



Changes
IN THE

DAIRY
FARMING
PICTURE



THEIR EFFECT ON FARMERS' EARNINGS
AT VARIOUS PRICE LEVELS



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Changes in the **Dairy Farming Picture**

**Their Effect on Farmers' Earnings
at Various Price Levels**

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THE LAST 40 years have brought more numerous and more striking changes in farm techniques than any similar period in recorded history. This period has also been characterized by a wide range in the price of farm products. This bulletin covers a complete cycle—from 1919, when farm prices reached their highest level up to that time, through the lowest point in the present century in the early thirties, to an all-time high in 1948.

In a period of such numerous and radical changes in production techniques and in economic conditions, farmers have been forced to make frequent adjustments to bring their business in line with changing conditions. With so many new factors coming into the picture and with limited experience to guide them, it is to be expected that the farmers' response would be far from uniform, but some general pattern of adjustment might be expected over several years.

The purpose of this study is to trace the changes in the organization of dairy farms in southeastern Minnesota from 1920 to 1949. Dairying is a leading source of income on Minnesota farms, and dairy farms are the most common type in the state. Dairy farms predominate in central and eastern counties.

Dairying is a relatively stable type of farming, in that changes in organiza-

tion are not as frequent or as quickly or easily made as in most other types. Consequently attention is given in this bulletin to the effect of changing techniques and prices on farm income and expense. Some consideration is also given to the question as to whether increased mechanization and commercialization have made the farmer more vulnerable in periods of declining prices.

Source of Data

A group of dairy farms for which accounting records were available for the years 1920, 1930, 1940, and 1949 supplied most of the basic information used. The number of farms used by years was as follows: 1920, 14 farms; 1930, 66 farms; 1940, 30 farms; and 1949, 34 farms. The location of these farms by counties is

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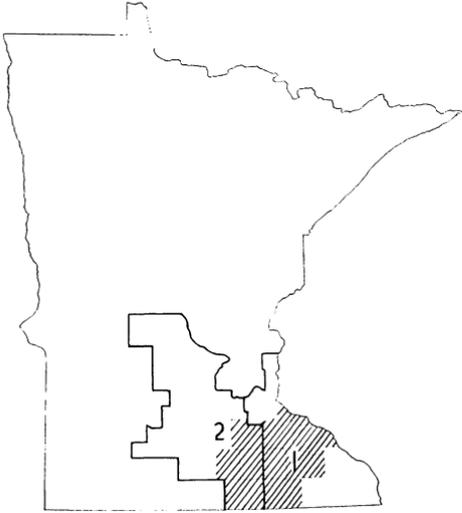


Fig. 1. Records used in this bulletin were from farms in the marked counties. All of these farms are in type-of-farming areas 1 and 2.

shown by diagonal lines in figure 1.³

Farms ranging in size from 140 to 180 acres were selected because they were typical of dairy farms of this area.⁴

The choice of farms was limited to those for which reasonably complete and accurate accounting records were available. All of the operators of farms used in this study were members of

farm accounting services and their records were kept under the direction and supervision of the Minnesota Agricultural Experiment Station. Farm management research workers supervised these records, checked them for accuracy and completeness, and made the tabulations used in this report.

A considerable change has taken place in the farms included in this study. For instance, none of those included in the 1920 study was used in the later studies. A considerable turnover of farms occurred also from 1930 to 1940 and from 1940 to 1949. However, only typical dairy farms were used in each of the years covered. Some of the differences in farm organization from period to period were due to changes in the farms used, but every effort was made to maintain a uniform selection of typical dairy farms each year.

No records were available for the same farms for the entire time covered. Nor would such records have been desirable, since many of the changes during the 29 years would have been due to the changing age and financial status of the operators and other personal factors associated with the passing of time. Thus, differences due to changing techniques and prices might have been obscured.

³ All the farms studied in 1920 were located in Steele County. For the other years they were scattered among all of the nine counties, except in 1930 when no farms in Mower, Olmsted, and Wabasha Counties were included.

⁴ Since 1940 a marked increase has occurred in the average size of farm in Minnesota as well as in surrounding states. However, the average increase in the size of farm in the nine counties covered by this study was only 3 per cent from 1920 to 1950. As the change was so small, the same size range was used in selecting the farms used in this study for each of the four years. Numbers of livestock per farm in this area have increased sharply since 1920 but the change in farm acreage is a very minor one

Changing Techniques in Production

Mechanical Power Displaces Horse Power

Substitution of mechanical for animal power on farms has been an out-

standing development of the period under study. Only 6 of the 14 farms studied in 1920 were equipped with tractors. The proportion increased to 58 per cent in 1930, 90 per cent in 1940, and 100 per cent in 1949. In fact, by 1949

there were two or more tractors on 21 of the 34 farms.

The tractors in 1920 had been in use only a short time. They were heavy and cumbersome and lacked the adaptability and flexibility of the modern tractor. Except for plows, most of the machines operated by the early tractors were designed for horse operation and hence the effectiveness of the tractors was not fully utilized. There were no power take-offs, and belt work was the principal use, other than plowing and seedbed preparation.

With the advent of the lighter and more flexible type of tractor, the power take-off, and machinery designed for tractor use, the adaptation of the tractor increased to the extent that horses were completely displaced on many farms. The average number of work horses per farm on the farms studied in 1920 was 5.9. By 1949 this number had dropped to 1.7 and most of these horses were used only occasionally.

This displacement of horses by tractor power not only saved labor and speeded up farm operations but it released feed for other livestock. The total amount released per farm studied from

1920 to 1949 was 7.5 tons of grain, 9 tons of roughage, and 7.2 acres of pasture.

Another source of power that became available on these farms was electricity. None of the farms had electric energy available in 1920, but 39 per cent were using it by 1930, 77 per cent by 1940, and all by 1949. Electricity was used for both power and lighting and was available for home as well as farm use. Pumping water for both farm and home use is now done largely with electric power.

