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The Experiment Station has about 300 research projects, ranging from improved diets for the family to better use of the products of our forests, and from a study of disease in plants or animals to the discovery of new markets for agricultural products. Results of this research are made available to the public through resident teaching facilities on campus, or through the off-campus work of the Agricultural Extension Service and its county agent organization.

The research is carried on at many places in the state. Some of it takes place in the laboratories and fields of the University's St. Paul Campus. Some is conducted at the Agricultural Experiment Station at Rosemount, or at the branch experiment stations—Waseca, Morris, Crookston, Grand Rapids, and Duluth.

Specialized research is carried on at the Fruit Breeding Farm, Excelsior; at the Potato Breeding Farm, Castle Danger; at the Forest Research Center, Cloquet; at the Hormel Institute, Austin; and at the Biological Station, Itasca State Park. In addition, hundreds of Minnesota farmers each year cooperate with the Station in experiments on their own farms, either as individuals or in groups that may represent several counties.

Agricultural Research in Minnesota has a broad scope. And its results underlie every major advance we make in modern agricultural knowledge or practice.

This publication is one of the many research reports issued by the University of Minnesota Agricultural Experiment Station. These reports—some more technical in nature—are distributed through your County Extension Agent or the Bulletin Room, University of Minnesota, Institute of Agriculture, St. Paul 1.

The Changing Picture OF FARMING IN SOUTHEASTERN MINNESOTA

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**Agricultural Experiment Station
UNIVERSITY OF MINNESOTA**

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The data on which this analysis of 25 years of farm records is based come from the continuing study of farm organizations in Southeastern Minnesota carried out cooperatively by the University of Minnesota and the Agricultural Research Service, United States Department of Agriculture.

The Changing Picture of Farming in Southeastern Minnesota

A QUARTER OF A CENTURY OF FARM RECORDS

George A. Pond and Truman R. Nodland¹

CHANGES IN FARM ORGANIZATION and farm earnings have been more numerous and more striking during the past 25 or 30 years than at any other time in the long history of agriculture. Some of these changes and the resulting effect on earnings are brought out in the financial and production records kept by a group of farmers in southeastern Minnesota. These farmers were members of the Southeastern Minnesota Farm Management Service. During the first three years, 1928 through 1930, only farms in Dodge, Freeborn, Goodhue, Rice, Steele, and Waseca Counties were included. Later it was expanded to include farms in Dakota, LeSueur, Mower, Nicollet, Olmsted, Scott, Wabasha, and Winona Counties, as well as a few in adjoining counties.

These farm records were supervised and summarized by the Department of Agricultural Economics and the Agricultural Extension Service of the University of Minnesota's Institute of Agriculture, and the Agricultural Research Service of the U. S. Department of Agriculture. Approximately 160 farmers per year have been included in this study from 1928 to the present time. As a result of changes in methods of accounting and in computing some of the measures for 1953 through 1955, the records for these three years are not entirely comparable with those for 1928 through 1952, so this study is based on that 25-year period. Any changes resulting from the inclusion of data from the last three years would be relatively minor.

The farmers included in this study kept records of their farm inventories, cash receipts and expenses, crop acreages and yields, numbers and production of livestock, the amount and value of feed for each class of livestock, and other supplementary information about the farm business. A full-time fieldman assisted these farmers with their rec-

ords, and checked the records for accuracy, completeness, and uniformity of interpretation. At the end of each year they were submitted to the Department of Agricultural Economics for further checking and analysis.

Only dairy farms reasonably typical of the sizes and types found in the area were included at the start. In the course of time some of the original cooperators reduced or discontinued their dairy enterprises and some individuals were added who did not stress dairying. As a result, sales of dairy products and dairy cattle dropped from 50 percent of total sales in 1928 and 1929 to slightly under 40 percent at the end of the period. However, the dairy enterprise remained the major source of income.

The average size of the farms studied increased from 163 acres in 1928 to 229 acres in 1952. This represented an increase of 40 percent, compared with 12 percent for all farms in the counties covered. This increase resulted in part from a turnover of farms, with smaller ones being dropped and larger ones added. It was also the result in part of

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increases in the size of farms already in the study. Forty-five percent of all farms included in the group starting during the first five years, 1928 to 1932, increased in acreage from 179 at the start to 335 by 1952; 50 percent showed no change; and 5 percent decreased from an average of 220 to 202 acres. There was more or less shifting in size from year to year, due both to changes in the area rented and to purchases of additional land.

The total number of farm-year records used in this study was 3,956. These were supplied by 753 different individuals (see table 1). Of these, more than two-thirds kept records for periods of five years or less. However, approximately one-half of the annual records were from farms remaining in the serv-

ice for more than 10 years and one-sixth for more than 20 years. Changes from year to year or period to period, as shown in this report, reflect in part changes in organization and operation of the same farms, and in part a change in the farms included.

The authors, who have observed these farms throughout the period of this study, feel that the trends in farm organization and practices are fairly representative of what has been occurring on all farms in the area. They do feel, however, that these record-keeping farmers were, in general, likely to adopt new techniques more readily and were a little quicker to expand the scale of their operations in order to use those new techniques in the most effective manner.

Table 1. Membership in Southeastern Minnesota Farm Management Service

Years in service	Individuals		Records	
	Number	Percent of total	Number	Percent of total
1-5	519	68.9	1,136	28.7
6-10	114	15.1	873	22.1
11-15	67	8.9	855	21.6
16-20	23	3.1	407	10.3
21-25	30	4.0	685	17.3
Total	753	100.0	3,956	100.0

Changes in Mechanization and Technology

PROBABLY the most striking feature of the period covered by this study was the change in mechanization and technology. In 1928, horses were used on all farms. By 1952, horses were maintained on less than half of the farms and were used only occasionally. The number of horses per 100 acres dropped from 3.4 in 1928 to 0.4 in 1952. By 1952, there were a little over two tractors per farm. The present tractors are larger than those of 1928, capable of higher-speed operation, more flexible, and adapted to a much wider variety of uses.

Changes in farm implements over the 25 years have been numerous and striking. Most implements currently

used are adapted to tractor operation and are equipped with rubber tires. Combines have replaced binders and stationary threshing machines. Four-row planters and cultivators are replacing two-row equipment. Practically all corn picking is now done mechanically, and two-row pickers are replacing one-row machines. Forage harvesting has been revolutionized by the use of windrow balers and field choppers. The practice of artificial drying of both hay and grain is increasing in the area. Rubber-tired trailers have replaced the horse-drawn wagon, and power-unloading devices lighten the labor load. Weed sprayers are coming into general use, as are fertilizer- and lime-distributing

Table 2. Changes in power and mechanical equipment on 41 identical farms from 1928-32 to 1952

	1928-32	1952
Percentage reporting horses	100	61
Crop acres per horse	22	108
Percentage reporting tractors	66	100
Crop acres per tractor	180	86
Percentage of farms:		
with high-line electric service	2.4	100
reporting combines*	0	59
reporting windrow balers*	0	18
reporting field choppers*	0	51
reporting corn pickers*	12	85
reporting grain elevators	27	69
reporting manure loaders	0	46
reporting crop dryers	0	26
reporting weed sprayers	0	49
reporting milk coolers	0	28
Investment per acre in power	\$2.95	\$14.22
Investment per acre in machinery	6.69	21.28
Investment per acre in power and machinery	\$9.64	\$35.50

* In addition to the farmers owning the machines, others hired them on a custom basis.

equipment. Silo-unloaders and barn cleaners are lightening the labor load on dairy farms. Electricity has come in as a source of power and light. Some of these changes are shown in table 2 for those farms for which records are available over a 20- to 25-year period. The average size of these farms increased from 196 to 260 acres during this time. The investment in tractors, trucks, automobiles, and electric equipment per acre has been increased nearly five times, and in machinery more than three times.

