to begin with and on the criteria used to measure size of business.

For example, using total farm acres to measure size of business, the investment in machinery and equipment on farms with more than 400 acres in the Atchison area and the investment on those with more than 200 acres in the Pemiscot area increased quite rapidly with further increases in size. In the Linn and Greene County areas, where the raising of livestock was more important, the investment in machinery increased at a slower rate than did the total farm acres, when compared to the Atchison and Pemiscot areas.

In terms of the number of men employed, investment in machinery and equipment in the Atchison and Greene areas rose fairly rapidly when the size of farm went beyond a two-man business. In the Linn area investment increased much more slowly than in either the Atchison or Greene area. In Pemiscot County, where a large amount of seasonal labor is used, the investment rose slowly up to the point where six men were employed and then it increased somewhat more rapidly.

Number of cows per farm also was used as a measure of size in the Greene area and acreage of cotton was used in the Pemiscot region. As the number of cows per farm increased in the Greene area, the investment in machinery and equipment slowly increased. This seemed to be true regardless of the number of cows kept. However, as the acreage of cotton increased in the Pemiscot area, the investment in machinery and equipment increased slowly up to around 100 to 120 acres. Then it increased quite rapidly.

8. The total hours of tractor use per farm amounted to an average of 1,232 hours. However, the average farm tractor was used 750 hours. Farms with a single tractor used them an average of 902 hours; farms with two tractors used them an average of 1,390 hours or 695 hours per tractor; farms with three tractors averaged 1,878 hours of use or 626 hours per tractor; and farms with four or more tractors used them an average of 3,401 hours or 850 hours per tractor.

Tractors in the Atchison area were used the most; in Pemiscot County they were used the least both in hours per farm and hours per tractor. The latter was undoubtedly due to the seasonal nature of tractor usage in the Pemiscot region. In the other areas, tractors were used more continuously throughout the year due to the livestock programs.

As the number of tractors per farm increased, the size of business generally increased. However, the size of business increased much less when measured in terms of man equivalent than when using other measures of size. This was because the productivity of labor on farms with two or more tractors increased considerably through the process of substituting equipment capital for labor.

Two relationships between the number of tractors per farm and size of business seemed especially significant in these four areas. First there was approximately \$4,000 invested in machinery and equipment per tractor, and second, each tractor was used on approximately 100 acres of cropland.

**9. Conclusions:** In present-day agriculture the majority of factors of production that enter into the farm business are "lumpy"—that is, they are not obtainable in infinitesimally small divisible units. Thus, the farm manager or entrepreneur has a problem of combining a given amount of labor with relatively fixed sets of machinery and equipment, various amounts of livestock, and certain fixed acreages of land. Also, the factors of production that tend to be fixed during the short-run or during the growing season tend to change and become more variable in the long-run.

A set of machinery including the equipment to prepare the ground, plant, cultivate, and harvest a particular crop is usually considered as an indivisible factor of production, at least in the short-run, as a set of machinery is a necessity on practically all farms. A certain amount of flexibility can be obtained only because various sizes of farm equipment usually are available. In the long-run, however, the size of the farm, the labor force, and the other factors of production, which are relatively fixed in the short-run can be adjusted to a given amount of machinery and equipment.

Hence, both methods of adjustment—that of adjusting the machinery to the land or other factors, and that of adjusting the other factors of production to a given amount of machinery and equipment—are used by farmers to maintain an efficient utilization of resources.

In the short-run the investment in machinery and equipment is more variable than total farm acres and the labor force. The farmer can make changes in the amount of machinery and equipment he is using, but he cannot make major changes in cropland acreage or in livestock numbers. Hence, in the short-run, the farmer's only decision is whether or not to buy a particular machine. This decision should be contingent upon certain recommended levels of use which are necessary to justify the cost of that machine. If the acreage of a particular crop does not meet these recommended levels

of use, the farmer may hire the work done, or he may want to go ahead and purchase the machine, recognizing that he must supplement its use on the home farm by doing custom work on neighboring farms during the next few years.

In the long-run all factors of production tend to be variable. Farmers are able to adjust the size of farm, the livestock program, the labor force, and thus make more efficient use of the machinery and equipment. Hence, in the long-run farmers should use recommended levels of use as a guide in adjusting the size of farm to the amount of investment in machinery and equipment needed for efficient farming operation.