Farm Machinery Pattern Changes

Adoption of mechanical power has led to adjustment in the design and construction of farm machinery. In general, the size and strength of soil-working machinery, such as plows, disks, and harrows, have been increased. The width of cut of most machines has been increased. Power take-offs or auxiliary motors have come into the picture to supply power to operate harvesting machinery. For the most part, the shift has been toward larger, more expensive machines of greater capacity and

Table 1. Proportion of Farms Reporting Specified Machines, 1920-1949

	1920	1930	1940	1949
			per cent	
Corn binder	93	85	87	39
Silage cutter (stationary)	71	53	50	31
Field chopper				28
Corn picker		12	20	55
Grain binder	100	98	96	55
Combine			6	24
Swather				6
Portable elevator		15	33	48
Dump rake	93	73	63	24
Side-delivery rake	22	69	80	88
Hay loader	57	77	87	61
Hay hoist				6
Windrow baler				12
Hay blower				4
Dehydrator				3
Fertilizer spreader		6	6	28
Lime spreader		1	6	15
Manure loader				12
Power sprayer				58
Power post-hole digger				3

Table 2. Amount of Crop Supplies Purchased per Farm

	Unit	1920	1930	1940	1949	
Seed						
Corn	bushels	1.9	1.2	4.3	7.6	
Oats	bushels	14.7	4.5	8.2	22.4	
Barley	bushels	1.7	5.6	1.2	3.4	
Wheat	bushels	7.6	8.0	1.0	2.2	
Alfalfa	pounds	11	30	51	160	
Clover, red	pounds	74	39	10	42	
Clover, alsike	pounds	4	8	16	16	
Clover, sweet	pounds	.....	69	76	42
Timothy	pounds	26	8	32	17	
Brome grass	pounds	.....	.....	17	63
Sudan grass	pounds	.....	.....	68	20
Total grass and legumes		pounds	115	154	270	360
Commercial fertilizer	pounds	.....	780	871	8,200
Lime	tons	.....	.8	2.9	27.4
Twine	pounds	244	223	204	102	

adapted to the increased speed of tractor operation.

New techniques in handling crops have led to the introduction of new types of farm implements and the discarding or decreased use of implements formerly in general use. This is indicated by the data presented in table 1. The corn binder and stationary silage cutter are being displaced by the field chopper and by the blower, which elevates the chopped corn into the silo. This process also involves the use of specially designed forage boxes for hauling and unloading the chopped corn.

The corn picker has also come into the picture during this period. Grain binders are giving way to combine harvesters. Side delivery rakes are replacing dump rakes, and field choppers and windrow balers dominate haying operations. The new types of equipment are often mounted on the tractor rather than hauled by it. New harvesting methods often require drying equipment for hay and grain.

Most of these new machines are considerably more expensive than those displaced. They also have more capacity. On smaller farms much of this new equipment is hired on a custom basis, as there is not enough work to be done

for each individual to buy the equipment. This is reflected in increased expenditures for custom work hired and also in the income from custom work done for others, as many farmers cover the cost of expensive machinery by doing custom work for their neighbors.

Farmers Adopt New Crop Practices

The principal changes in crop practices during the period include increased use of purchased seed, of fertilizer and lime, and of sprays for weed and insect control. Some of these changes are indicated in table 2. The shift from open-pollinated to hybrid corn has resulted in the exclusive use of purchased seed corn since 1940, whereas in earlier years most of the seed used was raised on the farm. The purchases of seed grain have also increased in recent years as the plant breeder developed more high-yielding and disease-resistant varieties.

The most striking change is the sharp rise in the use of commercial fertilizer and lime in recent years. There has also been a sharp increase in grass and legume seedings, a shift from red clover to alfalfa, and a substitution of brome

Table 3. Amount of Commercial Feed Purchased per Farm

Kind of feed	1920	1930	1940	1949
	pounds			
Bran	2,607	1,563	1,210	2,884
Middlings and shorts	1,521	581	493	700
Alfalfa leaf meal		34	26	316
Linseed and soybean meal	1,250	794	1,363	3,529
Meat scraps and tankage		441	500	911
Commercial mixed feeds				
Dairy feeds		426	465	5,050
Hog feeds	36	148	475	4,839
Poultry feeds	300	833	2,772	12,594
Total pounds	5,714	4,820	7,304	30,823

grass for timothy in hay and pasture mixtures. The decrease in quantity of twine bought reflects the shift from binder to combine harvester.

New Techniques in Livestock Production Adopted

New techniques in livestock production have resulted in increased production per animal and more efficiency in production. Dairy Herd Improvement Associations have served as a basis for selecting individuals for high production and for their ability to transmit that quality to their offspring.

Litter testing has been practiced to an increasing extent as a basis for selection of breeding gilts, too. Cross-breeding has become a standard practice in hog production in recent years and also is being practiced extensively

with poultry. New knowledge in the field of animal nutrition has resulted in more attention to supplying adequate protein in the ration and to the increased use of vitamins, minerals, and antibiotics. This is reflected in the data on feed purchases shown in table 3. Some of this increase in purchases of feed is due to an increased number of livestock per farm, but in general it represents to a considerable extent an attempt to improve the quality of the ration.

In addition, livestock sanitation and disease control have received more attention in recent years. Tests for such diseases as tuberculosis and brucellosis have aided in eliminating diseased animals. Outlays for sprays, vaccines, and other means of insect and disease control have increased rapidly in recent years (see miscellaneous livestock expense in table 10).

Changes in Farm Organization

Less Small Grain, More Sod Crops Planted

The proportion of tillable land in intertilled crops changed very little during the period covered by this study (see table 4). There was little net

change in the acreage of oats from 1920 to 1949, but sharp decreases in barley and wheat reduced the proportion of land in small grain. The proportion of tillable land in tame hay and rotation pasture increased decidedly, and non-legume hay was dropped by 1949.