Table 3. Changes in farm practices on 41 identical farms from 1928-32 to 1952

	1928-32	1952
Percentage using commercial fertilizer	39	100
Percentage using hybrid corn	5	100
Percentage raising soybeans	0	36
Percentage putting up grass silage	0	46
Percentage of cows bred artificially	0	75
Percentage keeping breeding bulls	100	51
Percentage commercial feeds of total feed used	7.6	23.2

Some changes in the technique of crop and livestock production are indicated in table 3. Not only is commercial fertilizer being used by all farmers but also the amounts per acre and the con-

centration of the essential elements have been increased. Hybrid corn, just barely introduced in 1928, is now grown by all farmers. Soybeans is a new crop in the area, and the practice of ensiling grass and legumes is increasing rapidly.

Artificial insemination dominates the cattle-breeding picture, and only about half the farmers maintain a bull for breeding purposes. Three times as large a proportion of the feed used is now purchased as commercial feed. Much of this includes proprietary feeds which contain protein, concentrates, minerals, vitamins, antibiotics, and other ingredients unheard of 25 years ago. Loose housing of dairy cattle is beginning to replace the conventional stanchion barn. Swine breeding has been revolutionized to the extent that cross-bred hogs dominate the picture. Livestock sanitation is receiving increased attention, and minerals and antibiotics have come into general use in livestock feeding. Sexed chicks are replacing "straight run" on most farms. Changes in livestock-production practices have been little short of revolutionary. Most of the new techniques in crop and livestock production increase the cash outlay of the farmer, but they also contribute strongly to more economical production.



Some of the effects of changes in technology during the quarter century covered by this study are reflected in the data presented in table 4. These data are obtained from farms in southeastern Minnesota comparable in size and type to the farms in the Southeastern Minnesota Farm Management Association. They include many of the same farms and cover approximately the same time period. The use of mechanical power and of large-scale machinery has resulted in a very material reduction in man labor and horse work per acre of crops or per unit of livestock. On the other hand, tractor use and machinery costs have risen sharply. The custom charges shown for corn

silage and alfalfa hay largely represent payments for hired power and machinery. The larger amounts of labor and horse-work used per acre in crop production in Winona County were due in part to the rolling topography of the land and the smaller size and less regular shape of fields, and not entirely to less mechanization of operations. In general, the savings in man labor and the elimination of work horses have not been completely balanced by the increases in mechanical power and machinery costs. Machinery and power use has also made possible improvement in the quality and timeliness of farm operations and taken some of the drudgery out of farm work.

Table 4. Changes in use of labor and power, and machinery costs in Southern Minnesota, 1935 to 1953

	Winona County,* 1935-40	Nicollet County,† 1941-45	Southern Minnesota,‡ 1951-53
Crop Costs			
Man hours per acre			
Corn, husked	20.4	9.6	6.4
Corn silage	20.6	15.5	10.5
Oats	8.5	7.2	5.0
Alfalfa hay	10.2	11.4	6.1
Horse hours per acre			
Corn, husked	34.3	6.4	.....
Corn silage	35.1	11.5	.....
Oats	13.8	4.6	.....
Alfalfa hay	14.6	11.0	.....
Tractor hours per acre			
Corn, husked	2.8	5.6	5.5
Corn silage	2.5	7.1	8.2
Oats	1.6	2.9	3.5
Alfalfa hay	0.6	2.1	4.1
Machinery costs per acre			
Corn, husked	\$1.55	\$2.55	\$3.22
Corn silage	2.50	3.69	4.99§
Oats	1.05	1.22	4.01
Alfalfa hay	1.10	2.32	6.05¶
Livestock costs			
Man hours per dairy cow	131.0	119.0	99.0
Man hours per 100# hogs produced	3.1	2.6	1.7
Horse hours per dairy cow	3.4	1.0	.....
Horse hours per 100# hogs produced	2.0	.....	.....
Equipment cost per dairy cow	\$4.20	\$6.14	\$10.00
Equipment cost per 100# hogs produced .....	.12	.21	.28

* Ag. Econ. Report No. 125. A Preliminary Report of Data Secured in 1940 on Farm Accounting Route in Winona County.

† Ag. Econ. Report No. 158. A Preliminary Report of Data Secured in 1941-45 on Farm Accounting Route in Nicollet County.

‡ Ag. Econ. Reports 199, 208, and 217. Farm Labor and Farm Costs.

§ In addition there was a charge of \$1.79 per acre for custom work—largely machinery and power.

¶ In addition there was a charge of \$3.73 per acre for custom work—largely machinery and power.

Changes in Farm Labor Supply

THESE FARMS were of the family-farm type that characterizes the area. The work was performed largely by the farmer and members of his family, who received no regular wage (see table 5). Slightly less family labor was available in the later years due to a decrease in family size and an increase in the time children spent in school. In spite of the

increase in farm size and in amount of livestock maintained, there was not a corresponding increase in the total amount of labor used or hired. The amount of labor used per 100 acres declined steadily and at a rather constant rate. Increasing costs of hired labor have provided an incentive for increased mechanization.

Table 5. Amount and source of farm labor used, number of workers*

	1928-29	1930-34	1935-39	1940-45	1946-52
Unpaid family help†	1.6	1.6	1.4	1.4	1.4
Hired workers	.4	.6	.9	.8	.6
Total workers	2.0	2.2	2.3	2.2	2.0
Workers per 100 acres	1.18	1.11	1.06	.99	.89

* 12-month equivalent basis.

† Including farm operator.

Changes in Weather and Prices

THE PERIOD covered by this study was characterized by a wide variation in natural and economic conditions, almost as striking as those in agricultural technique. It includes the drouth period of the thirties and the relatively favorable years of the forties and early fifties. The average annual rainfall varied from 17.3 inches to 36.9 inches, with an average of 27.5 inches for the 25-year period. This wide variation in precipitation naturally resulted in wide fluctuations in crop yields from year to year.

Even more important in affecting farm earnings was the variation in the price level. Minnesota farm prices reached their lowest ebb of the current century with an index of 54.9 in 1932, and rose to an all-time peak of 279.8 in 1948 (1935-1939=100). This resulted in wide fluctuations in farmers' earnings

and in their purchasing power, as will be discussed later. In most of the analyses to follow, the data will be grouped by periods selected to a considerable extent on the basis of weather and price conditions. Both weather and prices were fairly favorable in 1928 and 1929. The next five years included the drouth of the thirties and the low ebb of the price cycle. The years 1935-39 were grouped together since they represent some price recovery and especially because these years are widely used as a base for price indexes. The next six years covering the World War II period are grouped together. This was a period of relatively favorable weather and price conditions. The next seven years include the postwar adjustment period and the Korean War. Weather was generally favorable and prices were at an all-time peak level.

Changes in Capital Used in Farming

CHANGES IN TECHNOLOGY over the period of this study had a very definite effect on the amount of capital used in the farm business. The average value of farm property per acre on the farms studied is shown in table 6 for each of the five periods, also for the years 1928 and 1952. Part of the change over the period was due to changes in the physical quantity of the items involved, and part to changes in the price level at which these items are valued from year to year. Since there was a material change in size of farm from 1928 to 1952 these values are shown on an acre basis to eliminate increases due to scale of operation. They are also shown on a basis of the value of capital per worker (see table 5 for number of workers per farm) and per farm.

The advance in mechanization is indicated in the increase of 158 percent in the value of machinery and equipment per acre from 1928 to 1952, and 370 percent in mechanical power (including tractor, gas engines, and electricity). Horses have practically dropped out of the picture. Non-real estate values have increased 128 percent and real estate values 31 percent. Most of these increases have occurred since the close of World War II. The increase in

machinery and mechanical power inventories reflect the effect of increased mechanization. The changes in values of productive livestock and of feeds and supplies reflect largely changes in the price level of these items. The market value of real estate per acre in southeastern Minnesota continued to drop up to the beginning of World War II and showed only moderate change until the late forties. The proportion of total capital represented by non-real estate items increased from 28 to 40 percent over the 25-year period.

The adoption of mechanization and new technologies and the rise in real estate prices were the principal factors accounting for the increase in capital investment per acre of 57 percent. This increase has practically all occurred since the close of World War II. The acres farmed per worker increased from 86 to 121. More mechanization and the use of more mechanical power increase the productivity of the worker but they also increase the total capital invested in the farm business, both because of the cost of machinery and power and because of the fact that to use these larger power and machinery units economically requires a larger acreage of land per man.