The average level of use (in the four areas combined) along with a recommended level of use for each particular machine, based on the average amount that each machine was used, is given in Table 38.<sup>1</sup>

In both the short and the long-run the farmer should consider these recommended levels of use if he is to justify the cost of each particular type of machinery and equipment. Farmers who use their machinery and equipment above the recommended levels are undoubtedly those with above average managerial ability. These farmers have the ability to combine the factors of production in a more efficient manner. Therefore, the use they make of their machinery is an excellent guide for other farmers in determining whether or not the purchasing of a particular machine is justifiable.

<sup>1</sup>These minimum levels were arrived at by adjusting the average use either upward or downward. In doing so, extreme care was taken not to exceed the average number of days per year during which that particular farm operation could be performed with the particular machine in each area. Since the average use is based on farmers' past experience, this average takes into consideration timeliness of work, the farmer's ability to get the job done, and many other variables.



APPENDIX

TABLE 1. CAPITAL INVESTMENT PER FARMER WITH VARIATIONS IN THE DEGREE OF OWNERSHIP: 53 Farms, Atchison County, 1951

	Real Estate			Average All Farms*
	Completely Rented	Partly Owned	Completely Owned	
Number of farms	25	8	20	53
Size of farm (acres)	322	349	315	325
Capital investment				
Real estate	\$ ----	\$ 22,556	\$ 38,833	\$ 41,285
Livestock	12,317	11,302	17,720	14,203
Machinery and equipment	6,183	9,403	9,237	7,822
Feed and supplies	5,420	8,013	4,493	5,461
Total	\$ 23,920	\$ 51,274	\$ 70,283	\$ 68,771

\*This is the capital investment per farm or the capital invested by both the farm operator and the landlord.

TABLE 2. CAPITAL INVESTMENT PER FARMER WITH VARIATIONS IN THE DEGREE OF OWNERSHIP: 52 Farms, Linn County, 1951

	Real Estate			Average All Farms*
	Completely Rented	Partly Owned	Completely Owned	
Number of farms	6	13	33	52
Size of farm (acres)	252	298	215	240
Capital investments				
Real Estate	\$ ---	\$ 13,602	\$ 15,893	\$ 17,214
Livestock	6,837	10,129	11,422	10,570
Machinery and equipment	3,675	6,716	4,863	5,189
Feed and supplies	2,101	3,129	2,736	2,761
Total	\$ 12,613	\$ 33,576	\$ 34,914	\$ 35,734

\*This is the capital investment per farm or the capital invested by both the farm operator and the landlord.

TABLE 3. CAPITAL INVESTMENT PER FARMER WITH VARIATIONS IN THE DEGREE OF OWNERSHIP: 53 Farms, Greene County, 1951

	Real Estate			Average All Farms*
	Completely Rented	Partly Owned	Completely Owned	
Number of farms	4	22	27	53
Size of farm (acres)	296	229	172	205
Capital investments				
Real estate	\$ ---	\$ 14,591	\$ 18,991	\$ 21,172
Livestock	12,620	10,665	10,613	10,786
Machinery and equipment	6,434	5,806	5,882	5,892
Feed and supplies	2,797	1,453	1,522	1,590
Total	\$ 21,851	\$ 32,515	\$ 37,008	\$ 39,440

\*This is the capital investment per farm or the capital invested by both the farm operator and the landlord.



TABLE 4. CAPITAL INVESTMENT PER FARMER WITH VARIATIONS IN THE DEGREE OF OWNERSHIP: 54 Farms, Pemiscot County, 1951

	Real Estate			Average All Farms*
	Completely Rented	Partly Owned	Completely Owned	
Number of farms	30	12	12	54
Size of farm (acres)	188	228	142	187
Capital investments				
Real estate	\$ --	\$ 14,953	\$ 21,317	\$ 27,668
Livestock	654	1,548	1,224	979
Machinery and equipment	7,436	9,540	7,567	7,932
Feed and supplies	673	1,957	646	953
Total	\$ 8,763	\$ 27,998	\$ 39,754	\$ 37,532

\*This is the capital investment per farm or the capital invested by both the farm operator and the landlord.