Table 4. Percentage Distribution of Tillable Land

	1920	1930	1940	1949
Average number acres per farm	154	157	160	160
Average number tillable acres in crops	115	120	122	124
	per cent			
Per cent tillable acres in				
Corn	33	29	26	32
Soybeans			2	1
Other intertilled crops		6	2	1
Total intertilled crops	33	35	30	34
Oats	22	18	14	25
Barley	3	14	13	2
Wheat	15	5	4	1
Flax		2	3	1
Total grain crops	40	39	34	29
Hay, legume	13	12	18	20
Hay, nonlegume	2	2	2	
Rotation pasture	12	12	16	17
Total sod crops	27	26	36	37

Livestock Numbers Increase

Productive livestock increased from 28.0 animal units per farm in 1920 to 38.3 units in 1949.⁵ (See table 5.) This represents an increase of 37 per cent. Most of this change took place between 1940 and 1949. This increase in livestock was made possible (1) by shifts from small grain to corn and hay crops, which produce more feed per acre, (2) by higher yields from hybrid corn, (3) by improved-quality hay and pasture,

(4) by the use of feed released by the decrease in the number of work horses, and (5) by increases in feed purchases.

In addition to the greater numbers of livestock, production per animal for cows and chickens increased steadily. The butterfat production per cow was 170 pounds in 1920, 239 pounds in 1930, 254 pounds in 1940, and 301 pounds in 1949. Egg production per hen increased from 110 in 1930 to 128 in 1940 and to 195 in 1949.

⁵ An animal unit is a mature dairy cow or the number of other livestock that will consume the same amount of feed as a mature dairy cow.

Table 5. Numbers or Weight of Livestock per Farm

	1920	1930	1940	1949
Cows, number	14.1	14.3	12.4	17.2
Other cattle, number	15.3	14.5	15.3	18.2
Hogs produced, pounds	10,520	13,217	14,134	19,901
Sheep, number		4.9	14.2	8.2
Hens, number	130	158	182	251
Total number of productive livestock units ..	28.0	30.5	32.8	38.3
Number of work horses	5.9	5.1	3.5	1.7

Table 6. Average Farm Inventory Valuation and Percentage Distribution by Class of Property

	1920	1930	1940	1949
Average inventory valuation	\$33,122	\$22,125	\$16,146	\$33,747
	per cent			
Percentage distribution				
Productive livestock	10.9	13.0	12.5	16.2
Horses	1.8	2.1	2.3	0.4
Crops, feed, and seed	8.6	7.6	8.9	12.2
Machinery and power	5.8	7.7	13.6	14.0
Land and buildings	72.9	69.6	62.7	57.2

Farm Capital Values Vary Widely

Large fluctuations from period to period in the average value of farm capital reflect changes both in the price level and in the kinds and quantities of capital items used (see table 6). Changes in the general price level account for a considerable portion of these variations, especially in the case of land and buildings, crops, feed, seed, and livestock inventories. However, livestock numbers and feed inventories increased substantially.

The inventory of machinery and power was higher primarily because the number of machines in use increased and because most new machines were more expensive than those replaced. During the period covered by this study the proportion of the total farm capital tied up in fixed investment in land and buildings declined

and the proportion invested in working capital and equipment increased.

Farm Receipts Show Upward Trend

Changes in cash receipts per farm from 1920 to 1949 are shown in table 7. Variations from year to year are caused partly by changes in the quantity of goods sold and partly by changes in the price level of farm products. A general upward trend occurred in the quantity of livestock and livestock products sold (see table 8). Changes in the numbers of livestock and in the production of butterfat per cow and eggs per hen have already been noted.

As indicated in table 8, the largest increases in livestock and livestock products sold were from 1920 to 1930 and from 1940 to 1949. Production of livestock was relatively stable from 1930 to 1940.

In order to eliminate the effect of

Table 7. Average Cash Receipts per Farm

	1920	1930	1940	1949
Dairy products	\$1,625	\$1,292	\$1,091	\$ 4,086
Cattle	1,022	560	564	1,939
Hogs	1,271	1,127	802	3,746
Poultry and eggs	217	408	419	2,173
Sheep .....	.....	28	74	143
Total livestock and livestock products	\$4,135	\$3,415	\$2,950	\$12,087
Crops	400	322	402	751
Miscellaneous	120	203	661	497
Total sales	\$4,655	\$3,940	\$4,013	\$13,335

Table 8. Average Quantity of Livestock and Livestock Products Sold per Farm

	Unit	1920	1930	1940	1949
Butterfat	pounds	2,308	3,073	3,093	4,948
Dairy cows	number	3.5	3.7	3.7	5.0
Other dairy cattle	number	9.6	9.3	8.8	10.2
Hogs	pounds	9,770	13,991	15,599	20,643
Sheep	number	.....	2.7	6.5	7.4
Eggs	dozen	383	1,330	1,540	3,941
Poultry	pounds	260	701	815	1,171

changing prices, the data shown in table 7 have been recomputed on the basis of 1935-1939 prices (see table 9). These adjusted income figures bring out the steady increase in production throughout this period. The miscellaneous receipts in 1940 are out of line with the other years because of large receipts from work done off the farm and large Agricultural Adjustment payments on these farms this particular year.

The receipts from livestock and livestock products increased at a fairly uniform rate up to 1940 but at a much more rapid rate from 1940 to 1949 (table 9). The rapid increase during this latter period reflects the effects of unusually favorable weather conditions and of the many new technological changes in production that were adopted during this period.

Farm Expenditures Also Increase

Cash farm expenses increased from \$2,934 per farm in 1920 to \$10,159 per

farm in 1949. Part of this difference is due to a change in the quantity and kind of items purchased and part to changes in the price level during the period covered. In order to eliminate the effect of changes in price level, the data for each of the four selected years have been adjusted to the 1935-39 price level. These adjusted figures are shown in table 10.

Livestock purchased were principally sires for breeding purposes and baby chicks. Although numbers of livestock increased 37 per cent from 1920 to 1949, most of these farms were small enough so that only one sire was needed for each class of livestock. The increase in livestock bought, therefore, was due principally to the purchase of baby chicks. By 1949 artificial breeding fees (included in this item) were of greater importance but were partially offset by the fact that fewer bulls were needed.

