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Supply Responses in Milk Production in Southeastern Minnesota [1]

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CONTENTS

INTRODUCTION

Income received by farmers in one region may be directly affected by production in other, widely separated, regions of the country. This interdependence between producing regions makes itself especially felt in an area where many enterprises are combined in the farm organization. In southeastern Minnesota, which is a transition area between the Corn Belt and the northern dairy region, dairying is combined with the production of hogs, poultry, and cash grain. Here the income and welfare of farmers are affected, both by the production of dairy products in Wisconsin and New England and by the production of hogs, corn, beef cattle, and poultry products in the Corn Belt.

In response to the prices resulting from this competitive situation, certain changes in production have occurred and are now occurring in southeastern Minnesota. Can these changes be used as a basis for estimating what the organization of agriculture in this area will be

some years in the future? Do the changes now in progress tend
to favor expansion of dairying rather than other enterprises in south-
eastern Minnesota? Will the competitive position of this area,
relative to other areas producing dairy products, be strengthened or
weakened in the years ahead? In general, over a period of time,
what responses to changes in price will be made in dairy production
in this area?

These are some of the significant questions toward which this
study is directed. In suggesting answers to them, a comparatively
new technique that can be employed in analyzing long-time changes in
production in relation to long-time changes in price is used. This
technique is based principally upon studies of individual farms. A
number of complete individual farm records, covering a period of
years, were examined. Changes in production were noted and reasons
for these changes were discovered through interviews with the farmers.
Production of dairy products under three different price situations
some years ahead was estimated for each of these farms by detailed
budgeting. For purposes of comparison, a situation in a particular
year was represented in terms of what is normal or usual. Against
this "normal" year, the effect of factors of long-time character was
measured. The basis for this type of research has been stated by
Black (2).[3][4]

In addition to the study of individual farms, a study was made
of past trends and developments in the larger area of which these
farms were a part. Future production for the area as a whole was
estimated by an extension of results from the budget analysis of the
individual farms and other supplementary material to the entire area.

Briefly stated, the procedure employed has a twofold objective:
(1) To study developments and trends in production on these indivi-
dual farms during the immediate past; and (2) to estimate probable or
expected production at several price situations some years ahead.
The analysis of the processes which have brought about responses in the
past is essential in estimating future responses of a long-time character.

This study of the southeastern Minnesota area is a part of a larger
research plan, the object of which is to compare interregional competi-
tion between several areas. Reports of similar studies of areas in
Vermont and Wisconsin have already been published (1, 3). Reports
for areas in southern New England and Michigan will be published
shortly. In the course of each of these studies, a supply schedule has
been worked out, showing the character of production responses to
price changes in the given area. When these schedules for the separate
areas are combined, they will show the conditions of supply for an
entire region. And when the regional supply schedules are related
to appropriate demand schedules, they will provide a more secure basis
than has so far been available for long-time estimates of production
and price for the eastern and western parts of the northern dairy
region.

AGRICULTURE IN SOUTHEASTERN MINNESOTA

The area dealt with in the present study embraces five counties
in southeastern Minnetosa—Dodge, Freeborn, Rice, Steele, and Wa-

seca (fig. 1). These five counties form one of the most highly developed agricultural areas in Minnesota. Approximately 95 percent of the area is farm land, and 71 percent of all the land is improved. Average value per acre ranks considerably above the average for the State.
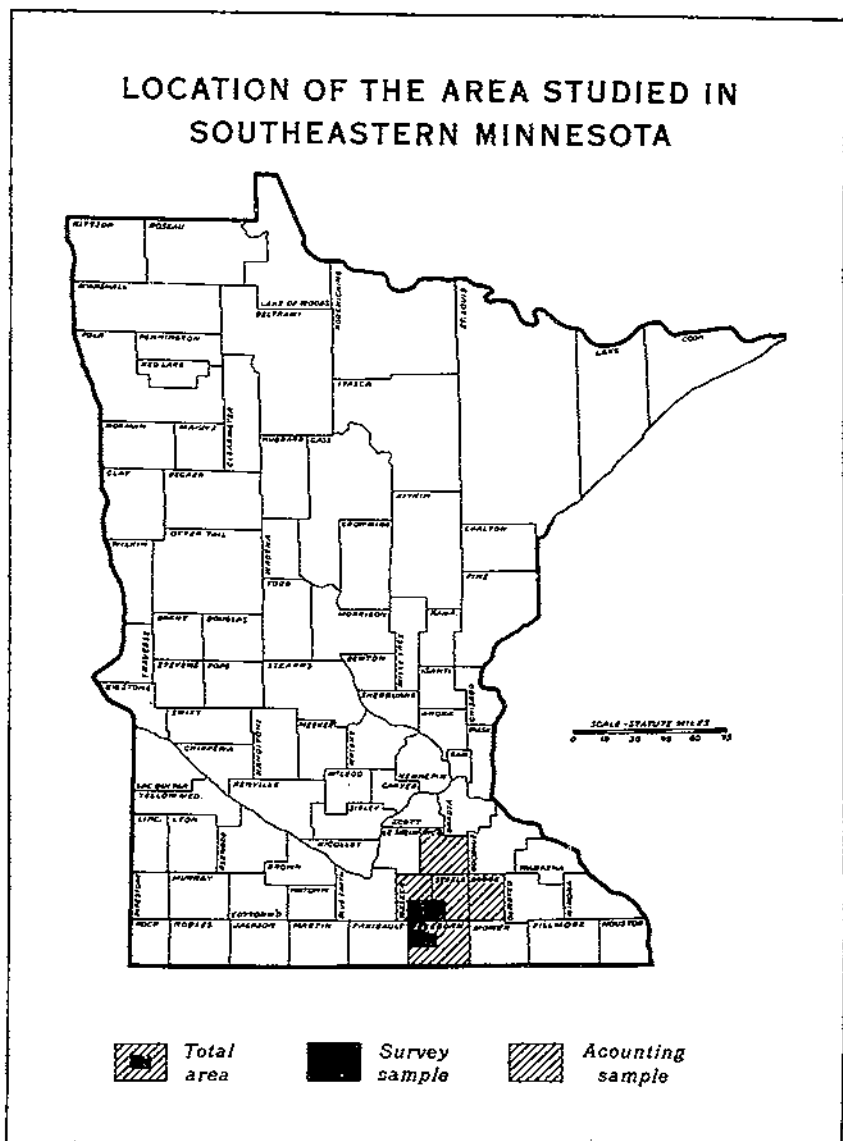
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FIGURE 1.—The area studied includes Freeborn, Waseca, Steele, Dodge, and Rice Counties. The accounting sample consists of 24 farms well distributed over the five-county area. Farm records, supervised by the southeastern Minnesota Farm Management Service (see footnote 5, p. 12) were kept on these farms. The survey sample consists of 150 farms in 9 adjacent townships located in Freeborn, Waseca, and Steele Counties, but mainly in the first.

TOPOGRAPHY, SOILS, AND CLIMATE

In topography, this general area varies from level to moderately rolling (fig. 2). Most of it is gently undulating. All the area has been glaciated, and much of it is covered with young gray drift. Over a smaller portion, the surface layer consists of old gray drift. In many places, a few boulders and smaller stones are present, but these do not ordinarily interfere with tillage operations. The soils are generally well supplied with lime, except in much of Dodge County and in the eastern parts of Rice and Steele Counties, where it is necessary to apply lime in order to grow alfalfa and sweet clover successfully. Natural drainage in most of the area is good, but numerous small wet depressions not suitable for cultivation are found, and in some flat areas artificial drainage by ditching or tiling has been necessary.

FIGURE 2.—Representative topography on a dairy farm in southeastern Minnesota. Because of the topography of the area, the use of legumes like the sweetclover in this scene and the application of manure are generally adequate as soil-conserving practices.

Because of the prevailingly level or gently undulating topography and the diversified cropping practices, soil erosion is not a serious problem on most of the farms. The principal soil conservation and fertility-building practices are the application of barnyard manure, the growing of alfalfa and clover, and the plowing under of sweetclover for green manure. Barnyard manure, in general, is available in sufficient quantity to cover all the land used for corn each year. On some of the sloping lands that are subject to erosion, strip cropping and contour cultivation are practiced. Most of the steeper slopes are used for permanent pasture or for woodland.

Climatic conditions are favorable for the production of corn, small grains, and forage crops. The average annual precipitation is 26 to 30 inches, and most of this falls during the summer months. The average length of the growing season is 140 to 160 days.

SETTLEMENT AND AGRICULTURAL DEVELOPMENT

Settlement and agricultural development of southeastern Minnesota began around 1855. Data on the growth of population and on the progress of agricultural development are shown in table 1. The population increased from 20,171 in 1860 to 103,729 in 1930. From 1860 to 1880 the rate of settlement was rapid; more than 7,000 new farms were established in the five counties during the 20 years. By 1880 the area was well settled and had taken shape as an agricultural community. . The period from 1880 to 1935 brought additional, although relatively smaller, increases in the number of farms, in the acreage of farms, and in the acreage of improved land. Significant agricultural developments since 1880 have been a considerable increase and improvement in farm buildings, farm equipment, and livestock, and a marked change from wheat farming to livestock farming (table 2).

TABLE 1.—*Population and agricultural development in southeastern Minnesota specified years 1860–1935* [1]

Year	Population	Farms	Land in farms	Improved land in farms	Percentage of all land in farms	Percentage of all land improved
	Number	*Number*	*1,000 acres*	*1,000 acres*	*Percent*	*Percent*
1860	20,171	2,118	365	87	22.5	5.4
1870	51,384	6,116	548	335	52.3	20.7
1880	74,739	9,432	1,319	1,009	81.4	62.3
1890	79,339	9,483	1,342	1,100	82.8	67.0
1900	92,542	10,487	1,527	1,242	94.2	76.6
1910	89,899	9,835	1,492	1,217	92.1	75.1
1920	97,745	10,095	1,465	1,149	90.4	70.9
1930	103,729	10,803	1,510	1,142	93.2	70.5
1935		11,219	1,534	1,156	94.7	71.3

[1] Counties included: Dodge, Freeborn, Rice, Steele, and Waseca with a total land area of 1,620,480 acres. Bureau of the Census.

TABLE 2.—*Value of farm real estate, number of livestock, and acreages of specified crops in southeastern Minnesota, specified years 1860–1935*

Year	Value of farm land and buildings	All cattle	All swine	Wheat	Corn	Hay and forage
	1,000 dollars	*Number*	*Number*	*Acres*	*Acres*	*Acres*
1860	2,213	16,160	10,789			
1870	13,565	44,856	18,865			
1880	25,007	65,813	42,074	414,655	52,810	144,716
1890	27,244	130,754	103,121	163,407	122,645	276,033
1900	57,028	191,178	142,565	302,463	128,195	238,774
1910	88,700	200,851	146,354	196,295	160,324	279,388
1920	212,226	220,341	172,204	151,032	167,261	245,759
1930	141,206	186,891	138,653	45,035	285,455	243,915
1935	86,862	228,738	104,381	35,744	332,773	219,895

Bureau of the Census.

TABLE 3.—*Population of four principal municipalities in southeastern Minnesota, 1900 and 1930*

Municipality	1900	1930
	Number	*Number*
Albert Lea	4,500	10,169
Faribault	7,868	12,767
Owatonna	5,561	7,654
Waseca	3,103	3,815
Total	21,032	34,405

Bureau of the Census.

Growth of population in the area since 1900 has been largely in the cities (table 3). In recent years the four largest cities have grown in importance as local markets and trading centers at the expense of numerous smaller places that have declined in activity and population.

PRODUCTS, MARKET OUTLETS. AND TRANSPORTATION

Diversified farming predominates (5). Several kinds of crops are grown, and several kinds of livestock are produced (fig. 3). Principal crops are corn, oats or mixed grain, and tame hay. Crop yields are higher than in many other counties in Minnesota. Most of the crops are used as feed for livestock, but some corn, barley, wheat, and other grains are sold for cash. The main livestock enterprise is dairying.
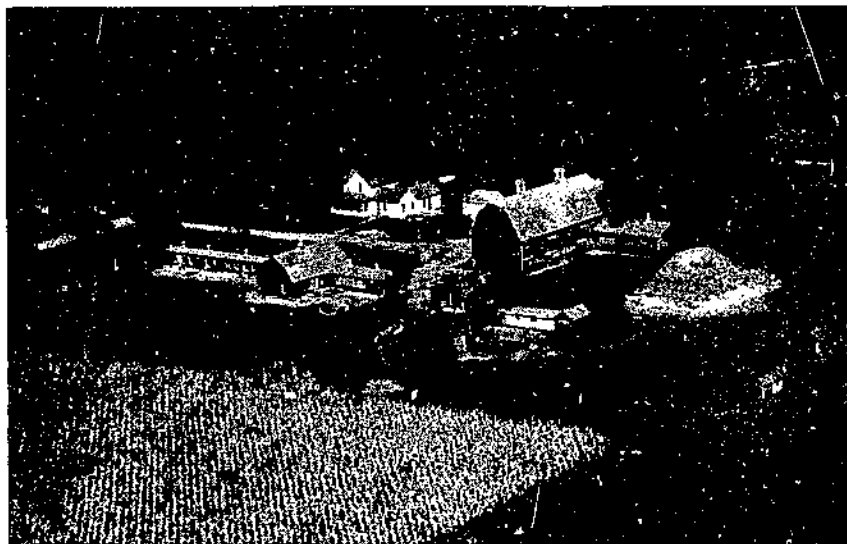
FIGURE 3.— An air view of a representative farmstead, southeastern Minnesota. The buildings on this farmstead show that hogs and poultry are combined with dairying in this area.

Hog production is the principal supplementary livestock enterprise, with poultry production a minor enterprise on most farms. Beef cattle and sheep are raised on relatively few farms.

Butterfat, sold as cream, is the largest single source of farm income. Most of the cream is delivered to creameries, and a small quantity is sold to cream-buying stations. Some farmers sell whole milk and cream to milk-distributing plants or directly to local consumers. In the eastern part of the area, whole milk is delivered to cheese factories.

In 1939, 78 creameries, well distributed throughout the area (7), were in operation in the 5 counties (9). Of these, 66 were organized on a cooperative basis and 12 were independent (fig. 4). Some of them marketed their butter through the Land O'Lakes sales agency, located in Minneapolis; others sold independently in the large national markets. Most of the patrons delivered cream in their own automobiles or trucks, but a few of the larger creameries operated cream trucks over regular routes.

Livestock marketed by farmers in this area is sold chiefly to packing plants in Albert Lea, Austin, and Winona, or is shipped to the market at South St. Paul.   With the increase in use of motortrucks, local livestock shipping associations in the area have declined in number and importance.   Most of the livestock marketed, especially that going to Austin and Albert Lea, is shipped by truck.   Trucking is done by many individual farmers as well as by commercial truckers and local buyers.

Eggs are sold to local stores and produce buyers.   Most of the poultry is bought by produce companies and independent traders. Surplus grain is usually sold to local grain elevators.

The area is well supplied with good highways.   Adequate facilities for rail transportation to all local and distant markets are furnished by the five railroads which traverse the area. ·

FIGURE 4.—Cooperative creamery in southeastern Minnesota.   This creamery is typical of the more recently built cooperative creameries.

RECENT TRENDS IN PRODUCTION

A study of the trends in production in the southeastern Minnesota area as a whole is essential as a background for a more detailed study of groups of individual farms and for an estimation of future production responses.

The trend in production of butterfat (fig. 5) has been decidedly upward during the period since 1927, with some short-time fluctuations caused principally by feed shortages resulting from unfavorable weather.   As measured by receipts of milk and cream at dairy plants, the average output during the 3 years 1936–38 was 12 percent greater than during the 3 years 1927–29.   This upward trend in dairying was undoubtedly encouraged by new developments in feed production, and particularly by the expansion of alfalfa acreages.

The trend in numbers of livestock was distinctly upward (fig. 6). Numbers of milk cows and other cattle increased, although the trend was temporarily interrupted by the feed shortages resulting from the droughts of 1934 and 1936. The number of hogs increased rapidly from 1929 to 1932 and remained large until 1934. Expansion in hog production during this period was greater than that of dairy cows. Production of hogs declined sharply in 1935 because of the Agricultural Adjustment Administration program and the drought of 1934. During the last few years it has increased somewhat, but has not regained its previous volume. At the end of 1927-38, the number of hogs was about the same as at the beginning of the period. The

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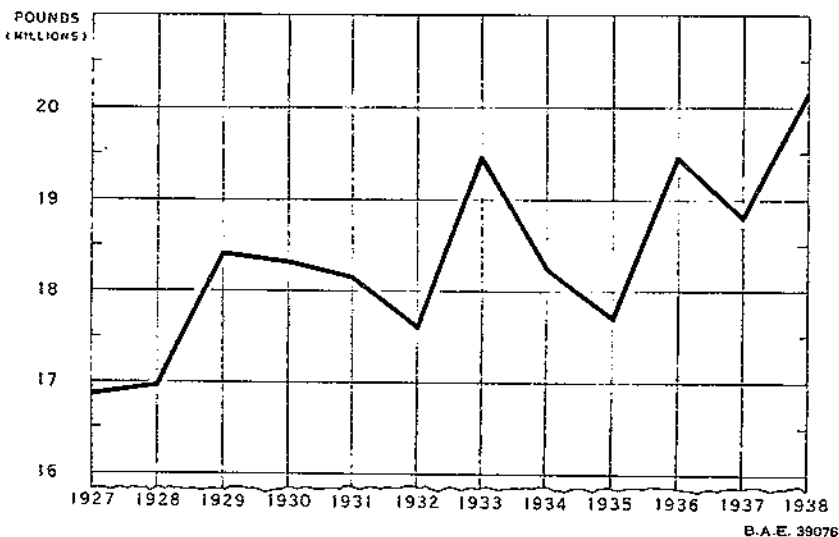
FIGURE 5.—Butterfat production in southeastern Minnesota, 1927-38. The trend of butterfat production in southeastern Minnesota as measured by quantities of cream and milk sold has been upward since 1927. Temporary interruptions were caused principally by feed shortages resulting from unfavorable weather. The average level of butterfat production during the last 3 years of the period covered was 12 percent greater than during the first 3 years. (See table 29 for method of estimating milk and cream deliveries in the area.)

number of horses declined throughout the entire period. The calculation of livestock units is found in table 30 (p. 55).

The chief acreage trends since 1927 show some expansion in total crop acreage, with considerable increases in corn, barley, and alfalfa, and reductions in acreages of other small grains and other hay crops. Total acreage in principal crops increased 8.6 percent. This percentage is based on a comparison of acreage averages for 1927-29 and 1936-38 (tables 31 and 32). About one-half of the increased acreage in principal crops was land previously in wild hay; the other half was previously untilled pasture and woodland. Acreage in corn increased 18 percent between these two 3-year periods. The average acreage in tame hay during the 3-year period 1936-38 was approximately 10 percent greater than for the 1927-29 period. Up to 1935

the total acreage of tame hay changed very little, but a continuous replacement of other tame hay by alfalfa was made (fig. 7).