TABLE 5. INVESTMENT IN TRACTORS WITH 8-12 MAXIMUM DRAWBAR HORSEPOWER:\* 10 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
Number of farms	2	3	3	2	10
Number of tractors	2	3	3	2	10
Tractors per farm	1.0	1.0	1.0	1.0	1.0
Percent of tractors purchased new	50	100	67	50	60
Original cost**	\$ 600	\$ 458	\$ 825	\$ 920	\$ 635
Age (years)	15.0	16.0	5.5	4.0	11.1
Estimated life	25.0	21.3	12.5	14.0	18.3
Present value	\$ 183	\$ 194	\$ 622	\$ 482	\$ 378

\*Farmers consider these as one-plow tractors.

\*\*Averages do not include tractors bought second-hand.

TABLE 6. INVESTMENT IN TRACTORS WITH 13-17 MAXIMUM DRAWBAR HORSEPOWER:\* 100 Farms Atchison, Linn, Greene, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
Number of farms	33	25	19	23	100
Number of tractors	42	28	20	29	119
Tractors per farm	1.3	1.1	1.0	1.3	1.2
Percent of tractors purchased new	67	82	75	66	71
Original cost**	\$ 1,199	\$ 1,346	\$ 1,408	\$ 1,604	\$ 1,366
Age (years)	7.8	3.5	3.4	2.1	4.6
Estimated life	13.7	10.6	10.6	7.8	11.1
Present value	\$ 660	\$ 957	\$ 994	\$ 1,007	\$ 871

\*Farmers consider these as two-plow tractors.

\*\*Averages do not include tractors bought second-hand.

TABLE 7. INVESTMENT IN TRACTORS WITH 18-23 MAXIMUM DRAWBAR HORSEPOWER:\* 102 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
Number of farms	19	21	26	36	102
Number of tractors	20	22	29	48	119
Tractors per farm	1.0	1.0	1.1	1.3	1.2
Percent of tractors purchased new	75	82	69	69	72
Original cost**	\$ 1,485	\$ 1,562	\$ 1,692	\$ 1,884	\$ 1,696
Age (years)	5.8	4.5	4.8	4.0	4.6
Estimated life	13.4	11.3	12.7	9.8	11.5
Present value	\$ 1,027	\$ 1,014	\$ 1,091	\$ 1,210	\$ 1,114

\*Farmers consider these as two-plow tractors.

\*\*Averages do not include tractors bought second-hand.

TABLE 8. INVESTMENT IN TRACTORS WITH 24-27 MAXIMUM DRAWBAR HORSEPOWER:\* 76 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
Number of farms	28	13	13	22	76
Number of tractors	41	14	13	34	102
Tractors per farm	1.5	1.1	1.0	1.6	1.3
Percent of tractors purchased new	90	86	69	79	83
Original cost**	\$ 1,921	\$ 1,851	\$ 1,983	\$ 2,399	\$ 2,071
Age (years)	4.5	4.3	3.4	2.4	3.7
Estimated life	11.8	12.2	11.3	10.4	11.4
Present value	\$ 1,323	\$ 1,366	\$ 1,208	\$ 1,756	\$ 1,458

\*Farmers consider these as three-plow tractors.

\*\*Averages do not include tractors bought second-hand.

TABLE 9. INVESTMENT IN TRACTORS WITH 30-38 MAXIMUM DRAWBAR HORSEPOWER:\* 6 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
Number of farms	1	2	2	1	6
Number of tractors	1	2	2	1	6
Tractors per farm	1.0	1.0	1.0	1.0	1.0
Percent of tractors purchased new	0	0	50	100	33
Original cost**	0	0	\$ 2,450	\$ 4,750	\$ 3,600
Age (years)	0	0	3.0	2.0	2.5
Estimated life	0	0	8.0	8.0	8.0
Present value	\$ 172	\$ 273	\$ 2,381	\$ 3,949	\$ 1,571

\*Farmers consider these as three-plow tractors or larger.

\*\*Averages do not include tractors bought second-hand.