Table 6. Average value of farm capital per acre, per worker, and per farm

Year	1928	1928-29	1930-34	1935-39	1940-45	1946-52	1952
Acres per farm	163	170	199	217	227	224	229
Machinery and equipment	\$7.94	\$7.78	\$6.91	\$6.49	\$8.68	\$14.88	\$20.47
Mechanical power*	2.98	3.12	3.01	3.64	4.71	8.76	14.00
Horses	3.13	3.02	2.37	2.41	1.61	.58	.31
Productive livestock	17.54	17.78	11.16	11.29	16.41	26.02	36.29
Feed and supplies	10.16	10.61	8.33	8.73	12.60	20.84	23.34
Total non-real estate	41.75	42.31	31.78	32.56	44.01	71.08	94.41
Land and buildings (market value)	110.00	110.00	70.40	63.58	74.07	119.43	144.10
Total value per acre	\$151.75	\$152.31	\$102.18	\$96.14	\$118.08	\$190.51	\$238.51
Total value per worker	\$13,018.00	\$12,939.00	\$9,234.00	\$9,079.00	\$12,162.00	\$21,318.00	\$28,749.00
Total value per farm	\$24,735.00	\$25,877.00	\$20,315.00	\$20,882.00	\$26,757.00	\$42,636.00	\$54,619.00

* Tractors, trucks, farm share of auto, electric motors, and gas engines.



Changes in Land Use and Crop Production

THE ACRES OF LAND in the various uses are shown in table 7. The tillable land not in crops was largely in areas too wet to plant at the usual seeding time or being left fallow for weed control. The proportion of tillable land remained constant at about 75 percent of the total acres in the farm. Most of the nontillable pasture land was either too wet to be cultivated regularly, en-

cumbered with stones or other obstructions, or too rough for cultivation. The timber was usually on land too steep for cultivation or otherwise unfit.

The percentage distribution of the tillable land in the various crops is shown by periods in table 8. The principal changes in the use of tillable land during this period are a decrease of the proportion in small grain from 41.1

Table 7. Average acreages in various land uses

	1928-29	1930-34	1935-39	1940-45	1946-52
Tillable land in crops	127.3	150.6	158.4	162.7	168.9
Tillable land not cropped .....	.....	1.2	2.9	4.0	1.1
Total tillable land	127.3	151.8	161.3	166.7	170.0
Nontillable pasture	23.7	25.1	29.3	29.9	26.6
Wild hay (including phalaris hay)	5.4	5.1	6.0	5.6	3.7
Timber not pastured	2.5	5.1	6.2	7.6	6.4
Roads and waste	5.3	5.7	7.9	10.1	10.4
Farmstead	5.7	6.0	6.5	6.7	6.7
Total acres in farm	169.9	198.8	217.2	226.6	223.8

percent to 31.1 percent of the total, an increase in cultivated crops from 31.1 percent to 36.1 percent, and an increase in hay and pasture on tillable land from 27.8 percent to 32.7 percent. Studies of the cost and returns from crops in this area during this period indicate that, in general, cultivated crops and hay and pasture crops were more profitable than small-grain crops. These shifts are in line with these findings.

Oats, barley, and wheat were the principal small-grain crops grown. Mixtures of oats and barley were fairly important up to 1939, but after that the acreage of barley, both alone and in mixtures, decreased very sharply. Oats alone or in mixtures (assuming mixtures of oats and barley, and oats and wheat, were half oats by weight) accounted for over 78 percent of the total small-grain acreage in 1952, as compared with only 44 percent in 1928. Small grain has an important place in crop rotations in this area as a com-

panion crop for seeding hay and pasture crops. Were it not for this fact, it is likely that there would have been even more reduction in the proportion of small grain in the rotation.

Corn is the principal cultivated crop grown on these farms. The shift to hybrid corn has already been mentioned. In the more recent years, more of the crop has been harvested as grain and less as silage and fodder. A few farmers grew soybeans as a hay crop during the thirties, but by 1940 the acreage was increased and the crop was harvested for grain. By 1952 more than a third of these farmers were raising soybeans for grain. The availability of combines to harvest the crop and the fact that there was little labor conflict with other crops on these farms was an important factor in bringing soybeans into the picture.

Alfalfa was the dominant hay and pasture crop. Usually it was mixed with brome grass and timothy, but alfalfa



Table 8. Proportion of tillable land in various crops

	1928-29	1930-34	1935-39	1940-45	1946-52
			(percent)		
Oats	10.1	9.8	9.3	13.2	20.1
Oats and barley	12.3	11.0	8.8	6.1	1.5
Oats and wheat	4.0	2.5	2.5	1.6	1.3
Barley	8.7	8.4	11.1	4.7	2.8
Wheat	2.0	2.7	4.9	3.1	2.0
Flax	1.5	1.4	1.3	3.4	2.1
Canning peas	.4	.7	.3	.9	1.0
Other small grains	2.1	3.8	2.0	1.0	.4
Total small grain and peas	41.1	40.3	40.2	34.0	31.2
Corn for grain	19.1	19.3	18.9	22.1	24.9
Corn silage	8.3	8.3	7.4	6.3	5.2
Corn fodder	2.0	1.5	.8	.6	.2
Sweet corn	.8	1.1	.9	1.1	.7
Soybeans for grain			.4	2.0	4.0
Other cultivated crops	.9	1.1	1.6	1.8	1.1
Total cultivated crops	31.1	31.3	30.0	33.9	36.1
Alfalfa hay (incl. alfalfa mixture)	5.4	6.9	10.7	10.9	15.7
Red clover hay	3.6	1.5	1.4	2.1	1.5
Other legumes and mixtures	3.0	4.2	3.5	3.8	2.0
Legumes for seed				.3	.3
Timothy and/or brome hay	1.0	1.3	.7	1.2	.5
Annual hay	1.3	1.0	.4	.4	.1
Miscellaneous	1.0	.5	.6	.1	.1
Total tillable land in hay	15.3	15.4	17.3	18.8	20.2
Alfalfa pasture		.6	1.0	1.7	6.0
Sweet clover pasture		3.9	3.8	1.4	.2
Other legumes and mixtures	12.5	2.7	4.0	5.2	2.3
Other tillable land in pasture		5.8	3.7	5.0	4.0
Total tillable land in pasture	12.5	13.0	12.5	13.3	12.5
Total tillable land in crops	100.0	100.0	100.0	100.0	100.0

dominated the stand. When alfalfa hay was raised for sale, pure stands were used. The proportion of alfalfa in the hay and pasture acreage increased from about 25 percent in the twenties to 85 percent in 1952. Sweetclover was used on many farms as a pasture crop in 1928, but by 1952 it had dropped out of the picture. Soil conservation considerations and the fact that these farms were heavily stocked with hay- and pasture-consuming animals resulted in the increase in proportion of tillable land in hay and pasture crops already noted.

In cases of most crop yields, fluctuations from year to year or period to

period are largely the result of variations in weather (see table 9). However, fluctuations from period to period are the result of two major factors: long-time weather trends and changing production techniques. In general, weather was most favorable during the first and the last two periods. Drouth and abnormally high temperatures reduced yields in the second and third periods. Most crop yields reached their maximum in the fifth period. An increased use of commercial fertilizer was an important factor producing this increase. The increase in corn yields starting in the late thirties reflects the shift to hybrid varieties.

Table 9. Crop yields, per acre, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Oats, bu.	46.1	40.0	43.4	44.9	47.5
Oats and barley, bu.	42.8	35.1	36.8	40.6	43.0
Oats and wheat, bu.	35.5	26.8	32.4	37.2	42.2
Barley, bu.	36.0	26.2	28.7	26.1	29.9
Wheat, bu.	21.6	18.2	17.5	19.1	20.0
Flax, bu.	9.1	8.7	8.8	9.6	11.8
Rye, bu.	18.0	15.0	17.8	14.0	18.5*
Corn, grain, bu.	44.5	43.4	47.2	52.1	53.1
Corn, silage, tons	8.0	7.8	8.0	8.6	8.9
Corn, fodder, tons	3.1	2.7	2.5	2.7	3.5*
Sweet corn, tons	1.4	2.6	2.6	2.8	3.4
Soybeans for grain			16.1	13.0	17.7
Alfalfa hay, tons	2.9	2.2	2.3	2.4	2.4
Red clover hay, tons	1.9	1.4	1.9	2.1	1.9
Mixed legumes and nonlegumes	2.0	1.3	1.7	1.7	1.5
Timothy and/or brome, tons	1.3	1.2	1.5	1.5	1.4
Wild hay, tons	1.2	1.1	1.2	1.0	.7

* No acreage or yield reported in 1952.