Increased feed purchases reflect the larger numbers of livestock and the higher rates of production. Most of the increase in feed bought was in com-

Table 9. Average Cash Receipts per Farm (Adjusted to 1935-39 Price Level)

Item	1920	1930	1940	1949
Dairy products	\$ 956	\$1,077	\$1,080	\$1,927
Cattle	700	496	613	732
Hogs	871	997	872	1,414
Poultry and eggs	105	343	476	1,065
Sheep .....	.....	24	81	54
Total livestock and livestock products	\$2,632	\$2,937	\$3,122	\$5,192
Crops	146	277	455	399
Miscellaneous	85	188	672	233
Total sales	\$2,863	\$3,402	\$4,249	\$5,824

Table 10. Average Cash Farm Expenditures per Farm (Adjusted to 1935-39 Price Level)

	1920	1930	1940	1949
Livestock purchased	\$ 306	\$ 241	\$ 256	\$ 367
Feed purchased				
Farm grains	72	91	149	241
Commercial	106	138	237	799
Total	\$ 178	\$ 229	\$ 386	\$1,040
Miscellaneous livestock expense	40	44	55	137
Crop expense	78	101	148	377
Custom work hired	31	79	114	215
Hired labor	197	177	201	229
Electric current		16	34	83
Mechanical power, new	156	196	210	318
Mechanical power, upkeep and operating expense	206	145	214	591
Farm machinery, new	248	148	222	456
Farm machinery, upkeep	59	37	50	147
Real estate improvements, new	308	187	232	569
Real estate improvements, upkeep	47	25	78	209
Taxes, real estate and personal	159	152	185	267
General farm expense (including insurance)	26	55	49	87
Total	\$2,039	\$1,832	\$2,434	\$5,092

mercial feeds, which usually are higher in protein content than farm grains, and this increase indicates growing attention to balanced rations.

Commercial feeds in general are also higher in price per pound of digestible nutrients than farm grains. Increased miscellaneous livestock expense reflects large expenditures for sanitation, veterinary services, and disease control.

Increases in crop expense are due to greater dependence on purchased seed and higher expenditures for insect and disease control. In 1940 the purchase of hybrid seed corn made up a large proportion of the increase in crop expense, and by 1949 the purchase of commercial fertilizers was one of the largest single items in this classification.

The increase in the hiring of custom work made it possible for the operator of a small farm to get the services of expensive machines, such as combines, corn pickers, windrow balers, and hay choppers, without the heavy investment that ownership would involve. By means of custom services and a large increase in power and machinery expenditures, farmers were able to hold

down outlay for hired labor in spite of the fact that the production of livestock practically doubled from 1920 to 1949.

Increases in the outlay for power and machinery in the later years show the rapid rate at which these farms were being mechanized, especially with new and expensive types of equipment.

Construction and maintenance of buildings and fences, and other real estate improvements are more flexible as to time than are any of the other items of farmers' expenditures. Painting and major repairs may be neglected for years without serious loss of operating efficiency. In the depression years of the 1930's both buildings and fences were allowed to deteriorate. More ample incomes during World War II and the postwar period made possible larger outlays for repair and maintenance and for new construction.

Net Cash Receipts Change with Price Level

Net cash operating receipts available for personal and household spending,

Table 11. Net Cash Receipts per Farm

	1920	1930	1940	1949
Cash farm receipts	\$4,655	\$3,940	\$4,013	\$13,335
Cash farm operating expense*	2,027	1,576	1,779	7,525
Net cash operating receipts	\$2,628	\$2,364	\$2,234	\$5,810
Operating expense per \$100 of receipts	\$44	\$40	\$44	\$56

* Cash farm expenditures less capital outlays for power, machinery, and buildings and for other real estate improvements.

debt servicing, and for savings and investment are shown in table 11.

The cash farm expenditures listed in the preceding section included capital outlays for power, machinery, and buildings and other real estate improvements. Over a period of years these outlays must be met out of the cash farm receipts in a self-sustaining business, but the amount of these items varies widely from year to year. They have, therefore, been deducted from the cash farm expenditures to make the comparisons between the specific years under consideration more significant.

The data presented in table 11 bring out one significant result of techno-

logical changes in farming in recent years. Operating expenses per dollar of income have increased. The farmer is purchasing for cash a large proportion of the raw materials and items of operating expense and is producing less on the farm.

This shows up even more strongly in the tabulations in table 12 in which the earnings and expense figures have all been reduced to the 1935-39 price level to make them more significantly comparable. When adjusted to a constant price level (1935-39), the proportion of each dollar of cash income needed to cover operating expense and the purchase of raw materials increased very materially from 1920 to 1949.

Table 12. Adjusted Net Cash Operating Receipts per Farm (Adjusted to 1935-39 Price Level)

	1920	1930	1940	1949
Cash farm receipts	\$2,863	\$3,402	\$4,249	\$5,824
Cash farm operating expense*	1,327	1,301	1,770	3,749
Net cash operating receipts	\$1,536	\$2,101	\$2,479	\$2,075
Operating expense per \$100 receipts	\$46	\$38	\$42	\$64

* Cash farm expenditures less capital outlays for power, machinery, and buildings and real estate improvements.

The Effect of Changing Techniques on Farmers' Earnings

Most of the changes in farm techniques during the period covered by this study were made in a period of rising prices. In general, they have re-

sulted in material increases in the earnings of farmers even when these earnings are computed on the basis of a constant price level. Greater efficiency

in production and greater size of business, made possible by the adoption of new techniques, have accounted for a substantial portion of the increase in earnings. Farm expense has increased materially during this period, but farm income has increased even more. Farming is being commercialized and a larger proportion of the items used in production are now being purchased instead of being produced on the farm.

Falling Prices Hurt Farmers

A debt-free farmer would not be financially disturbed by changing prices if the prices of the things he sells would change by the same proportion and in the same direction as the prices of the things he buys (including those for family living). However, when the general price level declines, the prices of farm products characteristically drop faster and farther than the prices of the things he buys for farm operation and for family living.