The normal feed-producing capacity of the area, as estimated by applying normal yields to reported acreages, increased 13 percent from 1927 to 1938 (table 36). This increase was caused partly by
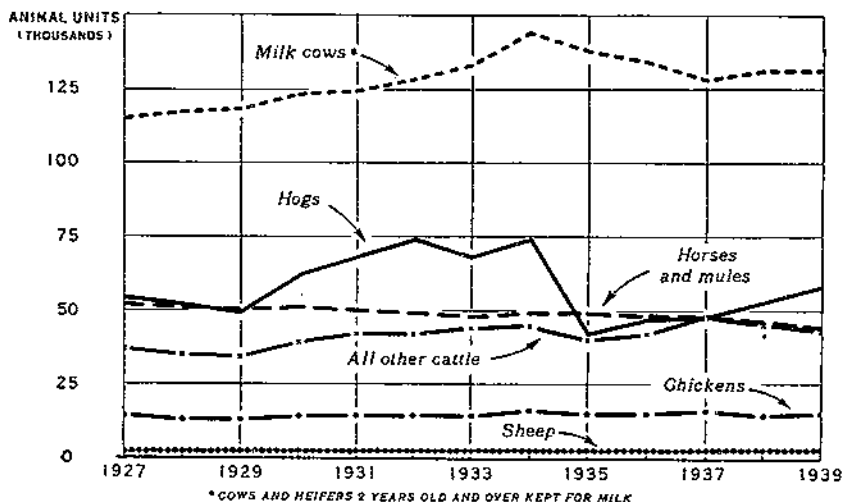
FIGURE 6.—Number of livestock, southeastern Minnesota, 1927–39. The upward trend in numbers of all classes of livestock, except horses, which took place during the period 1929–34, was interrupted by the conditions of drought and the prolonged depression. Toward the end of the period, evidences of a resumption of the upward trend were observed.
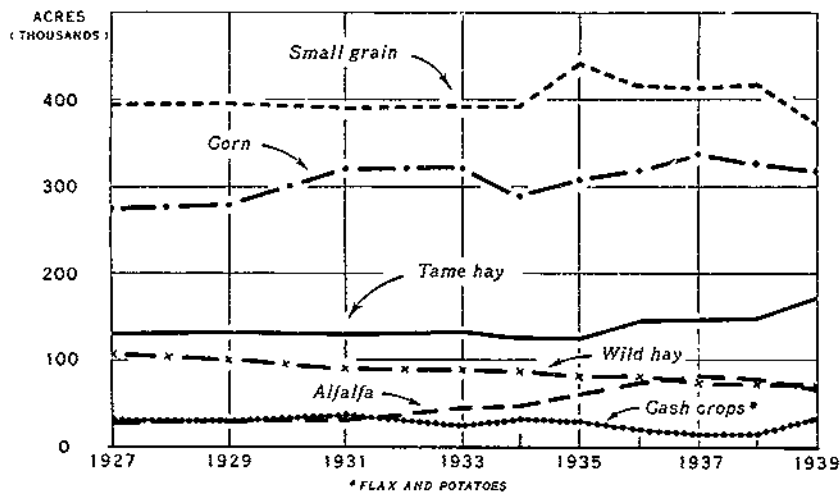
FIGURE 7.—Acreages of crops planted, by major classes, southeastern Minnesota, 1927–39. Outstanding trends in acreages of crops since 1927 are the marked increases in corn and alfalfa acreages, accompanied by a steady decline in wild hay.

expansion in acreages and partly by substitution of higher for lower producing feed crops.

In general, the yields of crops, besides being severely decreased by droughts in 1934 and 1936, declined during the period 1930–38 (table 34). This decline in yield tended to offset the expansion in acreages. Despite the increases in acreages and the changes toward higher yielding types of crops during the period, the level of feed production in terms of total digestible nutrients was barely maintained (fig. 8). The increase in butterfat production is attributable, not to increases in the total quantity of feed produced, but to an improvement in the quality of hay and to the release of feed for dairying through a decrease in the number of horses.
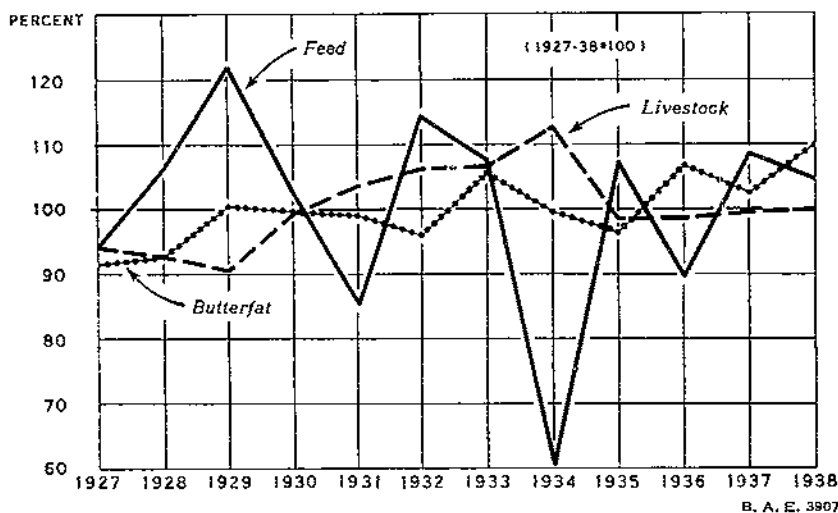
Figure 8.—Feed and butterfat production, and livestock numbers, southeastern Minnesota, 1927–38. Index numbers (1927–38=100). Fluctuations in total feed production are much larger than the fluctuations in butterfat production or in total numbers of livestock. Butterfat production is affected more quickly by changes in total feed production than are livestock numbers.

PRODUCTION TRENDS AND PRICE RELATIONSHIPS

Since 1927 the southeastern Minnesota area as a whole has been characterized by significant changes in the level of prices, with their consequent influence on agricultural production and farm income. With the decline in prices which began in 1929 and continued through 1933, expansion in production took place. This expansion was partly the result of an effort to offset the effect of price declines on farm income.

For the dairy enterprise, much of the original stimulus to expansion preceded the fall in prices. Livestock expansion was made possible by increases in total feed supplies, resulting principally from larger corn acreages and from the substitution of alfalfa for other hay crops. All livestock enterprises shared in this phase of expansion, but in varying degrees, owing to inherent differences. Little change in the relationships between prices favoring any one enterprise materially

from 1929 to 1933 was noted.   Improvements such as the introduction of alfalfa, however, tended to stimulate dairying to a greater degree than other livestock enterprises.   During recent years the rapid adoption of hybrid corn might have favored grain-consuming animals more than roughage-consuming animals except for the fact that improvements in corn yields have been offset by reduction in corn allotments.   The net effect has been to release additional acreages for roughage crops.

The drought of 1934 and the inauguration of the agricultural adjustment program together reduced feed supplies and livestock production.   As a result of smaller supplies and improvement in consumer buying power, prices began to recover, but all products did not
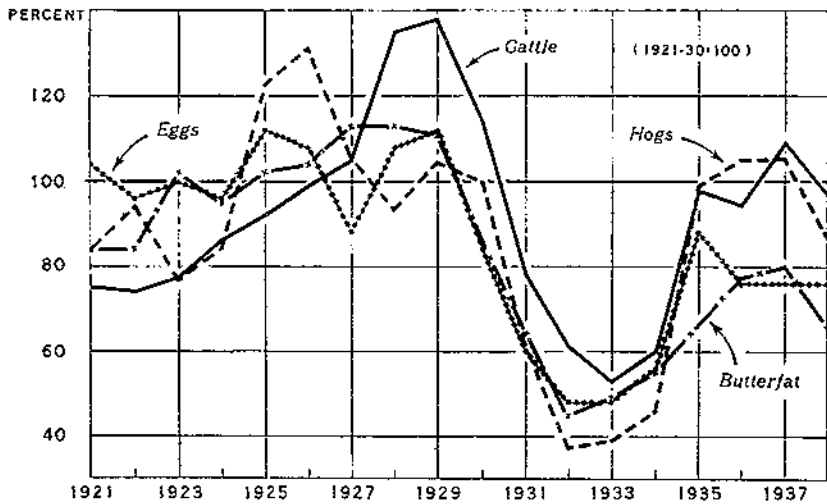
FIGURE 9.—Prices of principal farm products, southeastern Minnesota, 1921-38. Index numbers (1921-30 = 100).   The relationship between prices of butterfat and prices of other major farm products was favorable for dairy production during the 1920's if comparison is made with this relationship in 1910-14. Prices of butterfat were somewhat less favorable relative to hogs and cattle from 1935 to 1938.

share equally in this recovery (fig. 9).   Butterfat prices did not regain their previous relation to hog and beef cattle prices, although expansion and improvements in the raising of roughage crops and pasture tended partly to balance the less favorable price relationship by providing feed for dairy cows at low cost.

As the cash sale of grain is an alternative to feeding, the farm-production program is affected not only by changes in the relative prices of livestock products but also by changes in the price of feed grain.   The ratio of butterfat prices to grain prices was distinctly less favorable after 1934 than was the case for other livestock products (table 38).

With these exceptions since 1934, the relationships between prices of butterfat and other major farm products in this area do not appear to have changed significantly during the period 1927-38.   Prices of

the principal farm products in southeastern Minnesota are shown in figure 9. Complete series for 14 different farm products are given in table 37.

ANALYSIS OF PRODUCTION TRENDS ON SAMPLE GROUPS OF FARMS

This discussion of trends in farming in southeastern Minnesota has been in terms of area totals. In order to understand the reasons for these trends more clearly and to estimate probable future changes more exactly, a detailed study of the adjustments in production on individual farms in the area has been made. Two sample groups of farms were used. The first group, consisting of 24 farms scattered throughout the 5 counties of the southeastern area, will be referred to as the "accounting sample." The second group, consisting of 150 farms in a continuous area in Freeborn, Waseca, and Steele Counties, will be called the "survey sample."

THE ACCOUNTING SAMPLE

As the operators of the 24 accounting farms had participated in the Southeastern Minnesota Farm Management Service [5] during the 11-year period 1928–39, supervised records for these farms were available. Information in the records was supplemented by information procured through visits to these farms in 1939. Reasons for the short- and long-time changes in organization and practices revealed by the records were obtained from the farmers, as were facts about the soil and topography, drainage problems, and fertilizing and cropping practices. A brief history of each farm was obtained, as well as information relating to the farm family and to the amount of hired labor, equipment, and farm power used. In addition, the operator's plans for the future were recorded.

Presumably the farmers in this group are somewhat above average in ability. They have benefited, too, from their close contact with the farm-management specialists. The data on ages of operators show that they are a slightly younger group of farmers than the average for the area.

Farms in the accounting sample are well distributed over the five-county area (fig. 1). Naturally, some selection was involved in the process of getting participation in an accounting service over so long a period.

BUTTERFAT PRODUCTION

Total butterfat production on the 24 farms increased from 88,307 pounds in 1928–30 to 101,164 pounds in 1936–38, an increase of 14 percent over the 11-year period (table 39). Average production per farm was 3,679 pounds in 1928–30 and 4,215 pounds in 1936–38 (table 5). Except for the years 1935, 1937, and 1938, total production for

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[5] The Southeastern Minnesota Farm Management Service, which is a continuous project maintained cooperatively by the Bureau of Agricultural Economics and the Minnesota Agricultural Experiment Station, assists farmers in keeping farm records. A field man supervises these records and checks them for accuracy, completeness, and comparability. At the end of the year the records are sent to the Division of Agricultural Economics of the Minnesota Agricultural Experiment Station where they are closed and summarized. A report is prepared for each farmer in which is shown, not only an earnings statement and an analysis of his business, but also a comparison with similar information for the other farms included in the study. With this as a guide the farmer, with the help of the field man and other farm management specialists, analyzes his farm-management problems and develops his plans for future operations.

the group of farms increased each year over the production of the preceding year. The year of greatest production was 1936, when a total of 104,333 pounds of butterfat was produced.

Examination of individual farm records showed that the volume of butterfat production increased during the 11-year period on 13 farms, decreased on 4, and remained practically unchanged on 7. None of the farms showed a continuous increase or decrease in production throughout the period.

Butterfat production per cow, that is, the simple average of production per cow on each farm varied considerably from year to year but the average for the last 3 years was the same as for the first 3;
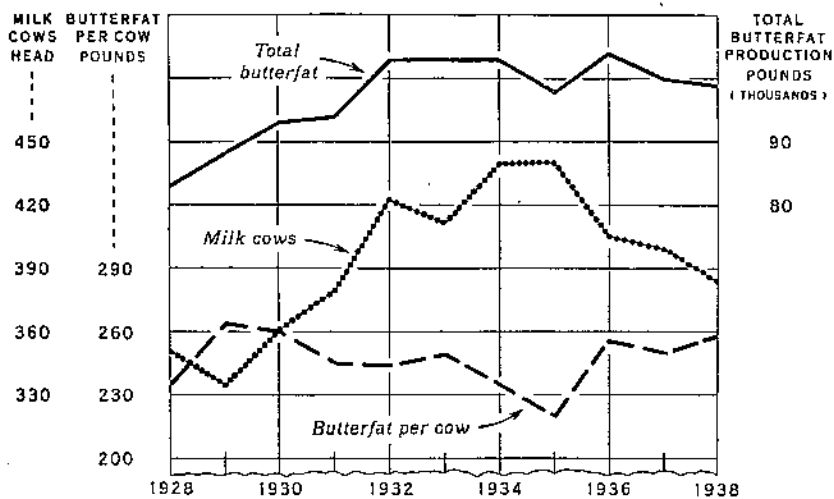
FIGURE 10.—Milk cows, butterfat production per cow, and total butterfat production on 24 accounting farms, southeastern Minnesota, 1928–38. Total butterfat production increased rapidly from 1928 to 1932, but has changed relatively little since that year. The upward trend was interrupted by feed shortages caused by drought and depression conditions. Since 1935, beef production has influenced trends in butterfat production on these farms. Variations in butterfat production per cow are more closely related to changes in the feed supply than are variations in the total number of cows.

that is, 267 pounds. On 8 farms, production per cow was greater at the end of the period than at the beginning; on 7, it was less; and on 9, it was about the same at the beginning and end of the period. The highest average production for the group of farms was attained in 1930, with 271 pounds; the lowest was an average of 248 pounds per cow in 1935.

The principal short-time factors affecting the quantity of butterfat produced per cow during this period were rate of feeding and disease. Yields of pasture and other feed crops were below normal on most farms in 1931, 1933, and 1934 as a result of insufficient rainfall and unusually hot weather (table 34). During these same years the number of cows was increased on most of the farms. This meant less feed available per cow and less butterfat produced per head (fig. 10). In 1936 feed production was again reduced by drought,

but the effect on production of butterfat at that time was not significant on most farms, because reserve supplies of feed were available from the good crops of the previous year and because the size of herds on many farms had been reduced.

Even in 1932–34 an increase in production per cow was apparent on a few farms. This was possible because of improvement in feeding and management. Feed supplies on some farms were reduced very little by drought before 1934.

During the second half of the period studied, an increased production per cow was brought about on a number of farms, largely as a result of more adequate feeding. In this part of the period, the quantity of roughage fed per cow increased considerably. The quality of roughage was improved by the greater proportion of alfalfa included. On some farms reduction in the quantity of concentrates fed·resulted in lower production per cow, whereas on others this reduction was more than offset by the increased quantity and improved quality of roughage fed.

The efficiency of dairy cows in converting feed nutrients into milk apparently remained about the same throughout the period. The quantity of total digestible nutrients (in addition to pasture) required by cows in producing a pound of butterfat varied only slightly from year to year. These variations appeared to be explainable largely by the variation in feed supplied by pasture.

The larger total butterfat production on the 24 farms in 1936–38 as compared with 1928–30 is explainable entirely by the 14-percent increase in the number of dairy cows. The same percentage increase in total production of butterfat was made. Average production per cow was the same in 1936–38 as in 1928–30.

LIVESTOCK PRODUCTION

DAIRY COWS.—Numbers of dairy cows at the end of the period as compared with the beginning were increased on 13 farms, decreased on 5, and relatively unchanged on 6. The average number per farm was 15 in 1928 and 16 in 1938. The largest numbers of dairy cows were kept in 1934 and 1935, when the average number per farm was 18.

Farmers who increased their herds gave price conditions and new techniques contributing to an increase in production of feed as their principal reasons for doing so (11). The low level of agricultural prices during the years following 1930 caused farmers.to look for ways of increasing their incomes. During the period 1931–34, the relationship between the price of butterfat and the prices of other farm products was about the same as it had been in the years immediately preceding. Farm records indicated that dairy production was a relatively profitable enterprise on most of the farms studied. Farm-management specialists recommended increases in the number of milk cows on several of these farms as a means of enlarging the farm income. Dairying offered an opportunity for expanding the volume of business without much increase in operating costs. Most of the farmers who increased the size of their herds in this period did not increase the

amount of hired labor used but worked harder themselves or had more help from other members of their families.

The chance to buy or rent additional land for feed production was an important factor enabling several farmers to increase the size of their dairy herds. As there was little chance to sell dairy breeding stock at satisfactory prices, some farmers who normally made such sales kept these cattle, hoping for an improvement in prices. This resulted in larger herds than would otherwise have been kept on these farms.

Most of the farmers who decreased the size of their dairy herds said they were influenced by price relationships. For example, the higher price of beef relative to the price of butterfat in 1935 and later years was apparently an incentive for some farmers to cull their dairy herds more closely. A few farmers reduced the number of milk cows kept and increased the number of hogs produced or the number of cattle raised for beef. Some farmers had to dispose of a number of their dairy cows during the period because of diseases, especially Bang's disease and garget. Disease also interfered with replacement plans.

Hogs.—The most significant changes in hog production on the 24 farms were the increased number of litters raised in 1931, 1932, and 1933, and the marked reduction in 1934 and 1935. The increased production following 1930 was brought about principally by farmers seeking to enlarge the size of their business in an effort to maintain their incomes in spite of the low prices of agricultural products. The reduction in 1934 and 1935 was a result of feed shortage due to the drought of 1934 and of the corn-hog program in effect in those years. In 1936, with corn-hog quotas removed, hog prices relatively high, and feed supplies replenished by the good crop of the previous year, production of hogs was readjusted upward. The total quantity of pork produced per farm was about the same in 1936–38 as it was in 1928–30.

The hog enterprise may be expanded or contracted relatively quickly. Most of the changes in numbers of litters raised and in the weights at which hogs are sold are made as adjustments to changes in relative prices and available feed supplies.