Changes in Kind, Numbers, and Production of Livestock

THE AVERAGE NUMBER and kind of the principal classes of livestock raised or produced on these farms by periods are shown in table 10. In addition to the classes of livestock listed, a few farmers raised turkeys, maintained beef-breeding cattle, or fattened cattle or sheep. These latter classes of livestock are included in the animal-unit figures. Dairy cattle, hogs, chickens, and sheep were the most important classes of stock on these farms during the period. Dairy cattle decreased in relative importance in later years; hogs and chickens increased. Beef-breeding cattle, feeder livestock, and turkeys, while raised on only a few farms, came into the picture largely in the later years. Some of these changes were the

results of changes in the farms included in the study from year to year, and some resulted from changes in the choice of livestock on the same farm during the period. The increase in animal units per 100 acres is in part due to the increased feed supply which resulted from higher crop yields since 1940. The drop in livestock production for the period 1935-39 reflects a decreased feed supply resulting from drouth conditions at that time.

The proportion of farms raising each class of livestock by periods is shown in table 11. Dairy cattle, hogs, and chickens were dropped on some farms in the later years. Some of the changes were due to the turnover of farmers making up the group. Complete data on beef

Table 10. Amount of livestock per 100 acres, 1928-52

	Unit	1928-29	1930-34	1935-39	1940-45	1946-52
Milk cows	Number	8.4	9.0	8.2	7.8	7.6
Other cattle	Number	8.8	9.7	9.0	7.9	7.6
Sheep	Number	4.0	5.7	6.1	7.2	4.6
Hens	Number	80.0	85.0	84.0	93.0	91.0
Hogs	Pounds	7,475	7,646	6,170	9,312	9,070
All livestock	Animal units	19.2	20.6	19.3	23.3	23.5

Table 11. Percentage of farms maintaining various classes of livestock

	1928-29	1930-34	1935-39	1940-45	1946-52
Milk cows	100	100	100	97	93
Hogs	98	97	96	97	87
Chickens	98	94	93	92	86
Sheep	24	31	35	32	22
Beef-breeding herd	0	*	*	10	6
Feeding cattle	0	*	*	14	9
Turkeys	0	*	8	7	2

* Data not available.

cattle, feeder stock, and turkeys are not available by years—but in general the beef cattle, either breeding or feeder stock, were brought into the picture during the forties.

crease of 18 percent over the average rate of earlier years occurred. The number of pigs weaned per litter showed little change from period to period. Likewise, the lamb crop was

Table 12. Amount of livestock per worker

	Unit	1928-29	1930-34	1935-39	1940-45	1946-52
Milk cows	Number	7.2	8.1	7.7	8.0	8.5
Other cattle	Number	7.5	8.7	8.5	8.1	9.1
Sheep	Number	3.4	5.2	5.7	7.4	5.1
Hens	Number	68	77	79	107	114
Hogs	Pounds	6,350	6,910	5,826	9,591	10,150
All livestock	Animal units	16.3	18.6	18.2	24.0	26.3

Labor is usually considered an important factor determining or conditioning the choice of livestock. However, the number of animal units of livestock maintained per worker increased 61 percent from the first period to the last (see table 12). This suggests considerable increase in the efficiency or effectiveness of labor use, and perhaps also a saving of time in crop production due to mechanization that made more labor available for livestock production.

Some data showing changes in rates of livestock production over the 25 years are shown in table 13. There was no material change in dairy production until the 1946-52 period, when an in-

crease of 18 percent over the average rate of earlier years occurred. The number of pigs weaned per litter showed little change from period to period. Likewise, the lamb crop was constant at about 100 percent except for the first two years. Data on weight of wool per head sheared are available only for the last 12 years. The range was from 8.2 to 9 pounds during these years, with an average of 8.7 pounds but with no definite trend either up or down.

The most striking change was in egg production. This was practically doubled from the first period to the last. In fact, the extreme range was from 92 eggs per hen in 1928 to 198 in 1952. There have been more improvements during this period in the breeding, feeding, and management of poultry than is true of any of the other classes of livestock.

Table 13. Rates of livestock production, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Butterfat per cow	244	240	238	244	284
Pigs weaned per litter	6.3	6.2	6.4	6.2	6.5
Percentage lamb crop	85	100	96	100	102
Eggs per hen	95	114	131	149	186

Changes in Farm Receipts, Expenses, and Earnings

THE CHANGES in size and organization of the farm business over this 25-year period—together with changes in farm technique, weather, and prices during this period—resulted in marked changes in farm receipts, farm expenses, and the operator's return for his labor and management. These changes from period to period are shown in table 14. Total farm receipts include: the income from the sale of farm products; any net increase in the capital used in farming; and the value of the living the farmer gets directly from the farm—including meat, milk, eggs, garden products, and an estimated rental value of the house occupied by the farm family.

Farm expense includes: the purchase of all items used in farm production; any net decrease in farm capital; the cost of board furnished to hired labor; an estimated value of any farm work performed by members of the farm family (other than the proprietor) for which they received no wage; and a charge for the use of the capital used in farm production.

The difference between total receipts and total expenses is the return to the farm operator for his labor and man-

agement and is termed "labor earnings".² This is one of the commonly used measures of farm financial success and takes into account all items of farm income and farm expense. A simpler measure, the net cash income or excess of cash receipts over cash expenses, is also shown.

Labor earnings dropped off sharply in the early thirties due to depressed prices and to the drouth which decreased the volume of salable products. Earnings started upward in the late thirties and by the last period were more than three times the level of 1928-29 and more than 15 times as high as in the early thirties. The farmers' net cash income showed the same general trends, but fluctuations between periods were less. Net cash income in 1946-52 was a little more than double that of 1928-29, and only a little less than three times that of the low period in the early thirties.

Part of the changes in income and earnings during this 25-year period, as shown in table 14, are due to changes in farm size during the period. In order

² For a definition of "labor earnings" see Journal of Farm Economics, 35:4: 595-598.

Table 14. Average income, expense, and labor earnings per farm, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Average number farms per year	148	140	149	176	166
Average acres per farm	170	199	217	227	224
Total farm sales	\$4,753	\$3,632	\$5,575	\$9,506	\$15,822
Increase in farm capital	617	0	524	727	2,169
Family living from farm	325	232	273	578	750
Total farm receipts	\$5,695	\$3,864	\$6,372	\$10,811	\$18,741
Total farm purchases	\$2,440	\$1,955	\$3,298	\$5,617	\$11,023
Decrease in farm capital	0	230	0	0	0
Board of hired labor	102	87	145	150	189
Interest on farm capital at 5 percent	1,294	1,016	1,044	1,338	2,132
Unpaid family labor	358	261	239	345	508
Total farm expense	\$4,194	\$3,549	\$4,726	\$7,450	\$13,852
Labor earnings	\$1,501	\$ 315	\$1,646	\$3,361	\$4,889
Net cash income (farm sales less farm purchases)	\$2,313	\$1,677	\$2,277	\$3,889	\$4,799

Table 15. Average farm sales, non-cash receipts, and total farm receipts per farm, 1928-1952

	1928-29	1930-34	1935-39	1940-45	1946-52
Dairy products	\$ 753	\$ 431	\$ 713	\$1,353	\$2,580
Cattle	1,662	1,188	1,451	2,349*	4,361†
Hogs	1,164	793	1,074	2,526	4,032
Sheep and wool	52	60	200	193	204
Poultry	140	166	381	656	515
Eggs	275	243	372	837	1,322
Horses	30	27	55	32	17
Corn	37	62	153	130	439
Small grain	241	177	357	272	683
Other crops	163	155	174	509	815
Income from off-farm labor	102	118	168	144	186
Government payments	0	74	230	220	62
Miscellaneous	134	138	247	285	606
Total farm sales	\$4,753	\$3,632	\$5,575	\$9,506	\$15,822
Increase in farm capital	617	0	524	727	2,169
Family living from farm	325	232	273	578‡	750‡
Total farm receipts	\$5,695	\$3,864	\$6,372	\$10,811	\$18,741
Farm receipts per 100 acres	\$3,352	\$1,944	\$2,934	\$4,771	\$8,374
Total farm receipts (adjusted to 1935-39 price level)	\$4,242	\$3,918	\$6,425	\$7,793	\$7,491

* Includes \$557 from the sales of beef cattle.