In the year 1947, when net farm income was the highest on record, the relation of prices received by farmers to prices paid by them was the most favorable in history. In 1932, when farmers' net income reached an extreme low, the relation of prices received to prices paid was the most unfavorable on record.

Farmers have always found themselves in a less advantageous position in a period of falling prices than in a period of rising prices. The question naturally arises as to whether new techniques in farming, involving as they do the purchase of a large proportion of the supplies used in production, will increase the disadvantage to the farmer in periods of declining prices.

New Techniques Increase Expenditures

The new techniques adopted in farming during the period of this study in-

crease the farmers' expenditures in two ways. They increase the proportion of cash outlay for a given volume of production and they also increase the total outlay by inducing an increase in the size of business.

Adoption of mechanical power and new machines has resulted in a cash outlay for motor fuel, whereas farm-produced grain and hay formerly were used to produce horse power. These new forms of power and machinery are usually more economical in operation with a larger acreage of crops. They also release family labor and make it available for the expansion of livestock production. This expansion calls for additional capital investments in livestock, buildings, and equipment, as well as for purchases of feed, supplies, and services for the additional livestock.

Expenses Show Varying Response to Price Changes

Cash farm operating expense on the farms studied increased from \$1,327 in 1920 to \$3,749 in 1949 (see table 12). As these data have been adjusted to a 1935-39 price base, the increase may be assumed to result principally from an increase in the number of items bought.

The goods and services purchased for use in farm production fall into two classes as far as price response is concerned: (1) items whose prices rise and fall at approximately the same rate as do the prices received by farmers, and (2) items whose prices change less rapidly than prices received by farmers.

In the first class are such things as purchased feeds, and most of these are of farm origin. The prices of commercial feeds do not follow farm prices quite as closely as those of whole grains because handling, processing, and transportation costs are included in the prices of commercial feeds. However, the difference is not large.

On the other hand, the prices of industrial products, such as twine, fer-

tilizers, sprays and dusts, tractor fuel, lubricants, machine parts and repairs, electric current, and materials for buildings and fence repairs, do not follow the prices of agricultural products closely. In a period of a declining general price level they will not drop as rapidly as the prices of the products the farmer sells.

New Technologies Most Profitable When Prices High

The four years covered in this study—1920, 1930, 1940, and 1949—are used to represent successive degrees in the application of new techniques to farming. By computing net income with each of these degrees of technology at several low price levels, it is possible to determine, at least roughly, to what extent the farmer is advantaged or disadvantaged in periods of low prices as a result of his adoption of new techniques in production.

The three price levels chosen are those of 1930, 1940, and 1932. The index of purchasing power of farm products in terms of the goods and services used in production was 93 in 1930; in 1940 it was 81; and in 1932 it reached the lowest point of the period covered by this study, 66.

Adjustments have been made in some of the expense items included in table 10 in order to make these comparisons at varying price levels more significant:

1. Some items listed as real estate upkeep in table 10 for 1940 and 1949 have been reclassified as capital investments and therefore eliminated from the cash operating expense in computing net income.

2. The item of general farm expense in 1940 and 1949 has been reduced by restricting it to the items purchased in 1930. This was done under the assumption that those items were adequate to maintain the level of production of these later years.

3. As the purchasing power of farm products was the most favorable on record for the three years preceding 1949, farmers tended to stress production at the expense of efficiency and continued to do so through 1949.

Under the assumption that the same level of production could have been maintained with less operating costs, operating expenses were reduced approximately 6 per cent for each of the three price bases used.

Cash farm receipts would have increased with higher levels of technology at all three price levels. The amount of increase would have been least at the low price level of 1932. Quantities of items bought changed very little from the 1920 level of technology to the 1930 level and only moderately from the 1930 to the 1940 level. The most rapid increase in the adoption of new technology was from 1940 to 1949 and the largest increase in quantity of items bought occurred during this period.

Net cash farm receipts would have been moderately greater with increasing use of new technologies at the highest (1920) price level. With the lower price level of 1940 there would have been a slight increase in net cash farm receipts from 1920 to 1930 but very little during the rest of the period. At the low (1932) price level there would have been little increase in net cash receipts in 1930 and 1940 over 1920 and still less at the 1949 technology level.

It is obvious that the financial advantage from the adoption of new technologies in farming is far greater at high price levels than at low levels.

New Technologies Affect Net Farm Income

The effect of different degrees of adoption of new farming techniques on cash farm receipts, cash farm expenses, and net cash farm receipts is

shown in figure 2. Both cash receipts and cash expenses would have increased with the wider use of new techniques at each of the price levels considered. Net cash receipts also increased at the 1930 and 1940 price levels but decreased at the low 1932 level.

At this low price level and with the 1949 level of technology, receipts were slightly below what they would have been with the techniques of production practiced in 1930 and 1940. The purchasing power of farm products was so low (index of 66) that most farms were being operated at a loss. The average operator's labor earnings on the farms used in this study was a minus figure in 1932.

With the larger size of business associated with the new techniques that had been adopted by 1949, the loss would obviously be greater if there were no gains in efficiency of production to offset the price disadvantage. But in 1932 any gains in efficiency were more than offset by the extremely unfavorable price relationships.

Depreciation of capital goods, such as machinery and buildings, is an item of expense that must in the long run be met out of the income of the farm. The value of depreciable property used in production on these farms increased from 1920 to 1949 to the extent that the annual depreciation charge increased from \$296 to \$1,282. An increase in the quantity and in the price of capital goods used caused this increase.

If the annual depreciation charge is deducted from net cash farm receipts (shown in figure 2), the net farm income is determined. Net farm income for each price level and each degree in the adoption of new techniques is shown in figure 3.

At the 1930 level (the highest of the three used in this comparison) net farm income increased from the 1920 to the 1930 level of technology; it was practically constant at the 1930 and 1940 levels; and it increased slightly from the 1940 to the 1949 levels.