Beef Cattle.—Before 1936, feeding of cattle primarily for production of beef was a regular enterprise on only 3 of the 24 farms. But the sharp rise in price of beef in 1935 and the relatively high price of beef cattle since that time have turned several other farmers in the group to the production of beef. As more feed was grown on farms and as lack of available labor tended to restrict further increases in dairy cows, beef production became favored as an enterprise that would add to income without materially increasing labor requirements. In 1938, 13 of the 24 farmers were feeding some cattle for beef. Most of these farmers bought and fattened young steers and heifers. Two farmers produced cross-bred calves from their dairy cows and beef bulls.

Sheep.—Production of sheep has been a relatively minor enterprise. During the last decade, however, the number of farmers keeping sheep increased and many of the farmers already raising sheep enlarged the

size of their flocks. The number of ewes on the 24 farms increased from an average of 4.4 per farm in 1928–30 to 10.6 in 1936–38. In 1928, 6 of the 24 farmers had flocks of sheep, and only 2 of these flocks contained more than 20 ewes; in 1938, 9 farmers had flocks, 5 of which included more than 20 ewes.

The principal reason given for this increase in numbers of sheep was the decline in agricultural prices and the desire of the farmers to maintain their incomes. To buy a few ewes required a relatively small investment. If some sheep were already being raised, little or no additional cash outlay was involved in a moderate increase in the size of the flock. Sheep, in many cases, could be economically fed on available roughage, aftermath, weeds around the farmstead, and a small quantity of grain. Principal obstacles to increased production of sheep on the majority of farms were lack of adequate fencing and competition of other livestock and crops for the land required for pasture.

POULTRY.—Production of poultry was expanded on most of the 24 farms during the period. The average number of hens per flock was increased by 30 percent, egg production was increased by 64 percent, and the number of chicks started was increased by 29 percent. Except for declines in 1932 and 1935, the trends in size of flocks and in total production of eggs moved upward from the beginning to the end of the period. The number of chicks started was increased rapidly from 1928 to 1933. After 1933 the number was somewhat irregular from year to year, but averaged higher than during the first years.

The average size of flocks in 1936–38 was 203 hens kept, plus 667 chicks raised each year. About 145 eggs per hen were produced annually.

Principal factors causing farmers to increase the size of their poultry enterprises were price conditions and new techniques, an appreciation of which was brought to the farmers by farm-management specialists. Farm records showed that on most farms poultry gave a relatively high return over feed costs. Expansion of the poultry enterprise usually meant a chance to invest more labor at productive work without a large expenditure for additional equipment. Prices of poultry and eggs were relatively more favorable than prices of hogs in 1928 and 1929 and again from 1932 to 1934. As hogs were the principal livestock competing with poultry for grain on these farms, these price relationships stimulated the increase in production of poultry. The spread of knowledge of new techniques of feeding, housing, and managing the laying flock to avoid disease and to produce eggs more economically was another important factor in causing farmers to increase the number of hens. Improved techniques in the raising of young chicks also encouraged expansion of this phase of the enterprise. The principal factors accounting for increased production of eggs per hen were more liberal feeding, increases in protein content of the rations, and the keeping, in general, of higher quality hens.

Decreases in size of flock and in production of eggs per hen occurred on a few farms. Reasons given for decreases in size and efficiency of the enterprise included disease, decreases in family labor, competition

with other livestock for feed or time, and the operator's dislike of caring for hens or chicks.

CROP PRODUCTION

Acreage of corn on the 24 farms increased from an average of 42 acres per farm in 1928–30 to 50 in 1936–38. Corn acreage trended upward continuously from 1928 to 1933, was reduced in 1934 and 1935, increased again substantially in 1936 and 1937, and was slightly reduced in 1938. The average acreage planted to corn was larger at the end of the period than at the beginning on 16 farms, and was somewhat smaller on 8 farms.

Farmers increased their acreage of corn because they wanted larger production of feed. Farm records showed that corn was a high-producing feed crop. Farm-management specialists recommended an increase in corn acreage on a number of farms. Most farmers aimed to grow all the corn practicable in what they considered a good cropping system, or all they could find time to cultivate properly. The chance to operate additional land made it possible for several farmers to increase their acreage of corn.

Acreage of corn was reduced on most of the farms in 1934 and 1935 as a result of participation in the corn-hog program. In 1936 and following years, corn acreage was larger, and several farmers indicated that they might have planted still more corn had they not been cooperating with the agricultural conservation program. On a few farms the acreage in corn was smaller at the end of the period than at the beginning, because of a decrease in the acreage of cropland rented by these farmers.

The total acreage of small grain on the 24 farms showed no noticeable trend from 1928 to 1938. Some of the farmers who rented or bought additional land did increase their acreages of small grain, but these increases were offset by decreases on the farms which were reduced in acreage or on which the proportion of cropland in corn, pasture, or hay increased.

Although the total acreage in small-grain crops remained about the same, some significant changes occurred in the acreages of individual grains. These changes are indicated in table 4, in which the average acreages in 1928–30 and in 1936–38 are shown. Increases were made in the acreages of barley, oats and barley, oats and wheat, and wheat. A reduction occurred in miscellaneous grain crops such as flax, flax and wheat, and oats with barley and wheat. The most important decrease was made in the acreage of oats.

TABLE 4.—*Acreages of small grains on 24 accounting farms, southeastern Minnesota, at beginning and end of the period, 1928–38*

Crop	1928–30	1936–38	Crop	1928–30	1936–38
	Acres	*Acres*		*Acres*	*Acres*
Oats	361	210	Winter wheat	27	65
Barley	232	265	Miscellaneous grains	97	49
Oats and barley	414	484			
Oats and wheat	45	76	Total	1,199	1,191
Spring wheat	23	42			

Acreage of oats on the 24 farms declined 42 percent during the period. Acreage harvested annually per farm averaged 15 acres for the first 3 years, 11 in the middle of the period, and 9 for the last 3 years. Eleven farmers discontinued raising oats altogether, and 8 reduced their acreages of the crop. Principal factors responsible for decreases in acreage of oats were the farm-record analyses, direct recommendations by farm-management specialists, and the farmers' own observations. Records showed that on most of the farms oats usually yielded fewer pounds of total digestible nutrients per acre than did barley. After 1928 the growing of oats and barley mixtures for feed became more and more common in the area, and this practice was generally recommended by farm-management specialists as a better practice than the raising of clear oats. Mixtures of oats and wheat were raised by some farmers who did not like the oats and barley mixture. Other farmers increased their acreage of oats and wheat mixture because of satisfaction with it as a poultry feed. Increases in the acreage of wheat and of clear barley were made principally because of the rise in the relative prices of these grains in the last half of the period.

SUMMARY OF CHANGES IN ACCOUNTING-SAMPLE FARMS

The principal net changes occurring on these 24 accounting farms appear to be much like those for the area as a whole. Important factors in farm organization and management are shown in table 5 and figure 10. Butterfat production and milk-cow numbers increased 14 percent over the 11-year period. Additional feed was provided by a 7-percent increase in average size of farm and a 15-percent increase in cropland. Acreage devoted to corn, tame hay, and rotation pasture increased. The proportion of alfalfa to other kinds of hay also increased.

The numbers of poultry and sheep appeared to have increased relatively more for the 24 farms in the accounting sample than for the entire area, whereas the number of hogs remained fairly constant, as compared with a net decrease in the area. The number of horses declined relatively more than in the area as a whole. Apparently these farmers have gone further in substituting tractors and truck power for horse power.

Significant changes were made in feeding practices. The quantity of silage and concentrates fed to dairy cows was decreased, but as the quantity of hay was increased, practically no reduction was made in the total quantity of digestible nutrients fed per cow. In 1932–34 feeding was somewhat below normal levels because of limited supplies of feed. Primarily as a result of changes in the rate of feeding, butterfat production per cow showed a decrease in the middle of the period, but was the same in 1936–38 as in 1928–30. In poultry feeding, an upward trend throughout the period is shown in the quantity of concentrates fed per hen. Production of eggs per hen did not change significantly during the first half of the period but by the end it had increased by about the same proportion as the increase in rate of feeding.

TABLE 5.—*Summary of important factors in farm organization and management: Averages per farm for 24 accounting farms, southeastern Minnesota, 1928–30 and 1936–38*

Factor	Unit	Annual average 1928–30	Annual average 1936–38	Factor	Unit	Annual average 1928–30	Annual average 1936–38
Farm acreage	Acre	170	182	Feeding practices:			
Cropland, total	Acre	126	145	Hay fed per cow	Pound	3,835	4,168
Corn	Acre	42	50	Silage fed per cow	Pound	7,876	7,491
Small grain	Acre	50	50	Concentrates fed per cow	Pound	2,072	1,779
Tame hay	Acre	18	24	Total digestible nutrients fed per cow	Pound	4,706	4,693
Tillable pasture	Acre	15	20				
Miscellaneous crops	Acre	1	1				
Livestock:				Concentrates fed per hen	Pound	109	132
Dairy cows	Number	15	17	Production:			
Other cattle	Number	18	21	Butterfat	Pound	3,679	4,215
Feeder cattle	Number	1	4	Butterfat per cow	Pound	267	267
Litters of hogs	Number	11	11	Eggs per hen	Number	121	145
Hens	Number	157	203				
Chicks hatched or bought	Number	517	667				
Ewes	Number	4	11				
Work horses	Number	6	4				

THE SURVEY SAMPLE

The 150 farms in the survey sample form a continuous area in parts of 9 adjoining townships in Freeborn, Waseca, and Steele Counties, with the largest number in Freeborn County. As many of the farms in the sample area are included, the group probably represents a wider range in sizes and types of farms than does the accounting sample.

Available information for these 150 farms was less complete than for the farms in the accounting sample. In the summer of 1936, farm-management records were obtained on 122 of them. In 1939, historical data, showing butterfat deliveries and changes in organization on 52 of the farms, were obtained; this information was complete for 42 of these farms and only partial for 10. In addition, interviews with the operators of these 52 farms were held in 1939, and reasons given by them for the changes that had been made were recorded. Data on crops were also taken from AAA records, and data on livestock from county assessors' records. For 24 farms, all these sources of information were available and these farms were used for budgeting purposes.

BUTTERFAT PRODUCTION

On the 42 farms for which complete historical data on butterfat deliveries for the period January 1927 through May 1939 were available, the total production of butterfat increased rapidly from 1928 to 1934, but declined sharply in 1935. It recovered temporarily in 1936 and fell off again in 1937 and 1938 (fig. 11).

Table 6 gives a detailed year-to-year examination of these changes, showing the number of farms that increased their butterfat produc-

tion from one year to the next, the number that decreased it, and the number that did not appreciably change it.   This table illustrates the fact that neighboring farmers do not all increase or decrease their production at the same time.   The variety of factors that influence the production of butterfat on individual farms accounts for this variation.

The general direction of change over the period on the same farms can be compared by calculating the percentage change in production for each farm.   The net increase in production on the 42 farms from

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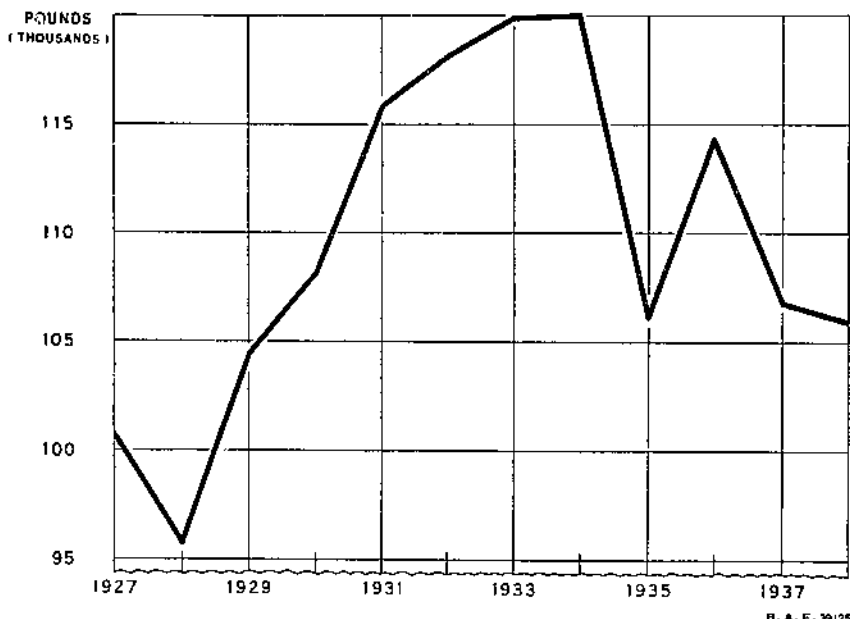
FIGURE 11.—Butterfat production on 42 survey farms, Freeborn County, 1927–38.   Quantities of butterfat sold increased rapidly up to 1934 when droughts and protracted depression brought a decline.   Since 1935, unfavorable relative prices of butterfat have limited production.

1927–29 to 1936–38 was 8.6 percent, but there was much dispersion about this percentage, as shown in table 7.

Individual production curves for 21 of the farms—half of those in the group—were similar to the average curve for all 42 farms in trend and pattern of response for the entire period.   On these 21 farms production increased up to 1933–34, followed by a decline.   Considerable differences in the level of production toward the end of the period, as compared with the beginning were found.   The average level of these 21 farms was not far from the general average obtained for all farms.

Production curves for the other 21 farms showed a variety of patterns.   On some farms hardly any change in production had been made during the entire period.   Other farms revealed either a consistent upward or a consistent downward trend throughout the period. A few farms indicated a wholly irregular pattern.

TABLE 6.—*Index numbers of butterfat production (quantities sold) on 42 survey farms, and distribution of farms by change in production from the preceding year, Freeborn County, 1927–38*

Year	Index numbers of butterfat production (1927–38= 100)	Change on individual farms		
		Increases	No appreciable change	Decreases
		Number	*Number*	*Number*
1927	91.9			
1928	87.3	14		28
1929	95.3	26	1	13
1930	98.6	24		18
1931	105.0	27	3	12
1932	107.7	19	3	20
1933	109.3	22	1	19
1934	109.4	19	4	19
1935	96.8	12	2	28
1936	104.3	25	2	15
1937	97.3	15	1	26
1938	98.6	20	3	19

TABLE 7.—*Distribution of 42 survey farms according to change in butterfat production, Freeborn County, 1927–29 to 1936–38*

Change in butterfat production (percent)	Farms	Change in butterfat production (percent)	Farms
Decreases:	*Number*	Increases—Continued:	*Number*
41 to 50	1	90 to 99	1
31 to 40		100 to 109	
21 to 30	4	110 to 119	
11 to 20	6	120 to 129	
1 to 10	5	130 to 139	
Increases:		140 to 149	
0 to 9	7	150 to 159	
10 to 19	5	160 to 169	
20 to 29	5	170 to 179	1
30 to 39	3	180 to 189	
40 to 49	2	190 to 199	
50 to 59	1	200 to 209	1
60 to 69			
70 to 79		Total	42
80 to 89			

In discussing the causes for the increase in production of butterfat up to 1934, the 21 farmers with similar production patterns mentioned favorable price conditions more often than any other factor. Prices of butterfat were favorable, both as to level and in comparison with hog prices during the first years of this period. Some farmers attributed their increases to increased production of feed. Others attributed their increases to improvement in cows. These two last causes were given with equal frequency. A few farmers named increases in available labor supply, and some mentioned the releasing of feed for cows through a reduction in numbers of hogs.

Several factors were thus cooperating to bring about the marked increase in production of butterfat from 1928 to 1934. Once production had begun to increase, it tended to continue, especially as the changed economic conditions after 1930 placed a premium on large production to counterbalance the decline in prices and in farm income. The fact that prices of cows were low relative to butterfat prices in 1933–34 (table 38) also tended to reduce the number that would have been culled and sold.

At the same time, as indicated by the farmers interviewed, the responses to changes in the price situation were further stimulated by several production factors. Some of these, like the continuing expansion of alfalfa acreage, were of a long-run character. The large yield per acre of all crops in the years 1928–30 was an additional stimulus to expansion in butterfat production.

In discussing the causes of the decline in production since 1935, the interviewed farmers referred most frequently to the sale of cows. Decreases in available labor, poor condition of cows, and diversification of enterprises were also mentioned. Other causes given were Bang's disease, low prices of butterfat, lower rates of feeding, and lower production of feed.

The sharp reduction in production of butterfat after 1934 was closely related to feed shortages caused by the droughts of 1934 and 1936. But it was also influenced by changes in price situations and the resultant adjustment in farm organization. Butterfat prices were less favorable relative to prices of hogs and beef cattle after 1934 than before. These changes in price situations caused some shift toward beef and cash-crop enterprises.

This price situation was probably one of the main factors in preventing a resumption of the upward trend in production of butterfat toward the end of the period, when an ample feed supply had again become available.

The farmers were asked about their future reactions to prices. At the time of the interview, butterfat was selling for 25 cents a pound. The farmers were asked what adjustment they would make if prices of butterfat continued at that low level. Twenty-one farmers out of 39 said that they would reduce production; the other 18 said that they would make no change. They were then asked whether they would change production if prices of butterfat went up to at least 35 cents, other prices remaining as they were. Only 14 out of the 39 indicated that they would increase production under these conditions.

This suggests that production of butterfat among this group of farmers may be more elastic relative to a downward than to an upward change in butterfat prices. Results from detailed budgeting for individual farms confirm this observation, as shown later in this bulletin.

LIVESTOCK PRODUCTION

Dairy Cows.—Like butterfat production, the number of dairy cattle increased from 1927 through 1934 and then declined but the number was higher at the end of the period (1927–38) than at the beginning (table 8). The decline in dairy cattle was accompanied by a slight increase in beef cattle.

During 1931–34 exceptionally large numbers of heifers were raised, and this expansion was subsequently reflected in an increase in the number of cows. As prices for cows were very low, far fewer cows were culled or sold for production during some of these years than was normally the case. In 1935, the number of young stock dropped sharply, principally as a result of the 1934 drought, which considerably reduced feed supplies.

The relationship between the number of cows and the number of heifers is a flexible one (table 8), and in the short run, is probably influenced mainly by feed supplies and price relationships.

TABLE 8.—*Index numbers of livestock, 42 survey farms, Freeborn County, 1927–38*

[1927–38=100]

Year	Cows [1]	Heifers [2] and bulls	Horses	Hogs [3]	Year	Cows [1]	Heifers [2] and bulls	Horses	Hogs [3]
1927	86	93	102	......	1933	106	110	97	105
1928	89	95	103	--	1934	112	114	100	83
1929	95	89	102	108	1935	111	85	104	107
1930	100	88	102	108	1936	103	114	99	102
1931	98	110	104	101	1937	104	95	98	89
1932	98	109	100	95	1938	99	99	94	102

[1] 3 years old and over.   [2] From 1 to 3 years old.   [3] 1929–38=100.