**TABLE 10. INVESTMENT IN TWO-BOTTOM 12-INCH MOLDBOARD PLOWS: 32 Farms, Atchison, Linn, and Pemiscot Counties, 1951**

	Atchison Area	Linn Area	Pemiscot Area	Average All Areas
Number of farms	4	16	12	32
Number of plows	4	17	15	36
Plows per farm	1.0	1.1	1.2	1.1
Percent of plows purchased new	100	76	80	81
Original cost*	\$ 141	\$ 163	\$ 230	\$ 188
Age (years)	8.5	5.4	2.6	4.7
Estimated life	18.2	14.3	8.1	12.5
Present value	\$ 99	\$ 108	\$ 164	\$ 130

\*Averages do not include plows bought second-hand.

**TABLE 11. INVESTMENT IN TWO-BOTTOM 14-INCH MOLDBOARD PLOWS: 84 Farms, Atchison, Linn, and Pemiscot Counties 1951**

	Atchison Area	Linn Area	Pemiscot Area	Average All Areas
Number of farms	29	30	25	84
Number of plows	36	30	33	99
Plows per farm	1.2	1.0	1.3	1.18
Percent of plows purchased new	72	90	70	77
Original cost*	\$ 176	\$ 189	\$ 220	\$ 194
Age (years)	6.5	3.9	2.9	4.9
Estimated life	15.9	12.5	8.2	12.5
Present value	\$ 114	\$ 140	\$ 144	\$ 132

\*Averages do not include plows bought second-hand.

**TABLE 12. INVESTMENT IN TWO-BOTTOM 16-INCH MOLDBOARD PLOWS: 12 Farms, Atchison County, 1951**

	Atchison Area
Number of farms	12
Number of plows	16
Plows per farm	1.3
Percent of plows purchased new	88
Original cost*	\$ 230
Age (years)	5.6
Estimated life	14.2
Present value	\$ 151

\* Averages do not include plows bought second-hand.

TABLE 13. INVESTMENT IN THREE-BOTTOM 14-INCH MOLDBOARD PLOWS:  
25 Farms, Atchison, Linn, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Pemiscot Area	Average All Areas
Number of farms	15	6	4	25
Number of plows	20	7	5	32
Plows per farm	1.3	1.2	1.2	1.3
Percent of plows purchased new	95	100	80	94
Original cost*	\$ 302	\$ 279	\$ 344	\$ 302
Age (years)	2.6	1.8	2.0	2.4
Estimated life	16.7	10.1	9.0	14.2
Present value	\$ 262	\$ 246	\$ 259	\$ 212

\* Averages do not include plows bought second-hand.

TABLE 14. INVESTMENT IN DISC PLOWS: 24 Farms, Greene County, 1951

	Two Disc	Three Disc
Number of farms	18	24
Number of machines	18	24
Machines per farm	1.0	1.0
Percent of machines purchased new	89	79
Original cost*	\$ 273	\$ 339
Age (years)	2.4	6.0
Estimated life	10.2	11.3
Present value	\$ 228	\$ 204

\* Averages do not include machines bought second-hand.

TABLE 15. INVESTMENT IN MIDDLEBUSTERS: 21 Farms, Pemiscot County, 1951

	Two Row	Three Row
Number of farms	25	21
Number of machines	28	25
Machines per farm	1.1	1.2
Percent of machines purchased new	68	100
Original cost*	\$ 215	\$ 346
Age (years)	3.9	2.3
Estimated life	10.5	9.2
Present value	\$ 140	\$ 278

\* Averages do not include machines bought second-hand.

TABLE 16. INVESTMENT IN STRAIGHT DISCS: 74 Farms, Atchison, Linn, and Greene Counties, 1951

	Atchison Area	Linn Area	Greene Area	Average All Areas
Number of farms	48	19	7	74
Number of discs	65	19	7	91
Discs per farm	1.4	1.0	1.0	1.2
Percent of discs purchased new	78	71	100	78
Original cost*	\$ 221	\$ 138	\$ 154	\$ 198
Age (years)	5.6	6.9	4.7	5.8
Estimated life	12.6	14.7	13.4	13.1
Present value	\$ 146	\$ 86	\$ 121	\$ 132

\* Averages do not include discs bought second-hand.