† Includes \$640 from the sales of beef cattle.

‡ Data for 1940-45 and 1946-52 include a credit for the use of the farmhouse by the farm family. In the earlier years the farmhouse was omitted from the farm investment and the cost of maintaining house was not included in farm expense.



to eliminate the effect of this changing size of farm, the income data have also been shown in table 15 on the basis of 100 acres of land. Cash sales are broken down by source in this table. There were few significant changes in the relative importance of the different items and receipts (see table 16). Dairy products decreased in percentage of total sales up to 1945 and then registered a slight recovery. Cattle sales fell off rather sharply in the early thirties but recovered their relative position by the end of the period. Hog sales held a fairly constant proportion of total sales, although they dropped behind in the late thirties. Poultry and eggs accounted for 8.7 percent of the cash receipts in 1928-29, rose to 15.7 percent in 1940-45, and then slipped back to 11.6 percent in the last period.

There was little change in the proportion of cash income from crop sales. The average proportion of the farmers' cash income from government payments was only 1.5 percent for the 25 years, and in no period was over 3.1 percent. This may be a surprise to those who

think government payments have been an important source of direct revenue for farmers in recent years.

A substantial portion of the difference in value of sales among these five periods is the result of changes in the price level during the period. Total farm receipts in the 1946-52 period were two-and-one-half times those of 1928-29 and more than four times those of 1930-34. Even if these total farm receipts are adjusted to the 1935-39 price level, the 1946-52 figure exceeds that of 1928-29 by 34 percent and the 1930-34 average by 22 percent.

Changes in farm expense by periods are shown in table 17 and the percentage distribution of the principal items in table 18. In most items of expense, little change in relative importance occurred during the period of this study. In fact, expenses showed some of the same fixity of pattern that characterized sales. Power expenses dropped to a smaller proportion of the total farm expense during the World War II years when tractor production for civilian use was curtailed. Hired labor

Table 16. Percentage distribution of farm sales, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
			(percent)		
Dairy products	35.0	32.7	26.0	24.7	27.6
Cattle	15.8	11.9	12.8	14.2	16.3
Hogs	24.5	21.8	19.3	26.6	25.5
Eggs	5.8	6.7	6.7	8.8	8.3
Poultry	2.9	4.6	6.8	6.9	3.3
Sheep and wool	1.1	1.6	3.6	2.0	1.3
Total livestock	85.1	79.3	75.2	83.2	82.3
Crops	9.3	10.9	12.3	9.6	12.2
Miscellaneous	5.6	9.8	12.5	7.2	5.5
Total	100.0	100.0	100.0	100.0	100.0

showed a downward trend relative to most other items as labor was displaced by power machinery.

The purchases of power and machinery and the expense of operating them rose sharply after the end of the war. Building repair and construction expense also rose rapidly after 1945, be-

cause of accumulated needs from the low-income period of the thirties and the war period when materials and labor were not available. These data also illustrate the fact that such fixed expenses as property taxes and insurance respond slowly to variations in economic conditions.

Table 17. Average farm purchases, non-cash expense, and total farm expense per farm, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Cattle	\$ 141	\$ 83	\$ 213	\$ 429	\$ 745
Hogs	85	52	72	157	191
Sheep	6	14	94	72	43
Poultry	37	41	80	154	161
Horses	36	33	43	29	11
Miscellaneous livestock expense	66	64	94	177	394
Miscellaneous crop expense	186	160	222	465	1,166
Feed	440	313	535	1,355	2,094
Power (new and upkeep)	399	321	559	740	1,895
New machinery and equipment	190	122	281	413	1,074
New buildings and other real estate improvements	130	81	245	316	312
Machinery and equipment upkeep	72	55	67	158	996
Building and fence upkeep	52	32	79	190	366
Hired labor	272	243	398	597	894
Property taxes and insurance	298	313	281	309	570
General farm expense	30	28	35	56	111
Total farm purchases	\$2,440	\$1,955	\$3,298	\$5,617	\$11,023
Decrease in farm capital	0	230	0	0	0
Board of hired labor	102	87	145	150	189
Interest on farm capital at 5 percent	1,294	1,016	1,044	1,338	2,132
Unpaid family labor	358	261	239	345	500
Total farm expense	\$4,194	\$3,549	\$4,726	\$7,450	\$13,852
Farm expense per 100 acres	\$2,468	\$1,785	\$2,176	\$3,288	\$6,189
Total farm expense (adjusted to 1935-39 price base)	\$3,162	\$3,782	\$4,726	\$5,917	\$4,644

Table 18. Percentage distribution of farm purchases, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
			(percent)		
Feed	18.0	16.1	16.2	24.2	19.0
Livestock	11.1	9.7	14.0	14.4	10.3
Power	17.8	18.2	18.2	13.7	17.3
Machinery and equipment	10.7	9.0	10.6	10.2	12.6
Hired labor	11.1	12.4	12.1	10.6	8.1
Buildings and other real estate improvements	7.4	5.7	9.8	9.0	12.3
Taxes and insurance	7.5	16.1	8.5	5.5	5.2
Crop expense	12.2	8.2	6.7	8.1	10.6
Other	4.2	4.6	3.9	4.3	4.6
Total	100.0	100.0	100.0	100.0	100.0

Much of the variation in farm expenses during this period, as was the case with farm income, was due to differences in the price level. If the total farm expenses are reduced to a constant price level (1935-39 base) much of the variation from period to period is eliminated. Total farm expenses in the last seven years were 384 percent of those of the lean years, 1930-34. With expenses adjusted to a constant price level they are only 21 percent

above the low period. The low point, 1928-29, is only 31 percent below the high point reached in the war period. Change in the price level was the principal cause of variations in both income and expense during the period covered by this study. Actual net income per farm, even with constant prices, was higher in the later years because of the increase in size of farm.

In computing total income for these farms, the value of products produced

Table 19. Family living from the farm, 1931-52

	Average 1931-34	Average 1935-39	Average 1940-45	Average 1946-52
Number of farms	130	149	176	166
	Quantities			
Whole milk, qts.	1,289	1,339	1,050	1,302
Skim milk, qts.	214	152	220	122
Cream, pts.	312	300	208	83
Farm-made butter, lbs.	8	6	3	1
Eggs, doz.	179	185	199	206
Poultry, lbs.	170	153	147	137
Cattle, lbs.	394	347	381	435
Hogs, lbs.	669	519	533	449
Sheep, lbs.	7	14	6	2
Potatoes, bu.	32	25	20	9
Farm fuel, cds.	8	8	6	2
	Values			
Dairy products	\$55.93	\$74.26	\$94.48	\$117.06
Meat	38.54	62.03	94.17	167.86
Eggs and poultry	41.23	50.46	80.36	103.08
Potatoes	14.56	14.69	18.97	11.67
Vegetables and fruit	29.64	34.75	47.18	64.50
Fuel	34.27	36.86	28.79	14.59
Est. rental value of house (at 10 percent of inventory value)	202.84	197.88	213.59	271.99
	\$417.01	\$470.93	\$577.54	\$750.75

on the farm and consumed by the farm family is included. The quantity and value of these products are shown in table 19. A detailed breakdown of these items for the years 1928 to 1930 is not available, so data for only the last 22 years are shown. Families were slightly smaller in the later years. The farm

price was used in computing values of these products. House rent was estimated at 10 percent of the inventory value of the house. Since most of the houses were constructed when building costs were much lower than they are now, this estimate is certainly quite conservative.