The changes in net farm income at different levels in the adoption of new technology showed the same general trends at the 1940 price level as at the 1930 level but the differences were smaller. Under the price level of 1932 net farm income is materially higher at the 1930 and 1940 levels of technology, but at the 1949 level it is the lowest of any of the four selected years. The net cash receipts at the low price level of 1932 are largely absorbed by the high depreciation charge resulting from the large investment in power and machinery in 1949.

If depreciation of capital goods had to be met each year out of the income of that year, new techniques in farming that involved increased capital investments would place the farmer who adopts them at a severe financial disadvantage in periods of sharply declining prices. On the other hand, these techniques give the farmer a large advantage in net income in periods of rising prices and particularly when farm prices are at a relatively high level.

It is possible to make capital investments during these high-level periods and to accumulate reserves that make it possible for him to carry on through periods of low income without using his low current income for capital investments. In actual practice that is precisely what happens. In 1920 outlays for machinery and new buildings exceeded by a wide margin those in 1930 and 1940, and the 1949 outlay was far larger than in 1920.

Good Years Offset Bad Years

Net cash farm receipts are available for meeting family living expense, for servicing debts, and for saving and investing. By deducting family living expense from net cash farm receipts, one can find how much will be left for debt servicing and savings. Information on family living expenses was not included in the 1930 records so it was necessary

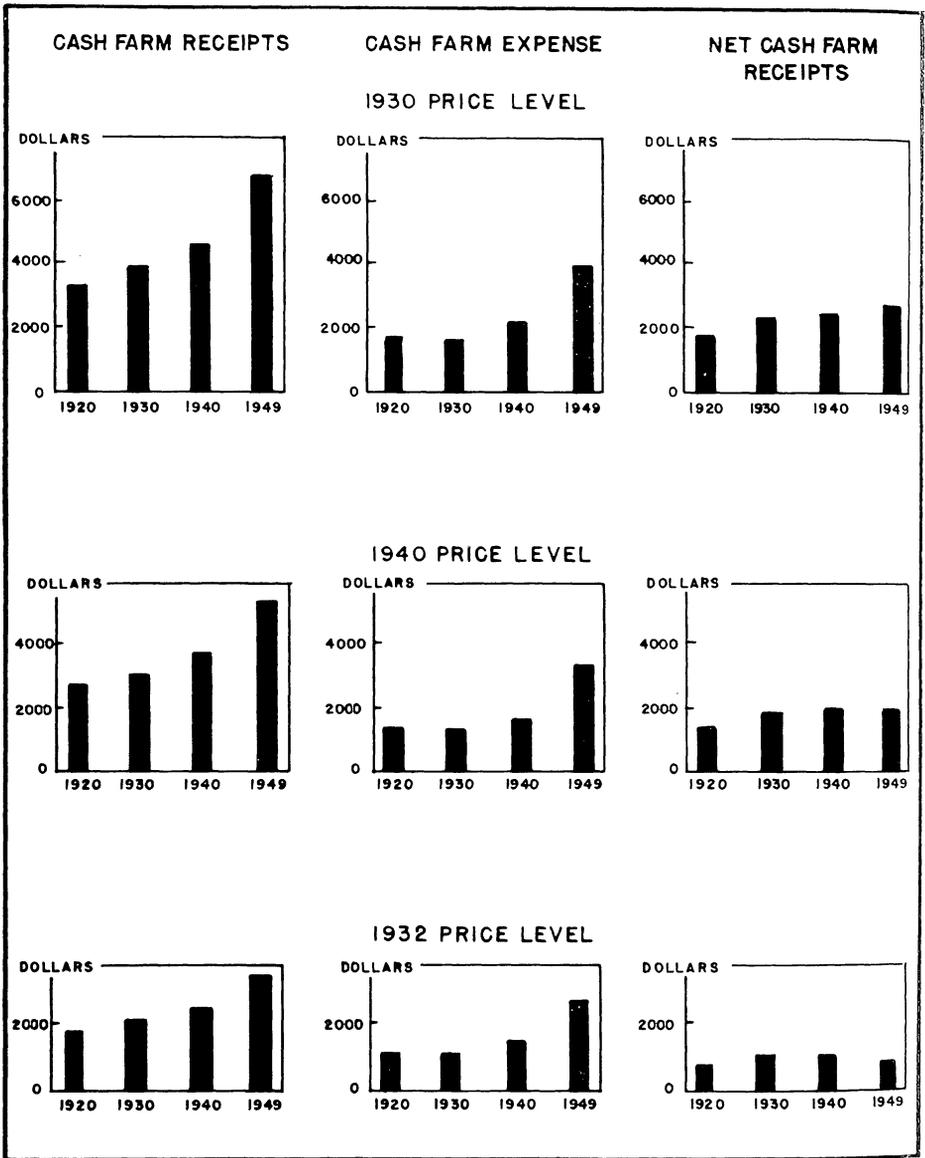


Fig. 2. Cash farm receipts, cash farm expense, and net cash farm receipts per farm—adjusted to various price levels. (Cash farm expense includes only operating expense.)

to limit this comparison to the three years, 1920, 1940, and 1949.