Most of the herds on the 42 farms consisted of Holsteins. There were 29 Holstein herds, 3 Holstein and Guernsey mixed, 2 Holstein and Shorthorn mixed, 2 Jersey, and 6 Shorthorn. Three of the farmers having Holstein herds had crossed with beef bulls for the purpose of raising baby beef during the period 1934–38, but in their opinion this breeding method had not proved satisfactory. In 1938, when they began to build up the herds that had been reduced for lack of replacement during the preceding years, they resumed the use of Holstein bulls. They said that pure beef breeds would be more successful for baby-beef production. Three farmers regularly bought feeder cattle for feeding out, in addition to keeping a dairy herd. Farmers with Shorthorn cattle fed out calves for beef production. Farmers having Holstein cows sold practically all bull calves as veal calves, and raised most of the heifers. These practices varied somewhat with price conditions.

OTHER LIVESTOCK.—Little trend in hog numbers has been noted since 1929. The annual variations are due largely to changes in corn supplies. Although farmers participating in the corn-hog program reported a decrease, much of this decrease appeared to have been offset by nonparticipating farmers.

Numbers of poultry on these 42 farms apparently has undergone little change during the last 12 years. Twenty-five of the farmers reported no change, 7 reported increases, and 10 reported decreases. Reasons given by farmers for both increases and decreases are of great variety, many of them strongly colored by purely personal considerations.

For the last few years the trend in the number of horses has been downward chiefly because of the general-purpose tractors.

Although only a few farmers are keeping sheep, the number has tended to increase during the last 7 or 8 years.

CROP PRODUCTION

From 1927 to 1938, the total acreage of farm land and cropland on the 42 farms changed very little. The average acreage operated per farm increased from 166 acres in 1935 to 171 acres in 1938, only 7 farms showing a change in acreage during the period. Seventy-five percent of all farm land was in crops, and this proportion remained practically unchanged.

But changes in the cropping pattern did occur, and they brought a larger feed-producing capacity per farm. Alfalfa and, more recently, reed canary grass and soybean hay contributed to this increase.

Hybrid corn and mixtures of small grains also considerably increased feed production.

Exact information about changes in acreage of the various crops during the period was not available for all individual farms, although the general character of the changes was learned through interviews with the farmers. For 23 of the 42 farmers, however, continuous data on crop acreages were obtained from agricultural conservation program records.

In 1938 the percentage of soil-depleting crops on these 23 farms was almost 15 percent less than it was in 1932 (table 9). This reduction was confined chiefly to corn. The acreage taken out of corn had been transferred mainly to rotation pasture, soybeans for hay, and other hay crops. No material increase in alfalfa acreage was made.

TABLE 9.—*Average acreage of cropland per farm and percentage distribution of cropland by designated classes on 23 farms participating continuously in AAA program, Freeborn County, 1932–38*

Year	Average cropland per farm [1]	Soil-depleting crops			Soil-conserving crops			Total crops
		Corn	Other	Total	Alfalfa	Other	Total	
	Acres	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1932	127.9	46.7	39.2	85.9	10.5	3.6	14.1	100.0
1933	128.0	42.8	41.7	84.5	11.2	4.3	15.5	100.0
1934	127.5	39.8	(²)	(²)	(²)	(²)	(²)	100.0
1935	127.6	34.5	50.1	84.6	10.0	5.4	15.4	100.0
1936	128.0	36.7	37.8	74.5	12.4	13.1	25.5	100.0
1937	135.6	34.2	38.2	72.4	13.5	14.1	27.6	100.0
1938	139.2	31.9	39.4	71.3	10.5	18.2	28.7	100.0

[1] Cropland follows the classification used by the Agricultural Conservation Program, it includes rotation pasture but excludes wild hay.
[2] Data not available.

On the remaining 19 farms, which either had never participated or had participated only occasionally, the trends in the cropping program apparently differed rather widely. These farms had more corn, and less of the soil-conserving crops. Some significant changes in small grains had taken place; the trend had been toward the mixed grains, which have a higher feed production per acre than the clear small grains. Alfalfa acreages had been either maintained or expanded, and reed canary grass had come in as a new crop.

The introduction of hybrid corn by these farmers began in 1932, but progressed slowly until 1938, when many started to raise it. In 1939 all but two of these farmers were raising hybrid corn either on all of their corn acreage or on a part of it.

SUMMARY OF CHANGES IN SURVEY-SAMPLE FARMS

The principal net changes on these 42 farms from 1927 to 1938 were in the same general direction as for the entire area, but were much less pronounced. Production of butterfat increased over the period, but the net upward movement was relatively less than that for the area as a whole and less than that for the accounting sample. Livestock numbers showed an increase in milk cows and young cattle, and decreases in horses and hogs.

Only slight changes in acreages of farm land and cropland were registered. Alfalfa and legume roughage increased moderately.

It is possible that the slighter degree of change in farm organization shown by this group may be explained at least in part by the tenure situation. Thirty-two of the 42 farms had been operated by the same farmer for 15 years or longer, and 4 for 12 years or longer. This suggests that, as a group, these farmers were better established and probably slightly older than the average for the area.[6] Nearly all were owner-operators. Several of the tenants were relatives of their landlords. No doubt, continuing incentives to further adjustment were somewhat less stimulating on many of these farms than would have been true on farms with younger, less firmly established operators. This may partly account for the failure of butterfat production to expand more after 1934.

PROSPECTIVE TRENDS IN PRODUCTION

The preceding analysis of trends in production not only furnishes an explanation of the reasons for past changes in the southeastern Minnesota area, but is an aid in estimating prospective trends.

One method of estimating future production for the area might be simply to extend these trends. But it is known that other developments outside the area may so change price relationships that the production of butterfat or hogs or beef in the area may be greatly modified. Until more exhaustive studies of trends in long-time demand for individual commodities and in supply responses in other areas are available, it will not be possible to estimate future prices or price relationships with any degree of assurance. It is necessary, therefore, to estimate future responses in production under each of several different price situations that may develop.

This is the approach that has been used in this study. Three possible price situations have been considered, and the probable trend of butterfat production under each has been estimated: (1) A situation which continues 1935 normal price relationships; (2) a situation in which prices of butterfat are somewhat more favorable; and (3) a situation with somewhat less favorable butterfat prices. These three price situations have been labeled A, B, and C, respectively. For 1935 normal price relationships, the relationships existing in the 10-year period, 1921–30, have been used. This was a relatively stable period for prices as compared with the more recent years. The average price of butterfat in the area in the record year 1935 was used in ascertaining the normal level of prices, and the prices of products and cost items were adjusted to this level in accordance with the 1921–30 average relationships. The more favorable butterfat prices have been considered as 20 percent above and the less favorable as 20 percent below these 1935 normal prices.

BUDGET-ESTIMATE PROCEDURE

Farm budgeting is an analytical technique for comparing net returns from several alternative organizations of an individual farm. The method has been developed and used in farm-management work for various purposes. As applied to the present purpose it furnishes a basis for determining what particular organization is most likely to

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[6] According to the United States Census of 1935, 53 percent of the owner-operators in southeastern Minnesota had operated the same farms for 15 years or more.

be in effect at some future date under specified conditions. Important elements of judgment are involved in the successful application of the budgeting method, but this is equally true of any other method that may be used in making future estimates. The reliability of the results obtained will depend in large measure upon the adequacy of the basic data. To the extent that objective data are available, the budget method provides a systematic procedure for carefully weighing the elements of the problem and reducing to a minimum the field to which judgment must be applied.

In the estimates undertaken in this study, careful and detailed records have been available for most of the farms budgeted. Yet for some elements in the problem, it has been necessary to rely upon the judgment of persons who are familiar with farm practices in the area as to the course that farmers will be likely to pursue.

As applied to an individual farm, the budget summarizes the various available resources, outlines some of the possible alternative combinations of crop and livestock enterprises that may conceivably be undertaken, and for each combination presents a consolidated statement of receipts and expenses. The net return from each budgeted combination is then the basis for learning which organization is most profitable.

Basic data for budget estimates of future production on individual farms in southeastern Minnesota were drawn from two selected sample groups of farms. From the 150 farms in the survey sample, 24 farms, representing various types of situations, were selected one group for budgeting. The 24 accounting farms scattered throughout the 5 counties made up the other group. A period of about 10 years has been considered; beginning with records for 1935, estimates have been prepared for a time centering around 1945.

The general budgeting procedure followed was the same for both sets of farms. Details of this procedure are given in full, pp. 47–51. At this point it will be sufficient to call attention to a few of the main problems.

NORMALIZING THE RECORD-YEAR DATA

It has been found most satisfactory in budgeting a farm to start with the record for a given year. With this as a basis, the first step in the budgeting procedure is to adjust or "normalize" the organization to what it would have been if prices, weather conditions, available labor, and so on, had been average or "normal" for that year. No given year is likely to be entirely normal, as accidents or fluctuations of various sorts always occur. But it seems reasonable to plan ahead on the basis of average expectations, and to do this it is helpful to start from a "normal" base year.

The records for the 24 survey farms covered the year from May 1935 through April 1936. The records for the accounting farms covered the calendar year 1935. In spite of the discrepancy in time covered, these two sets of records are similar in that both refer to the crop of 1935. To simplify the exposition, the record year for both the survey farms and the accounting farms is referred to in this study as 1935 (actual); after it has been normalized, it is referred to as 1935 normal for both samples.

If individual farm records are available for a number of years back, as was the case for the accounting farms, the task of normalizing

yield data, livestock production, and other factors is much simplified and results are more accurate for the specific farms. Records of past experience furnish the best basis also for estimating normal expenses for upkeep of farm buildings and equipment and for many items that occur irregularly or in variable amounts from year to year.

The procedure used for normalizing prices of products sold on the basis of 1921–30 average relationships has been mentioned and is more fully explained, pp. 48–49.

FURTHER CONSIDERATIONS IN ESTIMATING FUTURE PRODUCTION

Before a future budget for an individual farm could be worked out, it was necessary to estimate the general character of the probable farm organization. This estimate included consideration of the distribution of land in various uses, the general nature of crop production, the kind and approximate numbers of livestock, the supply of labor, power, and equipment, and the input-output relationships likely to prevail. These factors were estimated on the basis of data on past practices provided by the farm records and from information about his future plans obtained from the operator.

On the basis of this information alone, however, such matters as the probable effect of the increased use of hybrid corn and the effect on butterfat production of probable changes in the rate of feeding dairy cows could not be estimated satisfactorily. The methods used in making these estimates, therefore, need special explanation.

None of these farmers grew hybrid corn earlier than 1932, and only a few grew it before 1936, but by 1938 most of them were using hybrid seed on all or part of their corn acreage. Indications are that the use of this corn will continue to increase during the next few years. As yields of hybrid corn are generally higher than yields of open-pollinated varieties by an estimated 5 to 25 percent (4), normal yields of corn in 1945 may be expected to be higher than average yields for the period 1928–35. In view of these estimates, it was believed that the normal yields in 1935, increased by 10 percent, would be a conservative estimate of the average yield of all corn grown on these farms in 1945. This meant an estimated increase of 3 to 6 bushels per acre in 1945, as compared with normal yields in 1935.

Normal rates of feeding, calculated for each farmer on the basis of his feeding practices during the period 1928–35, were used in the preparation of the normalized budget for 1935 and in the preparation of budgets for 1945. Budgets for 1945 were also prepared using somewhat higher and somewhat lower rates of feeding than normal for dairy cows. This was done because many farmers feed more heavily when prices of butterfat are favorable relative to feed prices and more sparingly when butterfat prices are relatively unfavorable.

In learning the effect of changes in rate of feeding on butterfat production, use was made of findings in recent studies conducted jointly by the Bureau of Agricultural Economics and the Bureau of Dairy Industry, United States Department of Agriculture (6). Results obtained in these studies indicate that the principle of diminishing returns is operative in the feeding of dairy cows, but that the change in rate of returns for additional inputs of feed is small within a reasonably limited departure from the usual rate of feeding.

This information was used as a guide in budgeting the organizations

in which changes in the rate of dairy feeding were assumed. Variations from the normal level of feeding were limited to changes of 15 percent or less in the total digestible nutrients normally fed per cow. All changes in rate of feeding were calculated in terms of the farm grains fed. In keeping with a simple rule supported by the evidence from the recent studies mentioned (6) butterfat production was assumed to be increased or decreased by the same percentage that the rate of feeding was changed. The economic advisability of increasing or decreasing the rate of feeding under conditions of 20 percent higher or 20 percent lower prices of butterfat could then be ascertained by comparing the net returns obtained at different rates of feeding.

In setting up the alternative organization plans for these farms in 1945, it was assumed that a conservation or other farm program in this area would not be of such a nature as to modify the expected practices of the farmers adversely. This assumption is in keeping with experience in the area in the past. A recent study reveals that many farmers in this area planted larger acreages of soil-conserving crops than were required for full compliance with the Agricultural Conservation Program (12). The program in effect since 1936 has placed limits on the total acreage of soil-depleting crops on cooperating farms and has provided benefit payments for certain soil-conserving crops and practices. The shifts to more alfalfa and other hay and pasture crops that have occurred have been in line with former trends. In calculating net earnings from the various future organizations, no allowance was made for possible benefit payments from the Government.[7]

ESTIMATES OF FUTURE PRODUCTION FOR THE 24 ACCOUNTING FARMS

Estimates of future production of butterfat on the 24 accounting farms distributed throughout the five counties were arrived at by the budgeting method. As was indicated in tracing the history, comprehensive records covering the period from 1928 through 1938 were available for these farms. Information was also obtained by personal interviews on the changes in farm organization that were contemplated for the future and the changes that would probably be made in specified situations. These data provided a basis for budgeting a large number of practicable future organizations for each farm.

BUDGETING ALTERNATIVE PLANS FOR AN INDIVIDUAL FARM

Farm plans and budgets for a representative southeastern Minnesota farm are presented in abbreviated form on the following pages. Tables 10, 11, and 12 are summaries of the crop and livestock organizations and of the earnings statements for the various plans which were worked out in detail for this farm. Eight alternative plans for this farm in 1945 were budgeted, in addition to the actual and normalized organizations for 1935.

Data on the farm organization, production, receipts, expenses, and net earnings in 1935 were first tabulated. These comprised the budget of the farm business for that year.

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[7] For a study dealing specifically with the conservation program in southeastern Minnesota, see JOHNSON, SHERMAN E., MIGHELL, RONALD L., and HADY, FRANK T. PROBABLE EFFECTS OF THE AGRICULTURAL CONSERVATION PROGRAM ON LIVESTOCK PRODUCTION IN THE MIDWEST DAIRY REGION.—PART III. U. S. Bur. Agr. Econ., 123 pp., illus. 1940. [Processed.]

TABLE 10.—*Cropping systems for a representative accounting farm, southeastern Minnesota*

Farm plan	Flax	Oats and barley	Barley	Corn for grain	Corn for silage	Alfalfa hay	Sweet clover pasture	Alfalfa pasture	Total
1935	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Actual	25	45	-------	23	10	16	23	-------	142
Normalized	24	38	-------	32	8	16	23	4	145
1945									
I		28	22	34	11	19	27	4	145
II		28	19	33	12	19	30	4	145
III		28	22	34	11	19	27	4	145
IV		28	22	34	11	19	27	4	145
V		28	19	33	12	19	30	4	145
VI		28	25	37	10	18	23	4	145
VII		28	25	37	10	18	23	4	145
VIII		28	25	37	10	18	23	4	145

TABLE 11.—*Livestock systems for a representative accounting farm, southeastern Minnesota*

Farm plan	Milk cows	Concentrates per cow	Butterfat		Young dairy cattle	Hogs raised	Hens	Chicks started	Ewes
			Produced per cow	Sold					
1935	*Number*	*Pounds*	*Pounds*	*Pounds*	*Number*	*Number*	*Number*	*Number*	*Number*
Actual	13	2,215	223	2,621	12	64	152	500	31
Normalized	11	2,396	255	2,623	12	77	125	500	30
1945									
I	14	2,396	255	3,368	15	84	100	400	30
II	16	2,396	255	3,872	15	70	100	400	30
III	14	2,396	255	3,368	15	77	200	700	30
IV	14	2,396	255	3,368	15	91	200	700	30
V	16	2,396	255	3,872	15	77	200	700	30
VI	12	2,396	255	2,871	12	105	200	700	30
VII	12	2,913	276	3,128	12	98	200	700	30
VIII	12	1,879	234	2,614	12	112	200	700	30

TABLE 12.—*Financial summaries for a representative accounting farm* [1]

Farm plan	Receipts						Total expenses	Net cash income with—		
	Butterfat [2]	Cattle	Hogs	Poultry and eggs	Other [3]	Total		A prices	B prices	C prices
1935	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Actual [4]	904	460	1,107	542	1,314	4,327	2,548	1,779	....	....
Normalized	905	213	1,145	384	613	3,260	1,640	1,620	....	....
1945										
I	1,162	267	1,258	301	430	3,418	1,775	1,643	1,875	1,410
II	1,336	278	1,046	301	438	3,399	1,780	1,619	1,886	1,352
III	1,162	267	1,145	613	430	3,617	1,844	1,773	2,005	1,541
IV	1,162	267	1,371	613	367	3,780	1,917	1,863	2,096	1,631
V [5]	1,336	278	1,145	613	345	3,717	1,854	1,863	2,131	1,596
VI [6]	990	224	1,584	613	407	3,818	1,908	1,910	2,108	1,712
VII	1,079	224	1,484	613	407	3,807	1,906	1,901	2,117	1,686
VIII [7]	901	224	1,683	613	407	3,828	1,910	1,918	2,098	1,737

[1] Receipts include all cash income from products sold. No evaluation was made of farm products used in the house. Total expenses include out-of-pocket expenses for production and costs of repairs and depreciation. Interest charges were entered as an expense in case the capital was borrowed. No evaluation was made of work contributed by members of the family. Net cash income is the return to the operator and his family for their labor and capital.

[2] Receipts from the sale of butterfat at "A" prices, except in 1935 actual.

[3] Includes receipts from the sale of sheep, wool, and crops. In 1935 actual AAA receipts are also included, but no payments of this kind were estimated for the normal or future plans. The AAA payment and larger-than-normal sales of crops in 1935 are the principal items accounting for the relatively large amount of "other" receipts in 1935. Receipts from sheep and wool amount to $236 in each of the future plans.

[4] Based on prices actually received for products sold in 1935

[5] Plan selected for the B price situation.

[6] Plan selected for the A price situation.

[7] Plan selected for the C price situation.

Principal adjustments made in normalizing the 1935 record are shown in tables 10 and 11. Minor changes were made in the acreages of crops, in the numbers and production of livestock, and in rates of feeding. The effects of these changes, and of normalized prices, on receipts, expenses, and net earnings are shown in table 12. The actual record for 1935 shows cash receipts considerably larger than normal. This is accounted for mainly by the AAA payment and the larger than normal sales of cows, eggs, and grain. A charge for the decrease in feed inventory is the principal item causing expenses in the actual record to be larger than normal. In the normalized budget, and in the budgets of the future plans, feed and livestock inventories are assumed to be the same at the beginning and at the end of the year, and fixed depreciation charges are made on buildings and equipment. In these budgets the income and expense items are representative of average receipts and expenses over a period of years with a stabilized organization and operation of the farm.