Changes in the Household and Personal Expenses of Farm Families

ABOUT 60 PERCENT of the farmers included in this study kept personal and household accounts, as well as farm accounts. Their personal and household expenses by periods are shown in table 20. Since expenditures of this type are made by several members of the family,

it is somewhat more difficult to secure the same degree of accuracy as in the farm accounts. Only those records are tabulated that the farmers considered reasonably complete and accurate.

Some change in classification of the items was made from time to time, as

Table 20. Household and personal expenses, 1931-52

	Average 1931-34	Average 1935-39	Average 1940-45	Average 1946-52
Number of cases	76	99	111	87
Number adult equivalent—family	4.2	3.4	3.3	3.0
other	*	.8	.7	.6
Food	\$ 224	\$ 282	\$ 378	\$ 652
Operating and supplies	74	115	143	262
Clothing	94	117	182	305
Personal	68	62	59	81
Furnishing and equipment	25	90	100	269
Education, recreation	79	107	75	157
Medical, health, insurance	39	71	116	214
Church, gifts, and miscellaneous	†	†	257	258
Household and personal share, auto expense, new auto, and electric motors	103	147	120	232
Household and personal share, electricity	‡	‡	42	65
Total	\$ 706	\$ 991	\$1,472	\$2,485
State and Federal income tax			\$	305
Life insurance and misc. investments	92	99	571	530
Total taxes, insurance, and investments	92	99	571	835
Total cash, personal, and household expense	\$ 798	\$1,090	\$2,043	\$3,330
Food furnished by the farm	182	239	344	472
Fuel furnished by the farm	33	37	29	16
House rental	203	198	207	262
Total cash expenses and perquisites	418	474	580	750
	\$1,216	\$1,564	\$2,623	\$4,080

* Information not available.

† Included with education and recreation.

‡ Included with operating and supplies.

§ Included with church, gifts, and miscellaneous.

indicated in the footnotes. No information is available as to the size of farms from which these data were obtained, but the size of family was approximately the same as for all farms included in previous tables. Separate income tax data are available only for the years 1946 to 1952. Life insurance and other investments were relatively unimportant prior to 1940.

For 1931-45, personal and household expenses absorbed about one-half of the net cash income, as shown in table 9. During the last seven years this rose to about two-thirds of the net cash income. The larger proportion of the cash income spent for personal and household purposes probably reflects the purchases of things not available during the war years, as well as rising prices and an increasing level of living. The difference between net cash in-

come from farm operation and the expenditures for personal and household purposes is available for debt servicing and investment. It should be noted, however, that for purposes of the comparisons made in this discussion of receipts and expenses, all data have been computed on the basis of full ownership by the operator. Actually some of these operators were tenants and had to pay cash rent or a share of the production to the landlord. Others had either real estate or chattel mortgages and other financial obligations which absorbed a substantial part of the earnings shown in these computations.

By reporting all farmers on a full-owner basis, comparisons more significant for some purposes can be made, but it does cover up some facts as to financial progress of the individuals involved.

Changes in Feed Costs and Returns in Livestock Production

THE PRINCIPAL CLASSES of livestock on these farms were dairy cattle, hogs, and chickens. They were raised on more than 90 percent of all farms included in this study. Sheep were reported in 29 percent of the farm years covered. Beef breeding herds, feeder cattle, and turkeys were reported on 1 percent or less of the farm-year records. Since the numbers are so small data for these last three classes of livestock have been omitted in this section.

DAIRY CATTLE

The average production and feed consumption per dairy cow are presented in table 21. The average number of cows per 100 acres remains fairly constant through the periods covered. Dairy is one of the most stable livestock enterprises and does not lend itself to quick changes. Since 1940 the proportion of farms reporting dairy cows decreased slightly, but this decrease was due more to the inclusion of other than dairy farms in the later

years than to eliminating dairy herds on farms on which they had been maintained previously.

Production per cow remained quite constant until about 1945 but increased 24 percent by 1950, and has remained fairly constant at this level. The quality of the ration, as measured by the percentage of digestible nutrients that was protein, did improve in the more recent years. No estimate of the nutrients obtained from pasture is available, so that the figures on digestible nutrients shown are only for concentrates and harvested roughage. There is, however, no reason to assume that less ample pasture was supplied in the later years. It is also possible that in pushing production more roughage was supplied these cows than they actually consumed, in order that they pick it over and select the more palatable portions of it.

There was a slight shift away from fall freshening in recent years. This may be the result of breeding troubles rather than any conscious effort to change the seasonal pattern of produc-

Table 21. Dairy production and feed used per cow, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Number herds per year	148	140	149	170	155
Percentage farms with dairy herds	100	100	100	97	93
Number cows per herd	14.3	17.8	17.7	18.1	18.2
Number cows per 100 acres	8.4	9.0	8.2	8.0	8.1
Pounds of milk per cow	6,595	6,487	6,433	6,595	7,676
Pounds of butterfat per cow	244	240	238	244	284
Feed per cow, lbs.					
Corn	246	467	472	904	1,261
Small grain	1,320	1,174	908	946	907
Commercial dairy feed	287	277	220	247	394
Total concentrates	1,853	1,918	1,600	2,097	2,562
Legume hay	1,674	1,851	2,461	3,573	3,563
Other hay	1,344	1,023	941	524	786
Corn fodder and stover	782	639	537	332	153
Total dry roughage	3,800	3,513	3,939	4,429	4,502
Silage	7,185	7,049	6,910	6,079	6,775
T.D.N. per cow*	4,392	4,344	4,332	4,880	5,510
T.D.N. per lb. B.F.	18.0	18.1	18.2	20.0	19.4
Percentage T.D.N. that is protein	12.4	12.6	13.5	14.0	13.9
Percentage fall freshening	61.0	58.9	53.7	54.2	53.7†

* Not including nutrients from pasture.

† Average of 1946-51.

tion. As indicated in table 1, there was a steady turnover of the farms included, so that any trends may be influenced by a change in the composition of the group. However, the group was some-

what more stable in the later years so this factor is not likely to affect trends materially.

The value of product and the cost of feed per cow are shown in table 22.



The higher value of dairy products in recent years reflects both the higher price of all dairy products and the fact that more of the production was sold as

fluid milk, which commands a higher price per pound of butterfat than cream for use in butter production. In the earlier years cream for butter manu-

Table 22. Feed costs and returns for dairy cattle, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Value of produce per cow					
Sales of dairy products	\$ 115	\$ 65	\$ 77	\$ 128	\$ 248
Milk to livestock	20	12	12	14	17
Dairy produce used by family	8	4	5	6	8
Net increase in value of cows	2	-6	2	5	26
Total value produced	\$ 145	\$ 75	\$ 96	\$ 153	\$ 299
Feed cost per cow					
Concentrates	\$ 27	\$ 16	\$ 16	\$ 31	\$ 67
Roughages	36	27	24	31	58
Total feed costs	\$ 69	\$ 48	\$ 45	\$ 68	\$ 132
Return over feed per cow	\$ 76	\$ 27	\$ 51	\$ 85	\$ 167
Return per \$100 feed	\$ 210	\$ 160	\$ 211	\$ 228	\$ 227
Feed cost per lb. butterfat	\$.28	\$.20	\$.21	\$.28	\$.46
Feed cost per 100 lbs. milk	1.05	.73	.70	1.02	1.71
Price received per lb. butterfat					
Sold as mfg. cream .....	.52	.28	.34	.50	.80
Sold as whole milk .....	.79	.51	.48	.67	.99

facture was practically the only form of sale. By 1952 approximately 75 percent of these farmers sold whole milk.

The low return over feed cost in the second period, 1930-34, was in part the result of declining prices received for cows sold. During the other periods the price of cows was rising steadily. Since inventory values were in general held constant after a cow was first transferred to the milking herd, the net increase in value of cows largely reflected higher sales prices.