In periods of high incomes farmers purchase new automobiles, furniture,

and appliances for the home. Such purchases are a capital investment and are not included in living expense as defined here. Cash living expenses for the

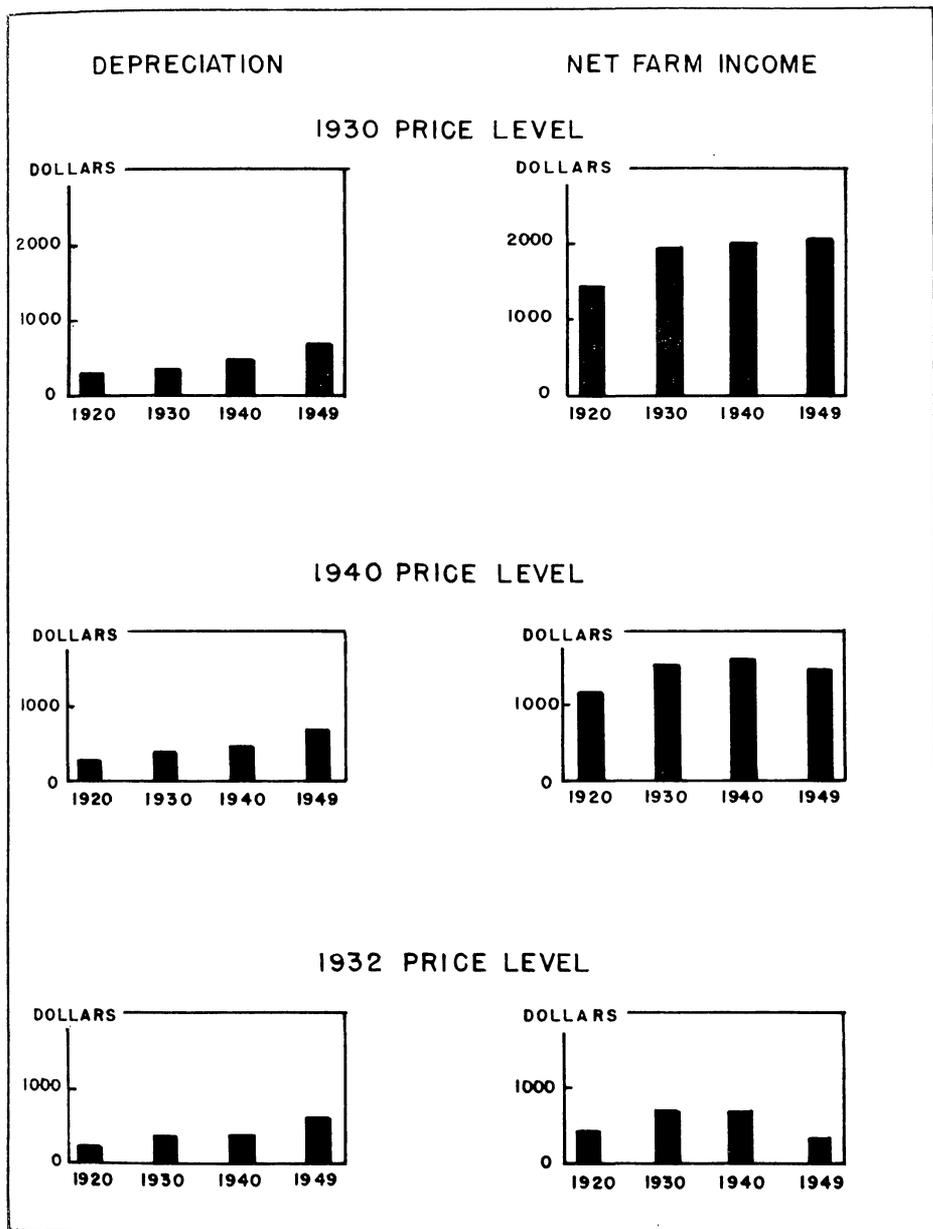


Fig. 3. Depreciation and net farm income per farm—adjusted to various price levels. (Net farm income is net cash farm receipts less depreciation.)

years 1920, 1940, and 1949 have been adjusted to three price levels—1930, 1932, and 1940—and deducted from the corresponding net cash farm receipt figure. In this way the amount is determined that would have been available for debt servicing and savings (see figure 4).

The living expenses of farmers increased very sharply from 1920 to 1940 and by a much smaller amount from 1940 to 1949. At the 1930 price the balance of net cash farm receipts left after deducting the cost of living was slightly higher at the 1940 level of technology than at the 1920 level and still higher at the 1949 level.

However, at the 1940 price level the balance was practically the same at each of the levels of technology.

With farm prices down to the 1932 level, the balance of the net cash farm receipts left after deducting living costs decreased with increasing levels of technology. The advantage of new technological developments in agriculture was completely wiped out at this extremely low price level.

At the level of prices existing in 1930 the amount available for debt servicing and savings was higher at the 1949 level of new techniques than at the levels of the other two years. At the 1940 price level the differences among the three levels of technical operation were very small. With prices dropping to the 1932 level, little was left for debt servicing at any of the specified levels—especially in 1949 when the possibility of debt servicing out of current income was almost eliminated.

But this lack may not represent a serious handicap—at least to the farmer who has had the advantage of a few years of new techniques at price levels of 1940 and higher. The larger amounts available in such years make it possible to reduce the debt load to manageable proportions.

The total mortgage debt in 1949 in type-of-farming areas 1 and 2 (the areas from which the records used in this

study are taken) was only 62 per cent of the debt in 1930 and 84 per cent of the debt in 1940.

The more widely fluctuating incomes that result from the adoption of new techniques in farming may prove a hazard for the young man just starting in and may call for a more flexible loan policy for farmers in general. However, the increase in funds available for debt servicing in years of favorable price relationships should far more than offset the effects of such extremely unfavorable price relationships as those of 1932.

The gains resulting from the use of advanced techniques should, in general, put the farmer in a stronger financial position but they will by no means solve his debt-servicing problems. Careful planning and judicious administration of his finances are still needed to preserve a sound financial setup.

General Trends Noted

New production techniques adopted on dairy farms in southeastern Minnesota during the last 30 years have generally resulted in an increase in farm earnings. This increase in farm earnings has resulted from greater efficiency in production and from an increase in the size of business, both of which are the direct or indirect results of the adoption of these new techniques.