In setting up alternative plans for 1945 on the farm that is used here as an illustration, the normalized 1935 organization was used as a base, but variations from this were made in the light of trends apparent from the farmer's records from 1936 through 1938. Changes in crop and livestock enterprises, expected within the next few years, were also taken into account. Differences between the various alternative plans were limited by the range of the farmer's probable variations in crop and livestock organization.

The operator of this farm had indicated an intention to grow somewhat less small grain and to use a larger proportion of the small-grain acreage for feed crops. He would discontinue flax production and would have larger acreages of corn, alfalfa hay, and sweet-clover pasture. These changes in distribution of crops would make it possible for him to expand his livestock enterprises.

In expanding his livestock program he would not be likely to exceed the following numbers in individual classes of livestock: 16 cows, 120 hogs raised, 40 sheep, 200 hens, and 700 chicks. These figures represent his maximum numbers in each class. He could not keep the maximum number in each class at the same time, or in any single year, because of the limitations of feed, labor, and management. For example, if he kept the maximum number of cows, he would keep fewer than the maximum number of hogs or sheep; to keep the maximum number of hogs he would limit the size of his dairy or poultry enterprise. The maximum number of cows on this farm was determined by barn room, and the maximum number of hens by the capacity of the poultry house. Maximum numbers of sheep, hogs, and chicks were determined by the total feed-producing capacity of the farm, as well as by the limitations of labor, capital, and management.

The various alternative plans were set up and budgeted in the order indicated by their numbers in the summary tables. As shown in table 10, plan I has less small grain but larger acreages of corn, hay, and pasture than the 1935 normalized plan. Plan I also has more cows and hogs but less poultry. Plan II differs from plan I in that it has two more cows and two fewer litters of hogs. Acreages of crops are adjusted to provide for the additional pasture and silage needed for the cows. Plan III differs from plan I in that it has one fewer litter of hogs, 100 more hens, and 300 more chicks. Net earnings for these three plans show that plan III would be the most profitable

under all 3 sets of price relationships. The earnings data also indicate that in the A and C price situations the rank of livestock in order of profitableness in feed utilization is (1) poultry, (2) hogs, and (3) cows. In the B price situation, cows give a larger return for feed than do hogs.

As poultry keeping is relatively profitable at the prices assumed, it seems reasonable to expect that if these prices prevailed for a long period this farmer would organize his business so that he might keep the maximum number of poultry—estimated to be 200 hens and 700 chicks.

Plans IV, V, and VI all provide for the maximum number of poultry, 200 hens and 700 chicks, but differ in numbers of cows and hogs. With normal prices, plan VI (with fewer cows and more hogs than the other plan referred to) would be the most profitable of the six organizations. Plan VII is similar to plan VI except that one less litter of hogs is raised and the grain thus saved is fed to the dairy herd. The additional grain fed per head is estimated to result in an average increase in butterfat production of 21 pounds per cow. Plan VIII is similar to plan VI except that grain fed to cows is reduced enough to feed an extra litter of hogs, and butterfat production per cow is estimated to be 21 pounds less.

An examination of the net earnings from the several plans reveals that plan VIII would be the most profitable plan in the A and C price situations. With A prices, however, plan VIII shows earnings of only $8 more than plan VI, which is not believed sufficient to induce the farmer to change his rate of feeding. Plan VI, with dairy cows fed at the normal rate, is therefore selected as the farmer's most probable organization if A prices should prevail. With C prices, however, it is believed that the farmer would decrease the quantity of concentrates fed to dairy cows and increase hog production as in plan VIII, as this would result in an increase in net earnings of $25 over plan VI. In the B price situation, plan V, with 16 cows fed at the normal rate, appears to be the most profitable as well as the most probable. As indicated in the footnote for table 12, plans VI, V, and VIII were selected as the most probable organizations of this farm in the future year with A, B, and C prices, respectively.

SUMMARY OF ESTIMATES

Results of budgeting for the 24 accounting farms suggest that production of butterfat will increase 13.3 percent if 1935 normal price relationships continue. If butterfat prices increase 20 percent, production will increase 22.7 percent, and, if butterfat prices decrease 20 percent, production will increase 2.7 percent.

Total quantities of butterfat sold from the 24 farms in 1935 and estimates for 1945 with A, B, and C prices are summarized in table 13. Estimated production in 1945 with A and B prices is considerably larger than normal production in 1935. Even with C prices prevailing, the 1945 production is somewhat greater than the normal in 1935. Taking the 1935 normal production as 100, the index in 1945 is 113.3 with A prices, 122.7 with B prices, and 102.7 with C prices. Using the quantity sold in A as 100, the variations in production are an increase of 8.4 percent with B prices and a decrease of 9.3 percent with C prices.

TABLE 13.—*Estimates of butterfat production (for sale) for 24 accounting farms, southeastern Minnesota*

Year and price situation	Butterfat production	Relatives	
		(1935 normal =100)	(A=100)
1935	*Pounds*		
Actual	86,633	96.7	85.4
Normal	89,555	100.0	88.3
1945			
A	101,426	113.3	100.0
B	109,926	122.7	108.4
C	91,908	102.7	90.7

With A prices prevailing, 13 farmers would sell more butterfat in 1945 than in 1935, 1 would sell an equal quantity, and 10 would sell less. With B prices prevailing, 17 would sell more and 7 would sell less. With C prices, 7 would sell more, 2 would sell an equal quantity, and 15 would sell less. These figures bring out the fact that, although some farmers would expand their production of butterfat and others would decrease it under any of the price situations assumed, a significant proportion would be influenced to produce more if butterfat prices were relatively high and less if butterfat prices were relatively low. In table 14 are shown the approximate percentages by which various numbers of farmers would change their production in each of the price situations. The distribution of farmers by percentage change during the period 1928–38, is also shown in this table.

TABLE 14.—*Distribution of 24 accounting farms in southeastern Minnesota according to change in butterfat production during specified periods and price situations*

Change in butterfat production (percent)	Farm distribution			
	1928–30 to 1936–38	1935 (normal) to 1945 (estimated)		
		A	B	C
	Number	*Number*	*Number*	*Number*
Decreases:				
31 to 40		1		3
21 to 30	1	1	2	3
11 to 20	3	3	2	4
1 to 10	4	5	3	5
Increases:				
0 to 9	3	5	2	2
10 to 19	3	2	6	2
20 to 29	5	2	1	1
30 to 39	2	1	2	1
40 to 49	1		2	1
50 to 59		2	1	
60 to 69			1	
70 to 79				
80 to 89	1	1		1
90 to 99			1	
100 and over	1	1	1	1
Total	24	24	24	24

Table 15 summarizes the average organization of the 24 farms in 1935, 1935 normal, and 1945. It shows also the effect of normalizing the actual organizations in 1935, and indicates the net differences between the normal 1935 organizations and the future organizations

as well as the net differences between the organizations selected for 1945 in different price situations.

The averages show an increase in acreages of most crops for 1945, resulting largely from an increase in the size of seven farms between 1935 and 1939. This additional land increased the average farm acreage by 19 acres, and would probably continue to be operated in the future whether butterfat prices were relatively high, or low, or normal. Data on crop acreages in A, B, and C indicate that variations of 20 percent in the relative price of butterfat would have only minor effects on the acreages in various classes of crops.

The averages for livestock show that these farmers are expected to have more milk cows, hogs, and chickens in 1945 (table 15). With B prices they would keep an average of one more cow than with A prices, and with C prices they would keep an average of one less. With A prices they would feed about the same quantity of concentrates per cow as in 1935 normal, but would get slightly higher production because of improved pastures and better hay. With B prices the average quantity of concentrates fed per cow would be increased over the quantity with A prices by 161 pounds; with C prices, it would be decreased by 247 pounds. Increases in the size of dairy herds and in quantities of feed fed to cows in the B situation would be brought about by producing less pork and selling smaller quantities of cash crops. In the C situation, with fewer cows and lighter feeding, more hogs would be raised, and somewhat less grain than in A would be available for cash sale.

TABLE 15.—*Important farm-management factors at designated times and price situations, averages for 24 accounting farms, southeastern Minnesota*

Factor	Unit	Price situation				
		1935		1945		
		Actual	Normal	A	B	C
Farm acreage	Acre	181	177	196	196	196
Cropland:						
Corn	Acre	44	45	56	55	57
Small grain, etc	Acre	58	55	57	57	58
Tame hay	Acre	23	21	24	24	23
Rotation pasture	Acre	18	18	21	22	20
Total	Acre	143	139	158	158	158
Livestock:						
Milk cows	Number	17	16	18	19	17
Concentrates per cow	Pound	1,122	1,916	1,915	2,076	1,668
Butterfat per cow	Pound	249	259	264	271	253
Butterfat sold	Pound	3,610	3,731	4,226	4,580	3,833
Young dairy cattle	Number	13	17	17	18	17
Hogs raised	Number	55	68	89	82	90
Hens	Number	176	187	296	293	296
Receipts:						
Butterfat	Dollar	1,239	1,278	1,443	1,878	1,048
Cattle	Dollar	500	410	471	484	458
Hogs	Dollar	944	1,065	1,405	1,297	1,508
Sheep and wool	Dollar	214	253	118	118	118
Poultry and eggs	Dollar	583	529	888	881	886
Crops	Dollar	590	410	408	476	488
Other	Dollar	2,051	125	139	139	139
Total receipts	Dollar	6,091	4,070	4,960	5,273	4,705
Total expenses	Dollar	3,911	1,957	2,326	2,322	2,331
Net cash income	Dollar	2,180	2,113	2,634	2,051	2,374

Total receipts are shown to vary considerably in A, B, and C. Total expenses, however, vary little with the different organizations used in the three price situations. As shown by the net cash incomes in A, B, and C, the effect of a 20-percent variation in butterfat prices will be only partly overcome by the changes in farm organization.

On most of these farms, hogs compete closely with dairy cows for the farm-grown grains. On some farms cows normally give a higher return for feed than do hogs, whereas on other farms hogs are more profitable than cows. When the competition is very close, with normal prices for butterfat, a change of 20 percent in butterfat prices may be expected to swing the advantage more definitely to one or the other of these enterprises. The number of cows that may be kept, however, has practical upper limits. Lower limits, also, are established by the requirements of utilizing to best advantage the minimum amounts of pasture land and hay crops on the farm, as well as by the operator's efforts to maintain a balanced or diversified organization. Upper and lower limits on the number of hogs are usually less distinct, but are influenced by the limitations of such factors as feed and available labor.

Increases in the size of dairy herds on these farms were associated with increases in acreages of pasture and hay, decreases in acreages of corn or small grain, and decreases in numbers of hogs raised or in the quantity of cash grain sold. Decreases in numbers of dairy cows were associated with decreases in acreages of pasture and hay (unless the dairy cows were replaced by beef cattle), increases in acreages of corn or small grain, and expansion of the hog enterprise.

The poultry enterprise remains relatively unaffected by changes in the price of butterfat. Even with butterfat prices 20 percent above normal, on most of the farms poultry gave higher returns for feed than any other livestock. Farmers therefore would tend to keep as many chickens as they could house, or could handle with the time and care they were inclined to give to poultry. It appeared that the sheep enterprise would not be affected by changes in the price of butterfat on the farms studied. Sheep were kept on only a few of the farms; as a rule flocks were small and were maintained cheaply on pasture, hay, and otherwise wasted roughage around the farm.

ESTIMATES OF FUTURE PRODUCTION FOR THE 24 SURVEY FARMS

The primary consideration in selecting the 24 survey farms for budgeting was to obtain a representation of the principal situations in this area that might influence farmers' responses. The rather complete information obtained for each of these farms included a farm-management schedule for the 1935 record year, a record of butterfat production for the period 1927–39, a record of changes in livestock by years for 1927–38, and of crops by years for the period 1932–38. Supplementary information was obtained in 1939 through a special interview with each farm operator.

For each of the 24 farms in the survey sample, an average of 8 plans were worked out. The budgeting procedure followed was the same as that used for the accounting farms, although there were some differences because of differences in the information available. In order to illustrate the procedure further and to show some of the

differences as well as the similarities, a summary of the budgets and plans for one of the farms in the survey group is presented.

BUDGETING ALTERNATIVE PLANS FOR AN INDIVIDUAL FARM

The farm used here as an illustration has a total area of 200 acres, of which 140 are in cropland, and the rest in native pasture. The absence of pasture on tillable land distinguishes this farm from many others in the area on which tillable pasture is the rule. It is also somewhat larger than the average, and differs from farms of similar size in that no cash crops are sold. All crops raised are fed to livestock. The farm is, however, representative in most respects. In all, 11 plans were worked out for this farm.

The first step was to normalize the farm plan for the production year beginning May 1935. It was found that a normal cropping plan contained more corn and less wheat and oats than in 1935. During that particular year the operator was participating in the AAA program and, for that reason, had reduced the acreage of corn and production of hogs. His normal cropping plans for 1935 reflect the plan generally in operation before 1934 (table 16). The operator's estimates of normal yields, which were found to be in agreement with yield figures for the area, were used. In the future plans the corn yield, which was increased by 10 percent because of the expected effect of hybrid corn, was the only one changed.

TABLE 16.—*Cropping systems for a representative survey farm, southeastern Minnesota*

Farm plan	Wheat and oats	Corn for—			Alfalfa	Sweet-clover pasture	Total
		Grain	Silage	Fodder			
1935	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Actual	70	45	9	3	13	....	140
Normal	63	55	10	....	12	....	140
1945							
I.	63	52	10	....	15	....	140
II.	63	52	10	....	15	....	140
III.	50	40	10	....	30	10	140
IV.	50	40	10	....	30	10	140
V.	66	56	8	....	10	....	140
VI.	66	56	8	....	10	....	140
VII.	66	56	8	....	10	....	140
VIII.	58	58	10	....	14	....	140
IX.	58	58	10	....	14	....	140

The livestock system was abnormal in 1935; fewer hogs and chickens than normal were kept (table 17). The number of cows was a little high, but the number of young stock was too low. Determination of the normal number of livestock was aided by the farmer's interview record, and by the assessor's record of numbers of livestock on the farm since 1927. Similarly, the record of butterfat sales back to 1927 could be checked against the number of cows for the same period.

After the normal production of feed and the normal number and kinds of livestock were determined, the next task was to estimate normal rates of feeding and to distribute the feed among the several classes of livestock.

The only estimate of feed distribution available was for the year

1935. The rates for that year were checked against normal feeding rates for a number of accounting farms in Freeborn County and the surrounding area. They were also checked against feeding rates given in previous farm-management studies in this area (*10*). By this process of comparison, feeding rates reported on the 1935 records were evaluated and adjusted. As far as possible the normal individual differences among operators in the efficiency of feeding various kinds of livestock were preserved.

The final step was to normalize receipts and expenses according to normal prices (table 18).

TABLE 17.—*Livestock systems for a representative survey farm, southeastern Minnesota*

Farm plan	Milk cows	Concen-trates fed per cow	Butterfat		Young dairy cattle	Hogs raised	Hens	Chicks raised or bought
			Pro-duced per cow	Sold				
1935	*Number*	*Pounds*	*Pounds*	*Pounds*	*Number*	*Number*	*Number*	*Number*
Actual	16	3,638	236	3,222	10	86	50	100
Normal	15	3,100	236	2,946	16	150	100	250
1945								
I	17	3,142	244	3,526	16	150	100	250
II	17	3,142	244	3,526	16	144	200	500
III	22	3,500	272	5,348	25	84	100	250
IV	25	3,260	272	6,136	16	84	100	250
V	12	3,437	236	2,251	16	168	100	250
VI	12	3,437	236	2,251	16	162	200	500
VII	12	3,100	225	2,112	16	168	135	338
VIII	15	2,886	243	3,046	16	156	200	500
IX	15	3,366	261	3,302	16	150	200	500

TABLE 18.—*Financial summaries for a representative survey farm, southeastern Minnesota*

Farm plan	Receipts						Total expenses	Net cash income with		
	Butter-fat	Cattle	Hogs	Poultry and eggs	Other	Total		A prices	B prices	C prices
1935	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Actual	1,070	56	1,430	135	409	3,100	1,271	1,829		....
Normal	978	275	2,498	228	34	4,013	1,809	2,204		....
1945										
I	1,171	273	2,408	228	34	4,204	1,856	2,348	2,582	2,114
II	1,171	273	2,357	496	34	4,331	1,875	2,456	2,690	2,222
III	1,776	414	1,379	228	34	3,831	2,161	1,670	2,025	1,315
IV	2,037	320	1,379	228	34	4,007	2,161	1,846	2,254	1,439
V	748	259	2,802	228	34	4,071	1,803	2,268	2,417	2,119
VI	748	259	2,854	496	34	4,191	1,822	2,369	2,518	2,219
VII	701	259	2,802	322	34	4,118	1,811	2,307	2,447	2,167
VIII	1,011	283	2,597	496	34	4,421	1,886	2,535	2,737	2,333
IX[2]	1,006	283	2,498	496	34	4,407	1,883	2,524	2,744	2,305

[1] Plan selected for A and C price situations.
[2] Plan selected for B price situation.

In selecting the tentative 1945 farm plans to be used for budgeting comparisons, it was decided for convenience to start with the cropping system. Fluctuations in crop acreages since 1932 have been used as approximate limits; since that year wide changes in acreage of corn and in acreages of other crops have occurred. Cropping plans were tentatively worked out with intermediate, minimum, and maximum

acreages of corn. The upper limit was about 45 percent of cropland and the lower limit about 30 percent of cropland. Similar limits for total soil-depleting crops were about 85 percent and 70 percent. These limits became an approximate working guide.

The different proportions of concentrates and roughage in the three basic cropping plans tended to make three different livestock systems—one having an intermediate number of dairy cows, one a maximum, and the third a minimum number of cows. For each cropping plan, alternative systems of livestock production were worked out.

A study of tables 16, 17, and 18, showing a summary of the plans, will enable the reader to follow the various steps in the procedure. This systematic order of budgeting is designed to explore the possibilities on the farm. From this, a final approximation of the most profitable plan for this particular farm and operator can be made.

A comparison shows that plan II is more profitable than plan I, because more profit is made in poultry than in hog production.

Plan III with 22 cows is less profitable than plan I with 17 cows. The expense for barn expansion and hired labor is greater in plan III, and gross receipts are less. This indicates that to decrease corn and small grain in order to grow more roughage for dairy cows is not profitable.

Plan IV compared with plan III shows that more cows and fewer young stock are profitable.