TABLE 17. INVESTMENT IN TANDEM DISCS: 110 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Greene Area	Pemiscot Area	Average All Areas
Number of farms	5	36	25	44	110
Number of discs	8	37	27	63	135
Discs per farm	1.6	1.0	1.1	1.4	1.3
Percent of discs purchased new	100	86	74	71	78
Original cost*	\$ 234	\$ 219	\$ 214	\$ 293	\$ 250
Age (years)	4.7	4.7	3.3	2.0	3.4
Estimated life	10.0	11.0	9.7	7.4	9.2
Present value	\$ 153	\$ 147	\$ 136	\$ 188	\$ 164

\* Averages do not include discs bought second-hand.

TABLE 18. INVESTMENT IN STALKCUTTERS: 32 Farms, Pemiscot County, 1951

	Pemiscot Area
Number of farms	32
Number of machines	36
Machines per farm	1.1
Percent of machines purchased new	78
Original cost*	\$ 118
Age (years)	4.6
Estimated life	10.8
Present value	\$ 67

\* Averages do not include machines bought second-hand.

TABLE 19. INVESTMENT IN GRAIN DRILLS: 89 Farms, Atchison, Linn, and Greene Counties, 1951

	Atchison Area	Linn Area	Greene Area	Average All Areas
Number of farms	20	29	40	89
Number of drills	20	29	40	89
Drills per farm	1.0	1.0	1.0	1.0
Percent of drills purchased new	70	66	68	67
Original cost*	\$ 248	\$ 324	\$ 302	\$ 296
Age (years)	10.8	5.8	6.8	7.4
Estimated life	18.1	14.8	13.0	14.8
Present value	\$ 139	\$ 182	\$ 158	\$ 161

\* Averages do not include drills bought second-hand.

TABLE 20. INVESTMENT IN TWO-ROW LISTERS: 53 Farms, Atchison County, 1951

Atchison Area	
Number of farms	53
Number of machines	76
Machines per farm	1.4
Percent of machines purchased new	78
Original cost*	\$ 232
Age (years)	4.7
Estimated life	11.7
Present value	\$ 148

\* Averages do not include machines bought second-hand.

TABLE 21. INVESTMENT IN CORN PLANTERS: 24 Farms, Linn County, 1951

	2 Row Horse	2 Row Tractor
Number of farms	24	24
Number of planters	24	24
Planters per farm	1.0	1.0
Percent of planters purchased new	59	67
Original cost*	\$ 129	\$ 195
Age (years)	12.4	7.2
Estimated life	14.5	15.3
Present value	\$ 59	\$ 123

\* Averages do not include planters bought second-hand.



TABLE 22. INVESTMENT IN GENERAL PURPOSE PLANTERS: 16 Farms, Pemiscot County, 1951

	Horse	Tractor	
	2 Row	2 Row	4 Row
Number of farms	7	22	16
Number of planters	8	22	18
Planters per farm	1.1	1.0	1.1
Percent of planters purchased new	50	68	100
Original cost*	\$ 148	\$ 182	\$ 470
Age (years)	8.7	2.4	1.4
Estimated life	16.2	8.9	9.3
Present value	\$ 57	\$ 127	\$ 401

\* Averages do not include planters bought second-hand.

TABLE 23. INVESTMENT IN FOUR ROW GO-DEVILS: 42 Farms, Atchison County, 1951

Atchison Area	
Number of farms	42
Number of machines	62
Machines per farm	1.5
Percent of machines purchased new	74
Original cost*	\$ 240
Age (years)	2.9
Estimated life	11.0
Present value	\$ 137

\* Averages do not include machines bought second-hand.

TABLE 24. INVESTMENT IN TWO ROW TRACTOR CULTIVATORS: 150 Farms, Atchison, Linn, and Pemiscot Counties, 1951

	Atchison Area	Linn Area	Pemiscot Area	Average All Areas
Number of farms	52	49	49	150
Number of cultivators	90	55	68	215
Cultivators per farm	1.5	1.1	1.4	1.4
Percent of cultivators purchased new	95	93	82	90
Original cost*	\$ 215	\$ 179	\$ 214	\$ 205
Age (years)	4.9	4.5	3.8	4.5
Estimated life	11.9	12.9	8.7	11.3
Present value	\$ 113	\$ 133	\$ 140	\$ 125

\* Averages do not include cultivators bought second-hand.