The return over feed per cow dropped sharply in the early thirties and then increased steadily in later periods. The return per \$100 of feed value was much more constant. Complete cost figures for dairy cows show that feed constitutes about one-half of the cost of maintaining a dairy cow. On the basis of this, there was some margin of profit each period except the early thirties.

Quantities of feed, feed costs, and returns for the entire dairy herd on a per cow basis are shown in table 23. For many purposes this is a useful basis of comparison. The basic unit is one cow, plus a share of the bull and of the young cattle in the herd raised for sale or replacement. The average number of these other cattle is slightly over one per cow. Many of these herds were purebreds or high grades, and more

young cattle were raised than were needed for replacements. The income from these sales of young cattle, as well as increases due to young stock growing into value, is reflected in the difference in the "net increase in value per cow" between tables 22 and 23. As in table 22, the return per \$100 feed is fairly constant over the years covered by this study.

HOGS

Hogs ranked second to dairy cattle as a source of income on these farms. The production of hogs and the amount of feed used in the production of 100 pounds of hogs are shown in table 24. Hog production per farm increased fairly steadily during this 25-year period, except for a minor decrease in the middle thirties following the government program for a reduction in hog numbers. The proportion of spring to fall litters was fairly constant at a ratio of 2 to 1. Only a slight increase in pigs weaned per litter was registered over the 25-year period. There was, however, an apparent increase in marketing weights since the weight of hogs produced per pig weaned increased from 222 to 244, or 10 percent.

The principal change in feeding practice during the period was the decrease

Table 23. Feed costs and returns for the entire dairy herd on a per cow basis, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Number of cows per herd	14.3	17.8	17.7	18.1	18.2
Number of head of young cattle	14.8	19.1	19.3	18.1	19.5
Feeds per cow, lbs.:					
Concentrates	2,225	2,428	2,026	2,620	3,259
Hay and fodder	5,318	5,187	5,517	6,127	6,349
Silage	9,890	9,863	9,483	8,208	9,183
Total hay equivalent*	8,615	8,415	8,678	8,863	9,410
Value of produce per cow:					
Dairy products	\$ 131	\$ 73	\$ 85	\$ 142	\$ 262
Net increase in value	55	15	35	44	110
Total value of produce	186	88	120	186	372
Feed cost per cow	91	63	60	90	175
Return above feed cost	95	25	60	96	197
Return for \$100 feed	\$ 205	\$ 140	\$ 202	\$ 208	\$ 213

* 3 lbs. silage assumed to be equal to 1 lb. of hay.

Table 24. Hog production and feed used, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Number of farms	145	136	143	170	144
Pounds of hogs produced per farm	13,506	15,719	14,151	21,700	23,253
Number of litters raised					
Spring	6.8	7.4	6.6	9.2	9.4
Fall	3.3	3.8	3.4	5.1	5.3
Total	10.1	11.2	10.0	14.3	14.7
Number pigs weaned per litter	6.3	6.2	6.4	6.2	6.5
Feed per 100 pounds hogs produced (lbs.)					
Corn	321	314	313	363	344
Small grain	163	118	111	119	118
Commercial feeds	10	12	16	28	40
Total concentrates	494	444	440	510	502
Skim milk	496	458	406	181	75
Total concentrate equivalent*	544	490	481	528	510

* 10 lbs. skim milk assumed to be equivalent to 1 lb. of concentrate.

in the use of skim milk, starting about 1940. With an increase in the production of hogs per farm and the reduced quantity of skim milk available because of the shift from cream to whole milk sales, more corn was fed and purchased concentrates were fed to keep up the protein content of the ration. Some pasture was used for hogs but no satisfactory measure of the quantity of feed obtained is available.

The feed cost and returns for the hog enterprise are shown in table 25. Except during the depression years of the early thirties, hogs paid for their feed

and left a substantial margin to cover labor, shelter, interest, and other costs.

A study of cost of hog production on these and similar farms during the years 1951-53 indicates that feed constitutes about 80 percent or more of the cost of hog production in this area. On this basis, hogs returned a margin over all costs even during the price depression period of the early thirties. This favorable cost-price relationship, together with an increased production of corn due to the use of hybrid varieties, explains the increasing emphasis on hog production, especially since 1940.

Table 25. Costs and returns per 100 pounds of hogs, 1928-52

	1929-30	1930-34	1935-39	1940-45	1946-52
Feed cost per 100 lbs.					
Concentrate	\$6.16	\$3.38	\$4.33	\$7.38	\$13.20
Skim milk	1.24	.68	.61	.37	.28
Pasture .....	.26	.14	.16	.18	.17
Total	\$7.66	\$4.20	\$5.10	\$7.93	\$13.65
Net increase in value per 100 lbs.	\$9.16	\$4.68	\$8.08	\$11.92	\$19.62
Return above feed cost per 100 lbs.	\$1.50	\$.48	\$2.98	\$3.99	\$ 5.97
Return per \$100 feed	\$ 120	\$ 111	\$ 159	\$ 150	\$ 144
Average price received per 100 lbs. hogs sold	\$8.92	\$4.98	\$7.03	\$11.49	\$19.70

CHICKENS

Chickens ranked third as a source of income on the farms included in this study. They stand out among the other livestock enterprises on these farms as showing the largest increase in numbers per farm, in production per unit, and in feeding efficiency. Data covering the numbers and production of poultry and

Table 26. Poultry production and feed used, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Number of farms	145	132	139	162	142
Number of hens per farm	138	178	194	244	264
Percentage of hens that are pullets	60	73	75	85	85
Egg production per hen	95	114	131	149	186
Feed consumed per hen per year, lbs.					
Concentrates	98	108	117	134	144
Skim milk and buttermilk	52	63	45	17	3
Total concentrate equivalent*	103	114	122	136	144
Concentrate equivalent per 1 dozen eggs	13.0	12.0	11.2	11.0	9.3

* Assuming 10 lbs. skim milk or buttermilk equals 1 lb. concentrate.

the feed used are shown in table 26. The data in table 26 cover both the laying flock and the rearing flock. The totals for the entire poultry enterprise are divided by the number of hens to put them on a per-hen basis.

The average size of flock practically doubled during the 25 years. Egg production per hen also doubled. The amount of feed per hen increased 43 percent from the first period to the last, but the amount of feed per dozen eggs decreased more than one-third. There was a substantial increase in the proportion of the laying flock that was pullets.

As in the case of hogs, the use of skim milk and buttermilk in poultry feeding was practically eliminated following 1940, and the proportion of commercial poultry feeds increased. The use of skim milk and buttermilk decreased from an average of 60 pounds per hen in the first two periods to practically none since 1944. No separation of the concentrates into farm grains and purchased concentrates are available for the earlier years, but the proportion increases from 23 percent in 1941 to 36 percent in 1952.

The data on cost of feed and the value of the product are shown in table 27. These figures also cover the whole flock, including the rearing of replacements. The net increase in the value of chickens is computed from changes of inventory of the farm flock, sales of cull hens, sales of cockerels or cull pullets from the rearing flock, and the

value of chickens consumed by the farm family.

Eggs constitute a larger proportion of the total value of poultry production in the later years, increasing from 62 percent in 1928 to 96 percent in 1952. White Leghorns were the most common breed of laying stock, and the major emphasis was on egg production. In the earlier years only straight-run chicks were purchased. By 1952 more than 75 percent of the chicks purchased were pullets. Meat production decreased because fewer cockerels were raised.

Complete cost studies covering this general area during the years 1951-53 indicate that feed makes up about two-thirds of the cost of poultry production. On this basis poultry showed a profit for each of these five periods: The profit per hen was less in the last period than in the earlier years, however, in spite of increased production per hen and fewer pounds of feed per dozen eggs. Feed cost was particularly high in 1946-52, because the amount used per hen had increased 43 percent from the 1928-29 level and the price of feed more than doubled.