Plan V with 12 cows and a correspondingly larger number of hogs than any of the other plans mentioned is less profitable than plans I and II with 17 cows. But as in the comparison of plans II with I, the profitableness increases as numbers of hogs are reduced and those of poultry increased. This is indicated in plan VI compared with plan V. Nevertheless, plan VI is less profitable than plan II. In plan VII the rate of feeding cows is lowered and the feed saved is transferred to poultry (see plans V and VII). Even at B prices, poultry feeding appears to be the better disposition of grain.

After comparing all these plans, two additional tentative plans, labeled VIII and IX, were worked out. These plans show that it is profitable with B prices to reduce the number of hogs and use the feed released to feed the cows more heavily. Fifteen cows, 156 hogs, and 200 poultry are more profitable than 17 cows, the same number of poultry, and fewer hogs. This superiority is brought about in part by slightly increasing corn and reducing small grain. Plan VIII becomes the most profitable for A and C price situations. This plan yields 3,046 pounds of butterfat for sale. With B prices a slightly different plan, plan IX, would be profitable. According to this plan, 3,302 pounds of butterfat would be sold.

The plans selected for the three price situations, plans VIII and IX, appear to be the most profitable, as well as the most probable, for they are in conformity with what this farmer has done in the past and with what he may be expected to do in the future.

SUMMARY OF ESTIMATES

The result of budgeting the 24 survey farms suggests that production of butterfat will change very little if prices of the products remain about the same as in 1935 normal. If prices of butterfat increase 20 percent, production will increase by 7.9 percent, and if

there is a 20-percent decrease in prices, production will fall by 9.8 percent.

Table 19 indicates actual quantities of butterfat sold by this group of 24 farmers in 1935, the normal production in 1935, and the expected production in 1945 at the three price situations.

TABLE 19.—*Estimates of butterfat production (for sale) for 24 survey farms, southeastern Minnesota*

Year and price situation	Butterfat production	Relatives	
		(1935 normal =100)	(A=100)
1935	*Pounds*		
Actual	63,326	95.9	95.1
Normal	66,037	100.0	99.2
1945			
A	66,587	100.8	100.0
B	71,274	107.9	107.1
C	59,562	90.2	89.5

In order to present the data in appropriate form for a long-time supply schedule, these figures can be expressed as percentages based on production in the A price situation. This schedule shows that the reaction in butterfat production is more when the price falls 20 percent than when it rises 20 percent. The economic pressure of competing enterprises on dairying makes itself felt when the price falls. When the price rises, this pressure is relieved but is not altogether removed. The distribution of the responses in table 20 indicates that particular conditions on each individual farm determine future responses. Changes in production from 1927–29 to 1936–38 are also indicated in this table.

TABLE 20.—*Distribution of 24 survey farms in southeastern Minnesota according to change in butterfat production during specified periods and price situations*

Change in butterfat production (percent)	Farm distribution			
	1927–29 to 1936–38	1935 (normal) to 1945 (estimated)		
		A	B	C
	Number	*Number*	*Number*	*Number*
Decreases:				
71 to 80				1
61 to 70				1
51 to 60				
41 to 50	1			
31 to 40				1
21 to 30	1	3	1	4
11 to 20	4	1	2	6
1 to 10	3	4	3	1
Increases:				
0 to 9	3	10	8	5
10 to 19	2	1	5	2
20 to 29	4	1	2	2
30 to 39	2	1	1	1
40 to 49	2			
50 to 59		2	1	
60 to 69				
70 to 79				
80 to 89				
90 to 99			1	
100 and over	2			
Total	24	24	24	24

Average farm organization and average production estimated for these farms at alternative price situations in 1945 are shown in table 21. A slight increase is expected in average acreage, as a few farms had already expanded their acreage in 1939 relative to 1935.

Few material differences in cropping programs at different prices are likely to occur. Some flexibility in the livestock program within the same crop program may be expected.

TABLE 21.— *Important farm-management factors at designated times and price situations, averages for 24 survey farms, southeastern Minnesota*

Factor	Unit	Price situation				
		1935		1945		
		Actual	Normal	A	B	C
Farm acreage	Acre	167	167	175	175	175
Cropland:						
Corn	Acre	40	49	49	48	49
Small grain	Acre	59	51	51	51	52
Hay and rotation pasture	Acre	22	21	32	33	31
Total	Acre	121	121	132	132	132
Livestock:						
Milk cows	Number	14	14	13	14	12
Concentrates fed per cow	Pound	2,440	2,263	2,152	2,402	2,092
Butterfat produced per cow	Pound	229	231	237	245	234
Butterfat sold	Pound	2,639	2,752	2,774	2,970	2,482
Young dairy cattle	Number	9	11	13	13	12
Steers	Number	1	2	(¹)	(¹)	2
Hogs raised	Number	40	61	73	71	72
Ewes kept	Number	4	4	9	9	11
Hens	Number	156	155	225	222	233
Chicks raised or bought	Number	382	365	494	489	548
Receipts:						
Butterfat	Dollar	872	910	917	1,178	656
Cattle	Dollar	284	299	261	263	331
Hogs	Dollar	854	980	1,180	1,157	1,165
Sheep and wool	Dollar	24	33	79	79	89
Poultry and eggs	Dollar	314	320	512	505	524
Crops	Dollar	367	459	623	570	671
Other	Dollar	569	300	174	174	174
Total receipts	Dollar	3,285	3,310	3,746	3,932	3,620
Total expenses	Dollar	1,291	1,559	1,634	1,631	1,668
Net cash income	Dollar	1,994	1,751	2,112	2,301	1,952

¹ Less than 1.

In the A price situation, as relative to normal, it is expected that about the same quantity of butterfat will be produced, more hogs and poultry will be raised, and more cash grain will be sold. In the B price situation more butterfat will be produced at the expense of cash crops and, to some extent, of hogs and poultry. In the C price situation, production of butterfat will show a distinct decrease. This decrease will be offset by increases in cash crops, beef cattle, sheep, and poultry.

CONSIDERING OTHER PRICE RELATIONSHIPS

The question arises as to whether a greater response in butterfat production could be expected, if prices changed 30 instead of 20 percent. This has been tested against the farm plans and the resulting most profitable budgets have been selected. The production, if prices

increased 30 percent, is estimated to be 110.4 percent of normal production in 1935.

The corresponding figure for a 30-percent decrease in prices was found to be 88.3 percent. Apparently the relative profitableness of the several enterprises in combination is such that a change in prices, as tested above, has only a minor effect on production.

This study has proceeded on the assumption that prices of dairy products only change, leaving prices of all other products and cost elements constant. Actually the prices of products and price relationships change in a great many ways. It would be an impossible task to consider all these situations, but it should be remembered that the three price situations assumed do in effect cover a number of parallel price situations.

In order to throw light on the effect of changes in prices of hogs and corn with the price of butterfat constant, price situations with 20-percent increases and decreases in prices of hogs and cash crops, other prices remaining the same, were applied to the farm plans and the corresponding budgets were compared.

A 20-percent increase in the prices of hogs and cash crops, it is estimated, would be followed by a 6.2-percent drop in butterfat production, and a 20-percent decrease in prices of hogs and cash crops by a 2.8-percent rise in production of butterfat. The production responses are smaller than for similar price changes in butterfat partly because the enterprises are so combined that they are differently affected by different price situations.

ESTIMATES FOR ALL FARMS IN THE SURVEY SAMPLE

To arrive at estimates of butterfat production in 1945 for the entire survey sample of 150 farms from the estimates for the 24 selected farms which were budgeted in detail, the following method was used.

The 24 farms budgeted were sorted into response classes for each of the three price situations. The range in the percentage change for each class corresponds to the intervals shown in table 20. The farms in the various response classes were described in terms of combinations of factors of which the particular percentage change expected was the resultant.

With a description of the farms in each response class and price situation as a guide, the records for the remaining 126 survey farms were examined and the farms sorted into response classes according to similarities in combination of factors with those farms already budgeted in these classes.

The sorting of the 126 farms was done for each of the 3 price situations separately. When the sorting was completed, the mode of the percentage changes for the farms budgeted in a class was applied directly to the total 1935 normal production for all the farms sorted into that class. As each farm was sorted independently for each price situation, it was necessary to test the consistency of the percentage changes for the three price situations. A farm that did not appear consistent in its responses was reexamined and a response pattern for all three situations was estimated. Farms that had suffered noticeably from feed shortage on account of the 1934 drought and farms that did not raise any alfalfa were given special consideration.

The final result of this process in terms of butterfat production is

shown for each price situation in table 22. It will be observed that the expected production is slightly higher in 1945 for all farms in the sample than for the 24 budgeted farms. Analysis of the reasons for this difference suggests that the farms budgeted had already gone somewhat farther in raising alfalfa and in carrying out certain improved practices that contribute to increased butterfat production. Some of the other farms are expected to do relatively more of this in the period ahead.

AREA ESTIMATES FROM THE SAMPLE ESTIMATES

The intensive budget analyses of the two groups of individual farms were the means of arriving at estimates for the entire area. To make the final area estimates, it was necessary to compare the two sets of results, to evaluate their representativeness, and to estimate the trend in factors which are of an area rather than of an individual farm character. As a further check the area estimates were supplemented by an over-all approach based only on data for the area as a whole.

Response or percentage change in production over time for a group of individual farms, as for an area, is the resultant of diverse individual responses. Factors responsible for these net responses are therefore important from the standpoint of whether or not groups of farms are representative of a larger area.

The next step is to compare the studied groups with the area as a whole in terms of the factors accounting for differences in net responses in the past. A comparison of the farm resources in 1935 and of other characteristics will aid in explaining the differences in expected responses in the future for the two groups.

TABLE 22.—*Relative butterfat production (for sale) in different years and price situations for the survey sample, southeastern Minnesota*

[1935 normal=100]

Year and price situation	Budgeted (24 farms)	Total (150 farms)
1935		
Actual	95.9	97.9
Normal	100.0	100.0
1945		
A	100.8	103.4
B	107.9	112.5
C	90.2	92.0

The earlier examination of responses in production of butterfat during the period 1928–38 indicated that the changes in the area were intermediate to those in the two sample groups of farms. The area as a whole produced 9 percent more butterfat in the 2-year period 1937–38 than in 1928–29, the accounting farms produced 16 percent more, and the survey farms 6 percent more. Comparisons based on other years change these differences only slightly. This comparison can be further analyzed by studying the charts of production for the area and for the two farm groups. The upward trend in production of butterfat flattened out for both the accounting farms and the survey farms as the period ended. For the area no such tendency

appeared and the trend continued strongly upward with no sign of flattening out. This difference between the area and the farm samples is significant.

Examination of the factors influencing net past responses for the two groups of farms reveals that the accounting farms increased production of butterfat more than the survey farms did, mainly because their available resources increased considerably. Changes in crops also contributed materially to an increased feed production. Similar influences affected the area as a whole. On the survey farms, however, little change in resources and less shift in crop acreages were made. The survey farms appeared to have become more nearly adjusted to the new cropping opportunities at a still earlier date and less change was possible in this period. On other farms, outside the survey area, expansion in alfalfa and rotation pasture, with its resultant increase in feed for dairy cattle, appears to have proceeded at a more rapid rate throughout the entire period.

As indicated in table 23, the 24 accounting farms were larger than the survey farms and decidedly larger than the average for the area as a whole. The 24 accounting farms raised relatively more hay and had more rotation pasture than the survey group of farms. The accounting farms had more alfalfa, but the survey farms had a higher proportion of the total hay acreage in alfalfa. Both samples had more than the average quantity of alfalfa for farms in southeastern Minnesota.

The livestock system is much alike for all groups. Dairying is more intensive on the 24 accounting farms than on the other groups. Output per cow is higher and the proportion of income obtained from dairying is slightly greater. It seems probable that the 24 accounting farms have more competent operators.

Another factor probably affecting the differences in response on these farms was the average age of the farm operator. In a study of farms in this area, a significant relationship was found between financial returns and age of operator (13). The ages of the operators in the survey sample were higher than those in the accounting sample. The younger farmers tend to be more aggressive and also frequently have more family labor available.

In 1935, the average age of the farm operator was 52 years for the 24 survey farms and 48 years for the entire survey group of 150 farms. For the 24 accounting farms it was 45 years.

TABLE 23.—*Acres of crops and numbers of livestock, averages per farm for selected groups of farms and the area, southeastern Minnesota, 1935*

Factor	Unit	24 accounting farms	24 survey farms	150 survey farms	Area
Farm acreage	Acres	181	167	154	140
Cropland:					
Corn	Acres	44	40	37	29
Small grain, etc	Acres	58	59	53	44
Alfalfa	Acres	14	12	10	6
Other tame hay	Acres	9	4	4	6
Tillable pasture	Acres	18	15	12	6
Total	Acres	143	130	116	91
Livestock:					
Milk cows	Number	17	14	13	13
Other cattle	Number	13	10	7	8
Hogs raised	Number	55	40	32	27
Hens	Number	176	156	151	90

TABLE 24.—*Age distribution of farm operators for selected groups of farms, southeastern Minnesota, 1935, and the State of Minnesota, 1930*

Age (years)	Percentage of all farm operators			
	24 accounting farms	24 survey farms	150 survey farms	State of Minnesota
	Percent	*Percent*	*Percent*	*Percent*
24 and under			0.7	3.0
25–34	4.2	12.5	12.0	19.6
35–44	45.8	12.5	22.1	27.2
45–54	37.5	37.5	33.6	23.0
55–64	12.5	16.7	19.5	17.3
65–74		20.8	10.1	8.4
75 and over			2.0	1.5
Total	100.0	100.0	100.0	100.0

COMPARISON OF FUTURE RESPONSES FOR THE TWO SELECTED GROUPS OF FARMS AS A BASIS FOR AREA ESTIMATES

To arrive at estimates on future output of butterfat for the area from the estimates for the selected groups of farms, it is necessary to evaluate the reasons for differences between such group estimates. The responses for the groups studied are shown in tables 13 and 22.

When the estimated production in 1945 with normal price relationships is considered, the 24 accounting farms are expected to increase by 13.3 percent over normal, whereas only 0.8 of 1 percent increase is expected for the 24 survey farms. Probable reasons for this difference are: (1) The former group has younger operators; (2) the cropping system in operation now and the effect that further improvement in choices of crops or feed-producing capacity may have upon farm organization; (3) the amount of farm resources, such as cropland, expected to be operated in 1945.

As the survey farms already have a relatively large acreage of alfalfa, no great expansion in feed production, benefiting only dairying, is expected. The estimated 3.4-percent increase in butterfat production for the survey area as a whole will be due mainly to greater expansion in alfalfa and to a relatively younger group of operators than on the budgeted survey farms.

The 24 accounting farms produce on the average more butterfat per cow than the survey farms. This higher rate of production tends to place dairying on the accounting farms in a better position relative to other enterprises than is the case on the survey farms. Expansion in alfalfa has continued longer on the accounting farms.

It appears that the introduction of hybrid corn will benefit hog production more directly than dairy production on those farms on which the alfalfa acreage is already relatively large, and on which the margin of profitableness between dairying and hog production is either very close or is favorable to hog production with the normal prices used.

The adoption of alfalfa has progressed considerably farther on the farms in both samples studied than in the area as a whole. Some natural obstacles to the successful growing of alfalfa are found in the eastern part of the area, but it is expected that further expansion in alfalfa will be greater for the area as a whole than for the farms budgeted. Moreover, as corn yields tend to be higher on the survey farms,

it may not be profitable to expand alfalfa quite so much on these farms.

The farms in both of the groups budgeted are expected to be larger in 1945 than in 1935 (tables 15 and 21). This suggests the likelihood of consolidation of farms in this area.

Examination of changes in total cropland in the area during the period 1927–38 suggests that significant increases cannot be expected by 1945. Expansion in the feed-producing capacity for the area is likely to be a matter of shifts in crops on already operated cropland rather than material expansion in total acreages of cropland.

The main difference in expected responses of the accounting and survey samples occurs in the estimates of butterfat production in the A price situation. Very little difference is found in responses for the two samples in the B and C situations relative to the A situation. Available data indicates strongly that this relationship would also hold for the area. The problem, therefore, was primarily that of estimating the A point.

AREA ESTIMATES

To assist in determining the probable production of butterfat for the area in 1945 in the A price situation from the two farm samples, an estimate based on recent data for the area as a whole was made. This estimate relies chiefly upon an extension into the future of the relationship that existed during the period 1927–38 between increases in normal feed-producing capacity and in the production of butterfat. A summary of the estimates is shown in table 25. The normal feed-producing capacity of the area increased 13 percent from 1927 to 1938. During the same period butterfat production increased 12 percent, measured on the basis of average production in the 3-year periods 1927–29 and 1936–38. As 1935 normal was the base year from which future changes in butterfat production were measured for the farm groups budgeted, it was necessary to estimate the 1935 normal production for the area.

TABLE 25.— *Estimates of normal feed-producing capacity and of butterfat production by designated years, southeastern Minnesota*

Year	Total digestible nutrients in feed production	Butterfat production [1]	Relatives	
			Total digestible nutrients in feed production	Butterfat production
	1,000 pounds	*1,000 pounds*		
1927	1, 106, 941	17, 420	100	100
1938	1, 255, 667	19, 469	113	112
1935 (normal)	1, 215, 107	19, 000	100	100
1945 (A price situation)	1, 335, 745	20, 700	110	109

[1] Receipts at dairy plants.

The trends in normal feed-producing capacity and in butterfat production are well represented by straight lines for the period 1927–38. By connecting the average values for the 3-year periods 1927–29 and 1936–38, centered at 1928 and 1937, the normal 1935 value for butterfat was read from the trend line. Similarly, by calculating the

average annual increase in feed-producing capacity between 1927 and 1938, the 1935 normal value for feed was calculated.

The estimate of 1945 normal feed production in the area was built up by examining recent trends in the production of each feed crop and by considering the probable future trends in each as indicated in the detailed analysis of budgeted farms.

The estimate of the 1945 production of butterfat for the A normal price situation was then obtained by applying the 1927–38 relationship
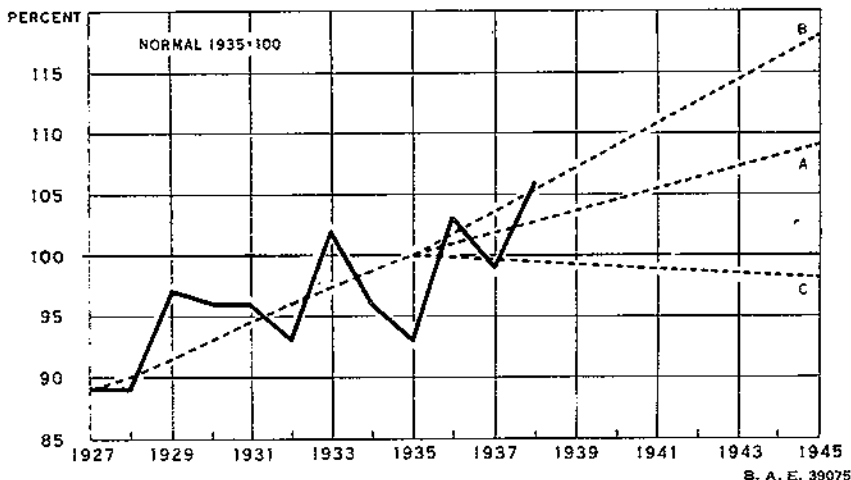

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FIGURE 12.—Butterfat production in southeastern Minnesota and probable future trends. (normal 1935=100). Quantities of butterfat sold fluctuated considerably during the period indicated by the solid line, but the trend was steadily upward at the rate of about 1 percent a year. The trend from 1935 to 1945, as estimated for A price situation, has a slightly lower rate of increase than the actual trend for the preceding period. (The broken line represents the actual trend in production for the period up to 1935 and estimated probable trends from 1935 to 1945, corresponding to the three price possibilities considered, A, B, and C.)

between increases in normal feed-producing capacity and increases in butterfat production.