TABLE 25. INVESTMENT IN FOUR ROW TRACTOR CULTIVATORS: 15 Farms, Pemiscot County, 1951

	Pemiscot Area
Number of farms	15
Number of cultivators	28
Cultivators per farm	1.5
Percent of cultivators purchased new	100
Original cost*	\$ 478
Age (years)	1.6
Estimated life	8.8
Present value	\$ 405

\* Averages do not include cultivators bought second-hand.

TABLE 26. INVESTMENT IN FIVE FOOT HORSE MOWERS: 29 Farms, Atchison, Linn, and Greene Counties, 1951

	Atchison Area	Linn Area	Greene Area	Average All Areas
Number of farms	9	14	6	29
Number of mowers	10	14	6	30
Mowers per farms	1.1	1.0	1.0	1.0
Percent of mowers purchased new	44	43	17	37
Original cost*	\$ 115	\$ 87	\$ 140	\$ 102
Age (years)	7.8	16.5	3.0	12.1
Estimated life	18.5	20.5	8.0	18.6
Present value	\$ 41	\$ 32	\$ 39	\$ 36

\* Averages do not include mowers bought second-hand.

TABLE 27. INVESTMENT IN SEVEN FOOT TRACTOR MOWERS: 114 Farms, Atchison, Linn, and Greene Counties, 1951

	Atchison Area	Linn Area	Greene Area	Average All Areas
Number of farms	44	37	33	114
Number of mowers	57	38	33	128
Mowers per farms	1.3	1.0	1.0	1.2
Percent of mowers purchased new	89	92	85	88
Original cost*	\$ 243	\$ 221	\$ 230	\$ 238
Age (years)	3.2	3.7	4.6	3.7
Estimated life	10.6	11.4	10.2	10.7
Present value	\$ 188	\$ 168	\$ 160	\$ 175

\* Average do not include mowers bought second-hand.

TABLE 28. INVESTMENT IN SIDE DELIVERY RAKES: 83 Farms, Atchison, Linn, and Greene Counties, 1951

	Atchison Area	Linn Area	Greene Area	Average All Areas
Number of farms	34	19	30	83
Number of rakes	38	19	30	87
Rakes per farm	1.1	1.0	1.0	1.0
Percent of rakes purchased new	82	74	83	80
Original cost*	\$ 212	\$ 214	\$ 232	\$ 219
Age (years)	6.7	3.0	4.8	5.2
Estimated life	13.7	9.8	10.3	11.7
Present value	\$ 130	\$ 150	\$ 150	\$ 142

\* Averages do not include rakes bought second-hand.

TABLE 29. INVESTMENT IN HAY BALERS: 38 Farms, Atchison, Linn, and Greene Counties, 1951

	Atchison Area	Linn Area	Greene Area	Average All Areas
Number of farms	11	12	15	38
Number of balers	11	12	15	38
Balers per farm	1.0	1.0	1.0	1.0
Percent of balers purchased new	91	100	93	95
Original cost*	\$ 1744	\$ 1228	\$ 1969	\$ 1657
Age (years)	1.6	2.4	2.4	2.2
Estimated life	8.4	10.6	8.5	9.2
Present value	\$ 1512	\$ 1002	\$ 1506	\$ 1349

\* Averages do not include balers bought second-hand.

TABLE 30. INVESTMENT IN COMBINES: 41 Farms, Atchison and Linn Counties, 1951

	Atchison		Linn		Both Counties	
	5 ft.	6 ft.	5 ft.	6 ft.	5 ft.	6 ft.
Number of farms	7	7	18	9	25	16
Number of combines	7	7	18	9	25	16
Combines per farm	1.0	1.0	1.0	1.0	1.0	1.0
Percent of combines purchased new	71	100	83	100	80	100
Original cost*	\$1362	\$1661	\$ 862	\$1233	\$ 987	\$1420
Age (years)	2.6	2.4	4.2	3.6	3.8	3.1
Estimated life	11.2	10.5	11.0	10.2	11.1	10.4
Present value	\$ 853	\$1401	\$ 654	\$ 953	\$ 710	\$1149

\* Averages do not include combines bought second-hand.