Table 27. Financial returns and feed costs per hen, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Value of produce per hen					
Eggs sold or used in home	\$2.18	\$1.48	\$2.07	\$3.62	\$6.02
Net increase in value of chickens	1.25	.64	.62	.91	.70
Total value produced	\$3.43	\$2.12	\$2.69	\$4.53	\$6.72
Feed cost per hen					
Concentrates	\$1.48	\$1.04	\$1.51	\$2.54	\$4.69
Skim milk and buttermilk .....	.13	.09	.06	.03	.....
Total feed cost	\$1.61	\$1.13	\$1.57	\$2.57	\$4.69
Return above feed cost per hen	\$1.82	\$.99	\$1.12	\$1.96	\$2.03
Return per \$100 of feed	\$213	\$188	\$173	\$177	\$143
Average price per dozen eggs sold (cents)....	27.5	15.7	18.9	28.9	39.0
Feed cost per dozen eggs produced (cents)....	20.3	11.9	14.4	20.7	30.3

SHEEP

Breeding flocks of sheep were maintained on approximately one-third of the farms included in this study. The proportion increased from 24 percent in 1928-29 to 35 percent in the period 1935-39, and dropped to an average of 22 percent in the past seven years. The average number of sheep per farm reporting was 40.3,³ and of these 27 were ewes. The average lamb crop was 98 percent. These flocks were to a considerable extent "scavenger flocks" used to clean up otherwise waste forage in

³ Two lambs under six months of age were considered as one head.

the fields and about the farmstead. Data covering feed consumption are presented in table 28. The feed reported per head is low because much of the otherwise wasted feed salvaged by the sheep was not recorded.

The value of sheep and wool production per head, the feed cost, and the returns over feed cost are shown in table 29. Sales of lamb and mutton were the principal sources of income from sheep. Wool accounts for only 28 percent of the income from these flocks. Since feed is the major cost in sheep production, these flocks of sheep were fairly profitable throughout these 25 years—even during the thirties when the price of wool dropped to low levels.

Table 28. Sheep production and feed used, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Number of farms	35	43	52	57	36
Sheep per farm*	28.8	37.0	37.7	43.7	45.0
Ewes kept for lambing	23.0	25.9	25.8	28.7	30.0
Percentage lamb crop	85	100	96	101	102
Percentage death loss	8.0	8.0	13.3	11.3	9.4
Feed per head, lbs.					
Concentrates	52	69	59	84	69
Hay and fodder	164	229	264	268	322
Silage	136	109	140	122	168

* Two lambs under six months of age considered one head.

Table 29. Cost and returns from sheep, 1928-52

	1928-29	1930-34	1935-39	1940-45	1946-52
Value of production per head					
Wool	\$2.45	\$1.10	\$1.82	\$2.79	\$3.46
Increase in value of sheep	5.80	2.31	3.73	5.43	11.13
Total value	\$8.25	\$3.41	\$5.55	\$8.22	\$14.59
Feed cost per head					
Concentrates	\$.69	\$.49	\$.54	\$1.18	\$1.67
Roughages	1.09	.96	1.11	1.35	3.10
Pasture	1.09	.79	.84	.99	1.28
Total feed cost	\$2.87	\$2.24	\$2.49	\$3.52	\$6.05
Return above feed cost per head	\$5.38	\$1.17	\$3.06	\$4.70	\$8.54
Return per \$100 feed	\$287	\$152	\$223	\$234	\$241
Price per pound of wool sold (cents)	36.3	16.2	24.8	40.3	52.4

It should be noted that these are relatively small flocks, receiving a substantial portion of their feed by salvaging products that would otherwise be wasted. Large flocks fed commercial feed would probably show a smaller

return over feed cost. On the other hand, because these flocks were small they did not receive as close attention at lambing time as would a larger commercial flock, and hence the percentage lamb crop is relatively low.

Twenty-Five Years of Agricultural Progress

THE RECORDS of a group of dairy farms in southeastern Minnesota for the 25-year period, 1928 through 1952, as presented in this study, give a picture of our changing agriculture in this area during a quarter century. Many, if not most, of these changes are more or less representative of what is happening to agriculture generally in Minnesota, and elsewhere as well. A virtual revolution in agricultural technology has occurred. Never in the long history of agriculture have as many and as striking changes in farm organization and farm practices been brought into the picture. It is only by viewing these in their long-time perspective that their significance becomes apparent.

That we have not been more impressed with this technical revolution as it occurred is due to other concurrent phenomena that diverted interest away from it. The period included one of the most severe drouths in the history of the state, as well as some years of

extremely favorable growing conditions. It was a period of the widest fluctuations on record in farm prices. It included World War II and most of the Korean War period. It is only as one looks back over this period that he gets a fair picture of this revolution in agricultural technology that is still in operation and is accelerating.

Some of the obvious changes are the mechanization of agriculture and the substitution of mechanical power for both animal power and human energy. Even more striking are the applications of science to crop and livestock breeding and production techniques. To use these new techniques effectively requires a larger production unit—fewer but larger farms. More capital per acre and per man are demanded. A larger proportion of this is used in the form of working capital and a lesser proportion in real estate. The situation calls for far more technical knowledge on the part of the farm operator. In other

words, fewer farmers and farm workers are needed but they need far more technical and business knowledge than

has been true in the past. The family farm still dominates the picture, but it is a larger, more highly capitalized unit.

What Is Ahead?

THE "AGRICULTURAL REVOLUTION" is still under way and is gaining in momentum. Agricultural and industrial research is moving at an ever-increasing pace. New techniques will continue to crowd their way into the agricultural picture as more intensive research bears fruit. Mechanization will continue to advance, and further increases in farm size may well be expected. All of this will call for more capital per farm unit and more "know-how" on the part of the farmer. It offers a real challenge to our system of agricultural instruction, both resident and extension. Science has not eliminated the need for physical strength and skills but it has created a pressing necessity for more technical training and knowledge.

The "new agriculture" will call for more capital. The day when one could start farming with a team of horses, a wagon, and a plow as did the pioneers who settled this state is gone, and gone forever. Most of the new techniques call for increased capital investments per acre and larger farms to use these techniques effectively.

The increased capital demands of our expanding farm units introduce another factor into the farm-loan picture. The ability of the individual borrower takes on increasing importance in any sound loaning policy. Credit agencies have long recognized three fundamental bases for farm credit—character, capacity, and collateral. In past practice collateral has received major consideration. Character, capacity, and general "know-how" must receive more attention in the future in any policy of sound farm finance.

The fact that a larger proportion of the items of expense in farm operation

is purchased and not produced on the farm is highly significant. In 1928, 51 cents of each dollar of cash farm income received by these southeastern Minnesota dairy farmers was paid out to cover cash outlay for farm operation. By 1952, this has increased to 72 cents. In other words, the margin of safety was only 28 cents instead of 49 cents.

With this narrowing margin, greater caution must be exercised by both borrower and lender. A larger business is needed to provide the same income. New criteria are needed in the farm-loan field if adequate capital is to be available under terms that assure reasonable safety to both borrower and lender.

The farming of the future is likely to be more highly specialized than that of the past. The more numerous and the more complicated the new techniques for the production of any particular crop or class of livestock, the more likely there is to be increased specialization on fewer enterprises. It is also quite possible that more and more custom services will be employed for special operations. This is just another aspect of specialization that will enable the farmer to adopt new techniques without large additional investments in equipment and training. It should result in a more effective use of the capital and manpower used in farming.

These larger farm units of the future and the selection and testing of the new techniques will call for a more adequate accounting service. It will be needed to guide production, check on the effect of changes in the organization of the farm, and evaluate the adoption of new equipment and new practices.

The members of the Southeastern Minnesota Farm Management Service

have had the guidance of carefully kept and systematically analysed records of their production methods and their financial operations. That these records have been a useful guide to them is indicated by the fact that their earnings are not only materially higher than the average earnings of other farms in the area, but they have been increased from year to year by a much larger amount than could be accounted for by changes in the price level.

The authors have had an opportunity over the 25 years of this study to ob-

serve the use the farmers have made of their records in planning changes in their farm organization and adjusting to changing conditions. With the increasing size of farm business, the wide variety of new techniques becoming available, the need for much more capital per farm unit, and the narrowing margin between cash receipts and cash expenses, adequate farm records accurately kept and carefully analysed will become increasingly important in the future as a guide to successful financial management.

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