In these 1945 estimates, no change from the total acreage of feed crops grown in 1938 is expected (table 36). A moderate increase in corn acreage was anticipated. A 10-percent estimated increase in corn yield resulting from the use of hybrid corn, together with acreage increases, would result in a considerable increase in corn production. Alfalfa was expected to increase, although at a much reduced rate from the rate of increase between 1927 and 1938.

Summarizing, it is found that 1945 normal production of butterfat is estimated to be 9 percent larger than the 1935 normal. The butterfat production in the B and C price situations as indicated by the budgeted samples is estimated at 18 percent more and 2 percent less than the 1935 normal production. Estimated responses for the area are shown in table 26 and are compared with the two samples in table 27. Production of butterfat for the years 1927–38 and estimated production in 1945 are shown in figure 12.

The estimated production of butterfat in the A, B, and C situations provides the material for a long-time supply schedule for the area. This is shown in figure 13.   To appreciate the significance of this schedule, it is necessary to go back to the basis upon which the estimates were made.   Each price situation was considered as a level of prices allowing short-time fluctuations but lasting for a period long
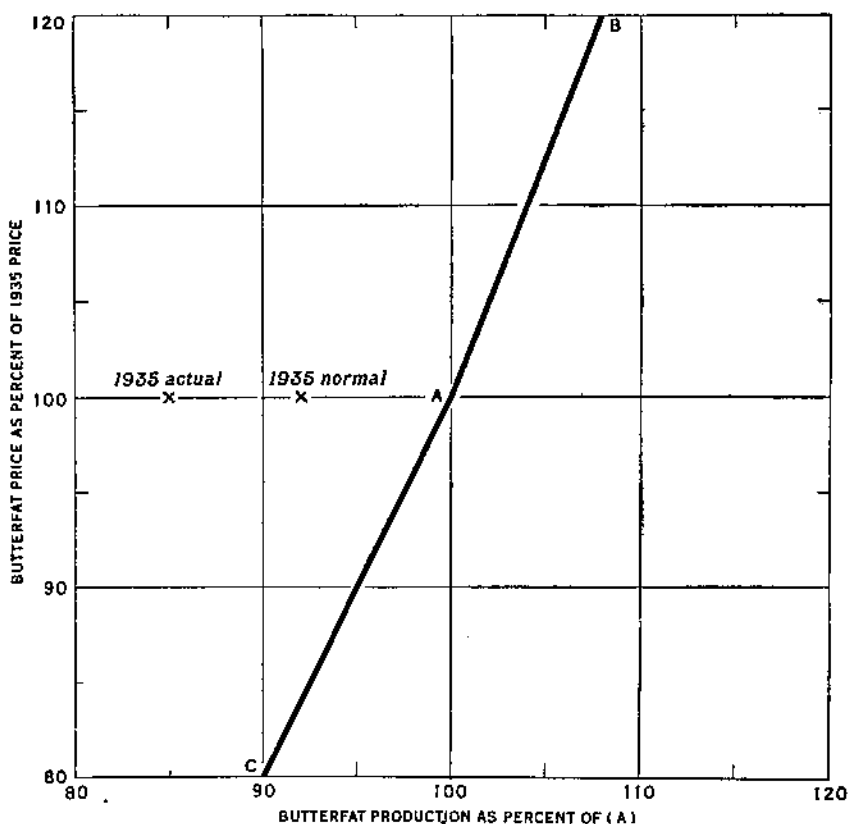
FIGURE 13.—Estimated production of butterfat at three price levels, southeastern Minnesota.   Measuring from the estimated 1945 production (for sale), with a continuation of 1935 normal price relationships, a 20-percent decline in butterfat prices (C price situation) would be accompanied by a significantly greater decrease in production than the increase that would result from a 20-percent rise in prices (B price situation).   The distance between 1935 and 1935 normal represents a correction for drought and depression conditions.   The distance between 1935 normal and A represents the change that is estimated for the 10-year period with a continuation of 1935 price relationships.

enough to influence farmers' plans.   If, for instance, the B price situation began in 1935 and lasted up to 1945, certain changes in farm organization and practices would probably take place, resulting in an 8-percent larger production of butterfat than if the A price situation had prevailed throughout this period.   The 8 percent is the farmers' response to a change of 20 percent in the price of butterfat over this period of time.

TABLE 26.—*Estimated butterfat production in southeastern Minnesota by designated years and price situations*

Year and price situation	Butterfat production [1]	Relatives	
		1935 normal= 100	A=100
1935	*1,000 pounds*		
Actual	17,664	93	85
Normal	19,000	100	92
1945			
A	20,700	109	100
B	22,356	118	108
C	18,630	98	90

[1] Receipts at dairy plants.

TABLE 27.—*Comparison of butterfat production (for sale) on selected groups of farms and in the entire area, southeastern Minnesota, by designated years and price situations*

[1935 normal=100]

Year and price situation	24 accounting farms	24 survey farms	150 survey farms	Area
1935	*Percent*	*Percent*	*Percent*	*Percent*
Actual	96.7	95.9	97.9	93
Normal	100.0	100.0	100.0	100
1945				
A	113.3	100.8	103.4	109
B	122.7	107.9	112.5	118
C	102.7	90.2	92.0	98

BUDGETARY ANALYSIS

The general plan of the budgeting in this bulletin was first to normalize the organization, practices, and production on the individual farm as of the base year from which future estimates were to be made. As the most complete records for the farms in the survey sample covered the year ending April 30, 1936, this was used as the base year for this group of farms. Detailed records, by calendar years from 1928 through 1938, were available for the farms in the accounting sample. The record year most comparable to that of the survey farms was 1935; this year was therefore used as the base year for the farms in the accounting sample. After being normalized, no important difference was found between the years used as a base for the two samples, and they could be considered comparable. To simplify the matter, the years are referred to as 1935 actual and 1935 normal for both samples.

A farm budget for the normalized year was then worked out. This served to picture the normal organization and operations on the farm as of that year. The next step was to budget several alternative organizations that might be used on this farm in a normal year about 10 years later, or approximately in 1945. A 10-year period was assumed to be long enough for the completion of adjustments that farmers might undertake in response to changes in price relationships.

AREA DATA USED AS A GUIDE IN BUDGETING

Data on prices, on yields of crops, and on crop and livestock requirements for each county or for the area as a whole are an essential foundation for an effective handling of individual farm budgets.

As a basis for normal relationships between the various prices, the 10-year period, 1921–30, has been selected as the "base period." This was a comparatively long period of relatively stable farm prices, less affected by abnormal events than any more recent period. Average prices in southeastern Minnesota for the period 1921–30 were computed for the principal livestock and livestock products, farm crops, and commercial feeds. The ratios of these average prices to one another were assumed to be "normal" for these commodities, but in view of the relatively high general level of farm prices during the period 1921–30, use of the average prices for this period in working out normalized budgets for the year 1935 could not be justified. An adjustment of these average prices was necessary; this was accomplished by using the average price of butterfat in 1935 as a key to the price level, and bringing the prices of other farm products into line with this in such a way that the ratio of the price of butterfat to the price of each other product in the adjusted-price series was the same as that in the series of average prices for the period 1921–30. These adjusted prices were then adopted as the normalized prices for the southeastern Minnesota area as shown in table 40.

Average threshing charges per bushel are shown for each of the common crops in table 40. Average quantity of seed used per acre and average quantity of twine required per acre are shown in table 41. Average yields per acre in each of the five counties are also given. Seeding rates, twine requirements, and threshing charges are estimated normal rates. Average yields of grain crops, by counties, are 20-year averages (1917–36) of yields reported annually by the Agricultural Marketing Service, United States Department of Agriculture, and the Minnesota State Department of Agriculture, cooperatively. Yields of hay crops are averages for the 10-year period 1921–30.

Normal requirements and production for livestock are based on data presented in the Minnesota Agricultural Experiment Station Technical Bulletin No. 44 (10). The standard feeding rates were useful in evaluating the feeding practices reported by individual farmers, and the standard cash costs per unit of the various livestock were helpful guides to the allocation of such expenses in budgeting.

ASCERTAINING THE NORMAL FARM ORGANIZATION

For a reliable testing of alternative farm organizations, correct input-output relationships for the various enterprises must be available. To arrive at these relationships, the organization for a particular year must be corrected to represent what normally or usually takes place. No assumption is made in the normalizing process that individual enterprises should be equally profitable. A discussion of procedure in normalizing the major items and treatment of these items with respect to future organizations is presented in the following paragraphs.

The normalized prices for each farmer are based on normalized prices for the area, as given in table 40, adjusted slightly upward or downward for the individual farmer in consideration of his actual

average prices in 1935 and the general quality of the product usually produced by him. They also reflect any relative advantage he might normally enjoy in market outlet or source of supply. For several of the commodities, no significant farm-to-farm differences in prices were found. This was especially true for grain, hay, and commercial feeds. On the other hand, evidence was obtained of significant farm-to-farm differences in the prices of some livestock and livestock products. Such differences were taken into account in ascertaining normalized prices of these commodities for the individual farmers.

The normal rates of seeding for various crops were arrived at on the basis of the farmer's practices in 1935, considered in the light of average seeding rates in the area. In the majority of cases, rates reported by individual farmers were rather closely in line with average rates for the area. In cases where the farmer's rate was abnormally high or low in 1935, it was adjusted downward or upward enough to make it a reasonable normal figure.

In deciding upon normal yields for each farm, an average was taken of yields obtained in the years from 1928 through 1935. In cases where unusually low yields during the drought years occurred, the average was adjusted on the basis of yields in more normal years. In the preparation of budgets for 1945 the same normal yields were used, except in cases where a noticeable trend in yield made it advisable to adjust the previous normal yield upward or downward before applying it to the future situation. Yields of corn for grain were generally estimated to be 10 percent higher by 1945 as a result of the increased use of hybrid corn.

Normal rates for important production factors in the livestock enterprises were based largely on records of average performance on the farm during the period of 1928 through 1935. For average butterfat production per cow, two rates were worked out in all cases in which a significant change occurred during the period of the records; one rate represents normal production as of 1935; the other represents probable normal production in the future, calculated on the basis of recorded average production in more recent years, and generally associated with some change in feeding practices.

The normal annual cost of tractor work on the farms budgeted was based on records of annual costs of tractor power on individual farms, 1928 through 1938. In estimating the annual costs for the future year, changes in crop acreages, changes in cropping practices, and changes in the number of work horses used were taken into consideration.

PREPARING THE BUDGETS

In carrying out the budgeting work, six different work sheets were used. The organization of each of these will be explained.

These work sheets provided columns for budgeting the 1935 actual organization, the 1935 normalized organization, and several alternative organizations for the future period. The titles of these work sheets give a general idea of the material recorded in each: (1) Farm resources; (2) acreage, production, and disposal of crops; (3) number, production, and disposal of livestock and livestock products; (4) feed budget; (5) financial summary; (6) summary and comparison of budgets.

The first step in actual budgeting included a review of the interview

notes, a study of the farm map, and of other items of the basic data available for the farm.

The second step was to complete the work sheet 1—farm resources—by listing on it the farm resources. This list included a record of acreages of land in different use classes; acreages of various crops; kind, size, and capacity of buildings; kind and numbers of livestock; amount of family and hired labor; indebtedness of the farmer; and a general statement regarding available farm machinery and equipment. Present as well as expected future resources were listed.

Work sheet 2 consisted of a tabulation of acreage, production, and disposal of crops in 1935, 1935 normalized, and 1945. For 1945, several alternative plans were worked out. For each of these plans were shown the acreage, yield, and production of each crop, and quantities used for feed, seed, and cash sale.

Data on livestock production and disposal for each of the budgets prepared were recorded in work sheet 3. Among the items listed were numbers of livestock, quantity of butterfat, beef, pork, poultry, and eggs produced, quantity of milk fed to livestock, quantity of products used for the household, and quantity of each product sold. In work sheet 4 detailed record was made of feed distribution to each class of livestock on the farm for each budget prepared. The total number of pounds of each kind of feed used was listed, and the average number of pounds of concentrates and roughages allowed per head or per unit was shown.

The financial summary, work sheet 5, consisted of a statement of receipts, expenses, and net earnings. Receipt items and expenses involved in each plan were here itemized and appropriate amounts listed for each budget. Net earnings were found by subtracting total expenses from total receipts. Receipts consist of income from sales of farm products or services rendered by the operator. Farm products used in the home figured in ascertaining quantities for sale but were not evaluated. Expenses include cash operating expenses for production and amortization of buildings, equipment, and horses. Interest on borrowed capital was included as an expense. In case future plans involve unequal amounts of capital outlay, the interest, amortization, and repairs on the additional investment are included as an expense. As no evaluations were made for labor performed by the operator or his family, net earnings or net cash income constitutes the return to the farm family for their labor and capital invested.

In work sheet 6 the farm organization, receipts, expenses, and earnings for each plan were summarized. Earnings were computed for each organization under three different sets of prices: A, Normal prices for all items; B, butterfat 20 percent above normal and all other items normal, and C, butterfat 20 percent below normal and all other items normal. The summarized plans were so arranged in this table that comparisons of one with another could readily be made.

It should be noted that the principal portion of each complete farm budget consisted of data recorded in work sheets 2, 3, 4, and 5.

Although each of these work sheets provided columns for the corresponding parts of several budgets, the order of preparation was to work out completely one budget at a time. Because of the independence of crop production, livestock production, and feed

distribution, the data in the corresponding work sheets had to be worked out more or less simultaneously, or with constant reference to each other. The financial summary was computed and listed in work sheet 5 after the crop, livestock, and feed information had all been entered in the foregoing tables.

Basis for Selecting the Most Probable Organization

It has been explained that the alternative organizations planned and budgeted for each farm were based on standard practices on that farm as modified by significant changes likely to occur during the period before 1945. Information which provided a basis for estimating such changes consisted of farm-record data for the years 1936, 1937, and 1938 and information obtained by the interviewer when the farm was visited in 1939. Several alternative plans were budgeted in order to learn the kind of organization most likely to be found on the farm in 1945. The alternative plans were set up in such a way that differences in their estimated net earnings would be traceable to changes in the size or production of specific enterprises in the farm business. That the alternative plans might be fairly compared, no drastic differences in general type of farming or in total size of business were assumed in the alternatives budgeted for the given farm. An important reason why a farmer grows several kinds of crops and raises several kinds of livestock is to maintain diversity and balance in his business. In keeping with this principle, minimum and maximum quantities were established for each type of crop and class of livestock usually produced on the farm. These lower and upper limits determined the range of probable variation in the size of enterprises on the given farm for budgeting purposes.

The farmer's probable earnings from each of the alternative organizations under "normal" price conditions were computed and shown in the financial summary. A comparison of the net earnings from the various alternative plans frequently indicated an additional alternative plan that would be the most profitable organization of all under-normal price conditions. Determination of a most profitable plan by such comparison became possible, as the first alternative plans were set up in such a way that the differences in their earnings were traceable to differences in specific enterprises. If an additional plan, more profitable than those first worked out, was indicated, it was budgeted and compared with the other plans under all three sets of price conditions.

A comparison of the net earnings from each of the plans under conditions of normal butterfat prices, high butterfat prices, and low butterfat prices could be made in summary sheet 6. As each alternative plan chosen for budgeting was required to meet the test of likeliness, it could be assumed that the plan which was most profitable under a given set of prices approached closely the organization which the farmer would be most likely to have under this set of prices, if he were allowed ample time in which to make adjustments from his previous normal organization.

USEFULNESS OF THE FINDINGS

The final purpose of research in problems of supply response as in other phases of agricultural economics is to assist farmers to make adjustments in the farming organizations that will be to the best

interests of themselves and of society.   This study of supply response in milk production is one of a series of similar area studies in which estimates of probable future production are attempted.   With reliable estimates of probable future output in different areas together with estimates of probable future demand, interregional maladjustments in agriculture may be prevented.

Even before results from all the area studies are available, the findings for each area have considerable significance.   The description of past trends in production and the analysis of the processes by which these trends were brought about, both in the area as a whole and in the two selected groups of farms, are useful to individual farmers, county planning committees, and agencies carrying on agricultural policies and programs.   From the viewpoint of the future planning of production, the detailed budgeting procedure used should prove of great usefulness to farmers in making plans and budgets to meet their own particular problems.   The study as a whole may serve as a starting point for estimating effects of programs or adjustments which may be recommended in connection with county planning work, conservation programs, and production adjustment programs.

As the price of a product is affected by competition between areas, the price associated with a plan of production for an area is dependent upon the supplies that are likely to be forthcoming from the different competing areas.   Completion of the comprehensive study of selected areas in major dairy regions in the United States, accompanied by estimates of the demand situation, will provide the necessary information for a long-time estimate of interregional competition in the production of dairy products.

COMPARISON WITH OTHER AREAS

Although an exhaustive analysis of interregional competition based on comparing responses in the areas studied must await a later occasion, it is of interest at this point to compare the results obtained for southeastern Minnesota with those of the Vermont and Wisconsin areas for which studies have already been published (1, 3).

All of these areas are expected to share in an expansion of dairy production in the future, in case of a continuation of normal prices or in case of a relative increase in prices of dairy products.   An expansion is expected in an area in Wisconsin even should prices of dairy products become less favorable (table 28).

TABLE 28.— *Comparison of estimated milk production (for sale) in 1946 in three price situations for designated areas*

[1936 normal-100]

Area	A	B	C
Vermont:[1]			
Cabot-Marshfield	108.8	116.7	90.5
Wisconsin:			
Dodge	107.8	119.9	93.0
Barron	108.6	118.2	100.8
Southeastern Minnesota [2]	109.0	118.0	98.0

[1] Changes in milk prices for the B and C situations in this area were 15 percent above and below A prices. It was estimated that such a change would be equivalent to a 20-percent change in prices in the other areas where normal prices are at a lower level.