The increase in earnings is especially marked in years when the purchasing power of farm products is relatively high. But even with a moderately low purchasing power of farm products the farmer still has larger earnings and a larger excess of income over farm expenditures to provide funds for family living, debt servicing, and savings. It is only when price relationships are extremely unfavorable to the farmer, as they were in 1932, that the use of new techniques involving a larger propor-

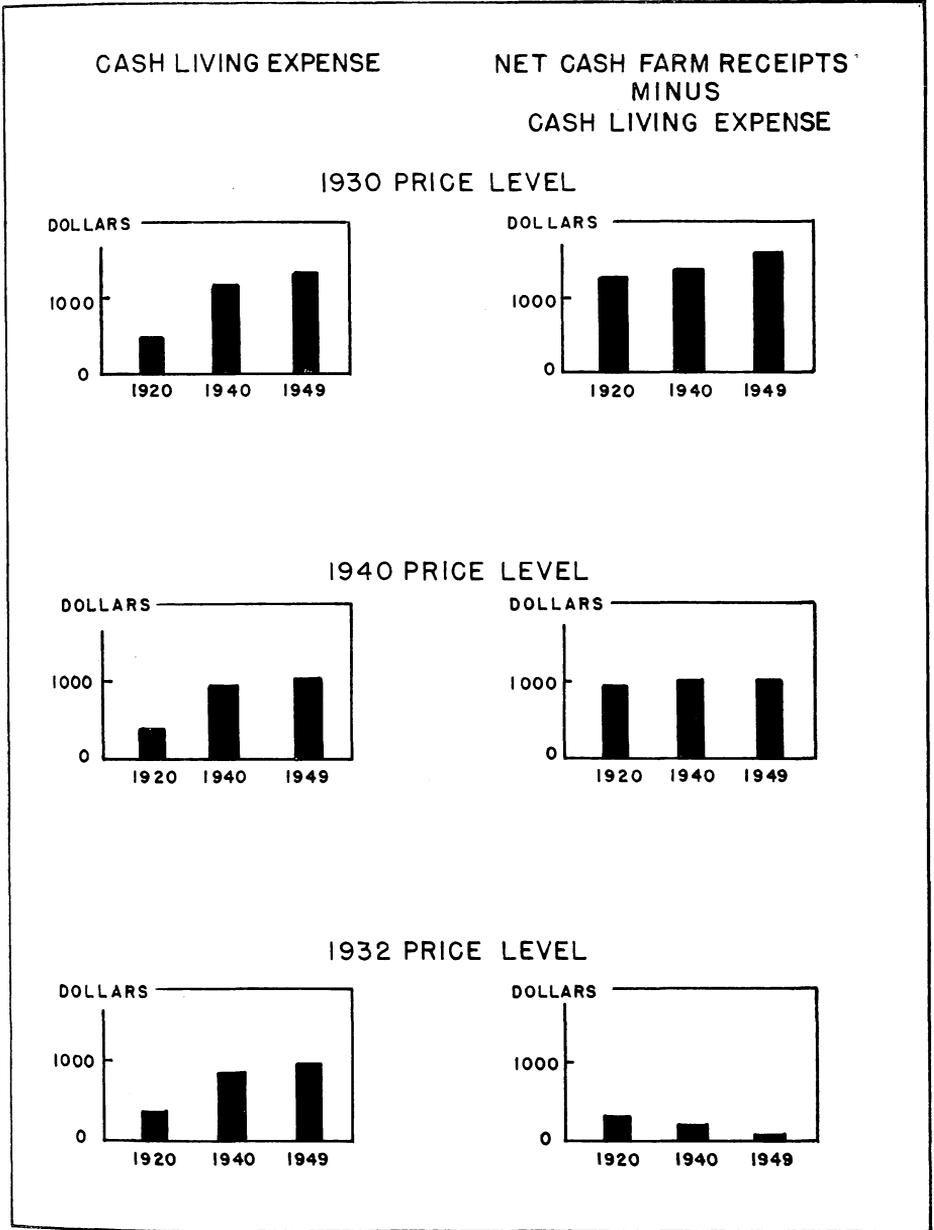


Fig. 4. Cash living expense and net cash farm receipts (without the cash living expense) per farm—adjusted to various price levels.

tion of purchased goods and services in production may prove a financial hardship. In such years outlay may be held down by deferring the purchase of equipment and the postponement of all except the most pressing items of repair and upkeep.

On the other hand, in years of favorable price relationships replacements of permanent equipment, new investments, and extensive repairs, as well as debt reduction, should receive major consideration in utilizing the larger excess of income over operating expense.

New techniques in farming require more judicious long-time financial planning in order to receive maximum benefit from them.

As most of these new techniques involve additional capital investments and also a larger volume of business to use them most effectively, they do create an additional financial burden for the starting farmer. The starting farmer needs not only more capital than formerly, but also more technical knowledge in order to use the new techniques to best advantage.

Summary and Conclusions

1. Changes in farm techniques on dairy farms in southeastern Minnesota during the last 30 years include the substitution of mechanical for animal power, the general mechanization of the farm business, and the adoption of new varieties of crops and new practices in crop and livestock production.

2. In general these new techniques have resulted in increased output per man, per acre, and per animal.

3. Labor saved by power machinery has been utilized largely by increased numbers of livestock.

4. Larger production of crops and livestock has increased both gross and net income per farm. But the expense per dollar of income has also increased since more of the goods and services used in production are now purchased rather than produced on the farm.

5. The increased earnings that result from the adoption of new production techniques are highest in years when the purchasing power of farm products is relatively high. Even with a moderately low purchasing power of farm products, the farmer still has a larger excess of income over operating expenditures. In general, it is only when price relationships are extremely un-

favorable to the farmer, as they were in 1932, that the use of new techniques may prove to be a hardship. Farmers could ease this situation by deferring the purchase and upkeep of equipment, buildings, and real estate improvements to years of more favorable price relationships.

6. New techniques in production adopted during the period covered by this study may result in wider fluctuations in income from year to year than occurred before their adoption even though the average gross and net incomes are higher.

7. The great variability of net earnings from year to year resulting from the use of new techniques calls for careful planning of capital investments and debt servicing by the farmer and perhaps a more flexible type of credit for farmers generally.

8. New techniques put an increasing burden on the starting farmer as they involve more capital investment in machinery and equipment, the purchase of more of the goods and services used in production, a larger size of business, and much more technical knowledge, mechanical ability, and business judgment.