TABLE 31. INVESTMENT IN ROW COMBINES: 14 Farms, Pemiscot County, 1951

	2-Row Tractor-drawn	3-Row Self-propelled
Number of farms	9	5
Number of machines	9	5
Machines per farm	1.0	1.0
Percent of machines purchased new	78	80
Original cost*	\$ 1464	\$ 5161
Age (years)	2.4	.7
Estimated life	7.4	5.5
Present value	\$ 830	\$ 4014

\* Averages do not include machines bought second-hand.

TABLE 32. INVESTMENT IN CORN PICKERS: 63 Farms, Atchison and Linn Counties, 1951

	Atchison		Linn		Both Counties	
	1-row	2-row	1-row	2-row	1-row	2-row
Number of farms	15	29	8	11	23	40
Number of corn pickers	15	34	7	10	22	44
Corn pickers per farm	1.0	1.2	.88	.91	.96	1.1
Percent of corn pickers purchased new	73	91	100	90	82	91
Original cost*	\$735	\$1586	\$828	\$903	\$771	\$1432
Age (years)	4.0	2.4	3.1	3.8	3.7	2.9
Estimated life	9.4	8.3	8.4	9.0	9.0	8.5
Present value	\$445	\$1177	\$623	\$641	\$501	\$1055

\* Averages do not include corn pickers bought second-hand.

TABLE 33. INVESTMENT IN CORN BINDERS, STATIONARY ENSILAGE CUTTERS, AND FIELD CHOPPERS; 26 Farms, Greene County, 1951

	Corn Binders	Ensilage Cutters	Field Choppers
Number of farms	9	12	5
Number of machines	9	12	5
Machines per farm	1.0	1.0	1.0
Percent of machines purchased new	67	83	100
Original cost*	\$ 426	\$ 385	\$1657
Age (years)	5.8	7.4	1.0
Estimated life	11.5	12.9	7.8
Present value	\$ 231	\$ 212	\$1438

\* Averages do not include machines bought second-hand.

TABLE 34. INVESTMENT IN TRACTOR MANURE SPREADERS: 103 Farms, Atchison, Linn, and Greene Counties, 1951

	Atchison Area	Linn Area	Greene Area	Average All Areas
Number of farms	34	32	37	103
Number of spreaders	36	32	38	106
Spreaders per farm	1.1	1.0	1.0	1.0
Percent of spreaders purchased new	75	84	84	81
Original cost*	\$ 242	\$ 230	\$ 286	\$ 255
Age (years)	9.8	9.1	5.6	8.0
Estimated life	18.9	16.0	12.6	15.6
Present value	\$ 160	\$ 143	\$ 202	\$ 168

\* Averages do not include spreaders bought second-hand.

TABLE 35. LEVELS OF USE FOR FARM MACHINERY AND EQUIPMENT: 212 Farms, Atchison, Linn, Greene, and Pemiscot Counties, 1951

Type of Equipment	Average Use All Four Areas	Recommended Use
Tractors:		
one	902 hours	750 hours
two	1,390	1,400
three	1,878	2,500
four or more	3,401	4,000
Moldboard plows:		
2 - 12 "	51 acres	50 acres
2 - 14 "	67	75
2 - 16 "	85	80
3 - 14 "	111	120
Disc plows:		
2 - disc	48	50
3 - disc	67	70
Middlebusters:		
2 - row	118	100
3 - row	250	250
Disc harrows:		
straight	234	230
tandem	174	175
Stalkcutters:	217	200
Grain drills:	55	50
Listers:	100	100
Planters:		
2 - row corn	89	75
2 - row general purpose	136	125
4 - row general purpose	267	250
"Go-devils":	116	100
2 - row tractor cultivators:	280	200
7 - foot tractor mowers:	137	125
Side delivery rakes:	98	80
Hay balers:	10,254 bales	10,000 bales
Combines:		
5 - foot tractor-drawn	119 acres	100 acres
6 - foot tractor-drawn	108	100
2 - row tractor-drawn	91	100
3 - row self-propelled	193	200
Corn pickers:		
one row	69	75
two row	157	125
Corn binders:	15	12
Stationary ensilage cutters:	203 tons	150 tons
Field choppers:	130	300
Manure spreaders:	162 loads	100 loads