[2] The production year May through April is understood in all areas. The designations 1936 and 1946 have been used in all areas except southeastern Minnesota.   In the latter, more of the available data referred to the calendar year 1935, so 1935 and 1945 seemed more appropriate.   In all areas the initial records cover the crop year 1935.

SUMMARY

This bulletin has as its primary purpose the determination of a long-time supply schedule for butterfat some years ahead in an area in southeastern Minnesota consisting of the five counties—Freeborn, Waseca, Steele, Dodge, and Rice. The procedure has been to analyze the past trends in production for the area as a whole and then, by budgeting two representative groups of individual farms, to arrive at an estimate of the future production for the area in three possible future price situations: (A) A continuation of 1935 normal prices; (B) a 20-percent increase in butterfat prices; and (C) a 20-percent decrease in butterfat prices.

Changes that occurred in the southeastern Minnesota area from 1927 to 1938 may be briefly summarized as follows. Butterfat production apparently increased about 12 percent. This increase was brought about by a corresponding increase in the number of cows rather than by a change in production per cow. The increase in the number of cows was made possible by expansion in crop acreages and shifts in feed crops. The principal crop change was a large increase in alfalfa and corn acreages. Normal feed-producing capacity was increased 13 percent between 1927 and 1938, although the full effect of this increase was not realized because of a decline in crop yields after 1930.

Hog production was drastically reduced in 1934 by drought and by the corn-hog program of the Agricultural Adjustment Administration, but when the period ended, the trend was distinctly upward again. Since 1935, production of beef cattle has tended to increase because of favorable price relationships. Poultry and sheep have also tended to increase during the period. The reduction in the number of horses has continued.

Some of the changes that have influenced farm production are still in progress. The increases in hybrid corn and alfalfa, the shift from horses to tractors, and the increasing mechanization of farms may be expected to continue.

The study of individual farm groups indicates changes in the same direction as for the area as a whole, but in somewhat different degree. The main reasons given by farmers for changes in production of butterfat were price conditions and new techniques like the introduction or expansion of crops capable of increasing production of feed for dairy cattle.

Assuming continuation of the normalized prices prevailing in this area in 1935 (the A price situation), the normal production of butterfat in the area in 1945 will be increased by 9 percent over that in 1935. This increase will result not only from a small increase in cropland, but, more importantly, from the future expansion of alfalfa, the expansion of other high-yielding roughage crops, and the increased use of hybrid corn. The budgeting analyses revealed that hogs and poultry compete strongly with dairying in this area. Consequently, the added feed supplies, becoming available from hybrid corn and better feed-producing small grains, may tend to expand hogs and poultry more than dairying. Yet on farms where the possibilities of expansion in alfalfa or other roughage crops are as yet largely unrealized, dairying may increase just as much as hogs and poultry, and perhaps more.

With an increase in the relative price of butterfat (the B price situation), some transfer of resources away from hogs, and to some extent from poultry, to dairy cows may be expected. The budgeting reveals, however, that even in this price situation dairying is not sufficiently superior on many farms to warrant more than a moderate increase in dairying at the expense of other enterprises.

With a relative decline in prices of butterfat (the C price situation) production of butterfat is expected to be slightly less than the normal output in 1935. Budgeting of various farm organizations indicates that in this price situation, alternative enterprises such as hogs, poultry, and beef cattle tend to become more profitable than dairying, and some contraction would be likely in the dairy enterprise. This contraction would be relatively larger than the estimated expansion in the event of an increase in prices of butterfat.

The analysis of the interrelations of farm enterprises in this area and of the manner in which these enterprises would be affected by changes in price relationships should be of considerable value to individual farmers as well as to public agencies engaged in planning agricultural adjustments.

Comparisons with areas in New England and in Wisconsin indicate that responses in dairy production are influenced by alternative enterprises and by changes within the dairy enterprise itself.

BASIC STATISTICAL DATA

TABLE 29.—*Butterfat production, and cows and heifers 2 years and over kept for milk, southeastern Minnesota, 1927–38* [1]

Year	Butterfat production in 11 counties [2]	Cows in 11 counties [3]	Butterfat per cow	Cows in 5 counties [3]	Butterfat production in 5 counties [4]	Index numbers of total butterfat (1927–38 = 100)
	1,000 pounds	*Number*	*Pounds*	*Number*	*1,000 pounds*	
1927	36,474	249,760	146	115,400	16,848	91.9
1928	36,542	252,000	145	117,000	16,065	92.5
1929	39,589	252,500	157	117,500	18,448	100.6
1930	39,549	263,000	150	122,000	18,300	99.8
1931	39,227	269,500	146	124,500	18,177	99.1
1932	38,003	275,500	138	127,500	17,595	96.0
1933	41,760	287,000	146	133,000	19,418	105.9
1934	39,469	310,000	127	143,500	18,224	99.4
1935	37,842	296,000	128	138,000	17,664	96.3
1936	41,378	283,500	146	133,500	19,491	106.3
1937	40,220	274,500	147	127,500	18,742	102.2
1938	42,945	278,000	154	131,000	20,174	110.0

[1] Butterfat production refers to receipts of cream and milk in terms of butterfat at dairy plants. Data taken from reports on Minnesota Dairy Products issued by the Agricultural Marketing Service, Minnesota Department of Agriculture, Division of Agricultural Statistics. Butterfat in cream for 1927–31 was estimated from reports for 1932–38. Milk was converted to butterfat on the basis of 3.5-percent fat.

[2] Consists of the 5 counties, Dodge, Freeborn, Rice, Steele, and Wasca, which constitute southeastern Minnesota for the purpose of this study, and 6 surrounding counties—Blue Earth, Faribault, LeSueur, Mower, Nicollet, and Olmsted.

[3] Minnesota Crop and Livestock Statistics. Annual reports of the Minnesota Federal-State Crop and Livestock Reporting Service.

[4] The dairy plants in this area undoubtedly received more cream and milk than the deliveries by farmers in the area. To arrive at the latter, receipts at plants in 6 surrounding counties were added, together with those of the 5-county area. Average delivery per cow in the larger area was then applied to the number of cows in the area studied.

TABLE 30.—*Livestock units in southeastern Minnesota, January 1, 1927–39*

Year	Livestock-unit equivalents of—[1]							Index numbers of total units (1927–38 =100)
	Milk cows [2]	All other cattle	Horses and mules	Hogs	Sheep	Chickens [3]	Total units	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	
1927	115,400	42,350	52,500	54,320	3,057	13,692	281,319	93.9
1928	117,000	39,750	51,200	51,560	3,029	13,296	275,835	92.1
1929	117,500	38,500	49,500	48,560	3,243	12,900	270,203	90.2
1930	122,000	44,500	50,700	61,600	3,757	13,532	296,089	98.8
1931	124,500	48,250	50,200	67,800	4,157	14,164	309,071	103.2
1932	127,500	47,750	49,400	74,400	4,072	14,191	317,313	105.9
1933	133,000	50,000	48,400	67,800	4,472	14,218	317,890	106.1
1934	143,500	50,750	48,800	73,800	4,929	15,541	337,320	112.6
1935	138,000	45,300	49,300	42,000	5,043	14,906	294,549	98.3
1936	133,500	47,250	48,300	47,200	5,057	14,758	295,065	98.8
1937	127,500	54,250	48,100	47,800	5,286	15,804	298,740	99.7
1938	131,000	51,000	46,500	53,000	4,986	14,495	300,981	100.5
1939	131,000	49,000	44,000	57,600	4,857	15,376	301,827	100.7

[1] One livestock unit equals: 1 horse; 1 cow; 2 other cattle; 5 hogs; 7 sheep; 100 chickens.
[2] Cows and heifers 2 years old and over kept for milk.
[3] Numbers reported by Minnesota State Farm Census corrected by the ratio between the numbers for the State of Minnesota reported by Minnesota Crop and Livestock Statistics and Minnesota State Farm Census.

Minnesota Crop and Livestock Statistics. Annual reports of the Minnesota Federal-State Crop and Livestock Reporting Service.

TABLE 31.—*Number and average size of farms, total land in farms, acreage of principal crops planted, and percentage that principal crops are of total land in farms, southeastern Minnesota, specified years, 1927–39* [1]

Year	Farms	Average size of farms	Land in farms	Principal crops planted	Percentage principal crops are of land in farms [2]
	Number	*Acres*	*1,000 acres*	*1,000 acres*	*Percent*
1927	10,160	142.9	1,452	831	57.2
1929	10,247	140.6	1,441	832	57.7
1931	10,362	140.9	1,460	872	59.7
1933	10,278	140.9	1,448	870	60.1
1934	10,474	140.5	1,472	834	56.7
1935	10,606	140.5	1,490	898	60.3
1936	10,441	142.4	1,487	897	60.3
1937	10,336	144.0	1,488	908	61.0
1938	10,228	144.9	1,482	903	60.9
1939	10,292	144.9	1,491	893	59.9

[1] Data not available for intervening years not listed in the table.
[2] Corn, small grain, tame hay, flax, and potatoes.

Minnesota State Farm Census. Annual reports of the Minnesota Federal-State Crop and Livestock Reporting Service.

TABLE 32.—*Acreages of principal crops planted, southeastern Minnesota, specified years 1927–39* [1]

Year	Corn	Oats	Barley	Other small grain	Alfalfa	Other tame hay	Wild hay [2]	Cash crops [3]	Total cropland [3]
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
1927	275,497	237,862	66,407	89,586	25,819	104,653	106,652	31,181	831,005
1929	277,660	222,333	104,130	69,154	28,193	104,287	101,081	26,704	832,461
1931	317,694	249,670	89,419	51,133	30,159	99,139	90,379	35,024	872,238
1933	320,873	269,962	77,345	44,942	43,733	88,560	88,019	24,678	876,093
1934	288,786	266,817	76,370	48,726	45,801	78,082	87,106	29,635	834,217
1935	305,600	262,206	103,555	74,086	58,875	64,849	81,388	28,487	897,638
1936	319,345	257,633	100,909	57,778	71,724	71,384	80,295	18,701	897,474
1937	335,702	249,459	93,949	68,990	79,945	66,258	74,260	14,121	908,424
1938	325,569	253,805	92,671	68,867	78,666	69,413	73,017	14,504	902,995
1939	316,610	237,325	92,367	44,863	67,224	103,094	70,074	31,576	892,999

[1] Data not available for intervening years not listed in the table.
[2] Wild hay not included in total.
[3] Cash crops are flax and potatoes.

Minnesota State Farm Census. Annual reports of the Minnesota Federal-State Crop and Livestock Reporting Service.

TABLE 33.—*Percentage that each crop was of the total acres in principal crops, southeastern Minnesota, specified years 1927–39* [1]

Year	Corn	Oats	Barley	Other small grain	Alfalfa	Other tame hay	Wild hay [2]	Cash crop [3]	Total [3]
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1927	33.1	28.6	8.0	10.8	3.1	12.6	12.8	3.8	100.0
1929	33.4	26.7	12.5	8.3	3.4	12.5	12.1	3.2	100.0
1931	36.4	28.6	10.2	5.9	3.5	11.4	10.4	4.0	100.0
1933	36.9	31.0	8.9	5.2	5.0	10.2	10.1	2.8	100.0
1934	34.6	32.0	9.2	5.8	5.5	9.3	10.4	3.6	100.0
1935	34.0	29.2	11.5	8.3	6.6	7.2	9.1	3.2	100.0
1936	35.6	28.7	11.2	6.4	8.0	8.0	8.9	2.1	100.0
1937	36.9	27.5	10.3	7.6	8.8	7.3	8.2	1.6	100.0
1938	36.1	28.1	10.3	7.6	8.6	7.7	8.1	1.6	100.0
1939	35.5	26.6	10.3	5.0	7.5	11.6	7.8	3.5	100.0

[1] Data not available for intervening years not listed in the table.
[2] Wild hay not included in total.
[3] Cash crops are flax and potatoes.

Minnesota State Farm Census. Annual reports of the Minnesota Federal-State Crop and Livestock Reporting Service.

TABLE 34.—*Weather conditions and crop yield, southeastern Minnesota, 1927–38* [1]

Year	Total precipitation		Mean temperature June–August	Average yield per acre of—				
	Annual	April–August		Corn	Oats	Barley	Tame hay	Wild hay
	Inches	*Inches*	*Degrees F.*	*Bushels*	*Bushels*	*Bushels*	*Tons*	*Tons*
1927	26.11	11.66	66.7	30.6	29.3	29.6	2.1	1.5
1928	27.44	20.65	68.6	37.5	41.9	34.5	2.0	1.5
1929	27.41	15.99	69.6	45.2	42.4	33.5	2.6	1.5
1930	34.55	25.31	71.5	38.9	41.9	31.4	1.7	1.1
1931	28.21	14.00	72.9	32.6	32.5	24.1	1.3	0.8
1932	22.72	14.26	71.8	42.3	40.4	29.1	1.8	1.3
1933	24.59	12.77	73.3	50.5	30.2	24.7	1.3	0.9
1934	22.57	10.80	72.6	30.1	16.7	14.4	0.9	0.5
1935	32.40	22.89	70.1	36.3	40.6	29.5	1.9	1.3
1936	20.25	10.64	73.0	33.0	34.2	24.2	1.4	0.9
1937	23.53	14.62	72.5	37.0	42.9	30.0	1.0	1.1
1938	30.38	18.74	71.8	40.5	31.6	26.1	1.9	1.2

[1] Data on weather are from records of the U. S. Weather Bureau for the station at Waseca, Minn. Data on yield of crops are weighted averages calculated from county data in Minnesota Crop and Livestock Statistics. Annual reports of the Minnesota Federal-State Crop and Livestock Reporting Service.

TABLE 35.—*Total digestible nutrients produced by various crops, southeastern Minnesota, 1927–38* [1]

Year	Total digestible nutrients in—						
	Corn	Oats	Barley	Tame hay	Wild hay	Total feed	Index numbers of total feed (1927–38 =100)
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	
1927	373,905	160,237	74,386	322,283	137,460	1,068,271	91.2
1928	458,600	207,815	131,018	267,230	153,506	1,218,169	104.0
1929	561,452	217,946	130,767	378,710	127,928	1,416,803	121.0
1930	518,730	211,049	108,658	267,190	90,488	1,196,115	102.2
1931	471,493	186,406	84,562	201,970	60,392	1,004,823	85.3
1932	631,998	229,388	96,400	289,915	92,660	1,340,361	114.5
1933	737,896	181,349	73,298	214,125	65,660	1,272,828	108.7
1934	448,730	86,104	42,644	116,380	27,520	721,298	61.6
1935	537,609	245,215	117,228	266,800	87,120	1,253,972	107.1
1936	483,750	202,819	88,493	215,200	58,624	1,048,796	89.6
1937	565,587	246,037	108,531	288,100	66,080	1,274,335	108.5
1938	601,046	183,635	93,372	291,600	65,520	1,235,173	105.5

[1] Computed from data from the Minnesota Crop and Livestock Statistics.   Annual reports of the Minnesota Federal-State Crop and Livestock Reporting Service.

TABLE 36.—*Estimated normal feed-producing capacity by individual crops in 1927 1938, and 1945 in southeastern Minnesota* [1]

Crop	Yield per acre [2]	Total digestible nutrients per acre [3]	Acreage [4]			Total digestible nutrients		
			1927	1938	1945	1927	1938	1945
	Bushels	Pounds	Acres	Acres	Acres	1,000 pounds	1,000 pounds	1,000 pounds
Corn	38.1	1,709	273,000	331,300	338,000	467,491	564,916	[5]632,060
Oats	37.2	846	240,600	256,100	250,000	203,786	216,457	211,500
Barley	28.4	1,064	67,200	95,600	105,000	71,339	101,948	111,720
	Tons							
Wild hay	1.17	940	112,100	70,000	55,000	105,610	65,651	51,700
Alfalfa	2.51	2,509	30,001	81,025	93,000	75,688	202,244	233,244
Clover and timothy	1.49	1,489	110,126	42,725	35,050	166,256	62,726	52,189
Other tame hay	1.44	1,442	11,473	29,350	30,050	16,771	41,725	43,332
Total			844,500	906,100	906,100	1,106,941	1,255,667	1,335,745

[1] The normal feed-producing capacity for southeastern Minnesota is computed from totals of the separate crops in Dodge, Freeborn, Rice, Steele, and Waseca Counties comprising this area.   Normal yields were applied to reported acreages for 1927 and 1938 and to estimated acreages for 1945.

[2] Yields presented for tame hay, corn, oats, barley, and wild hay, 1917–36, are computed from county yields published in the Supplement to Bulletin 347, Minnesota Agricultural Experiment Station (5). The county yields for tame hay were distributed to alfalfa, clover, and timothy, and other tame hay according to the relationships between the corresponding State average yields, 1926–36.   The Agriculture Marketing Service, U. S. Department of Agriculture.

[3] Total digestible nutrient rates used per 100 pounds of feed are: Corn, 80; oats, 71; barley, 78; wild hay, 40; and tame hay, 50.

[4] The acreage data are the sums of the county acreages in each crop for 1927 and 1938, as given in Minnesota Crop and Livestock Statistics.   The acreage in tame hay was divided into alfalfa, clover and timothy, and other tame hay, according to the proportion of each as given in the Minnesota State Farm Census for 1927 and 1938.

[5] Increase in corn yields 10 percent due to use of hybrid corn.

TABLE 37.—*Average annual weighted prices in southeastern Minnesota, 1910-38*

Year	Wheat per bushel	Corn per bushel	Oats per bushel	Barley per bushel	Rye per bushel	Flax per bushel	Potatoes per bushel	Hogs per hundred-weight	Cattle per hundred-weight	Lambs and sheep per hundredweight	Chickens per pound	Eggs per dozen	Butterfat per pound	Milk cows per head [1]
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	1.01	0.55	0.38	0.58	0.66	2.21	0.69	8.39	4.27	5.39	0.10	0.21	0.32	40.00
1911	.92	.53	.37	.88	.77	2.09	.84	6.39	4.01	4.69	.10	.17	.28	39.70
1912	.84	.57	.34	.64	.60	1.57	.69	6.99	4.74	5.23	.13	.20	.33	42.40
1913	.78	.56	.33	.50	.51	1.23	.58	7.73	5.78	5.77	.11	.20	.34	56.10
1914	.90	.60	.38	.51	.71	1.35	.64	7.67	6.00	5.94	.11	.20	.31	60.60
1915	1.01	.66	.37	.57	.88	1.69	.52	6.65	5.62	6.34	.10	.20	.32	56.70
1916	1.22	.81	.41	.72	1.04	2.11	1.05	8.56	6.10	7.79	.13	.22	.35	60.90
1917	2.01	1.29	.59	1.14	1.65	2.95	1.50	14.29	7.62	12.25	.15	.33	.44	72.90
1918	2.04	1.36	.70	1.24	1.73	3.58	.98	16.52	8.81	13.11	.19	.35	.51	83.40
1919	2.23	1.36	.62	1.03	1.37	4.03	1.44	16.64	9.09	11.81	.19	.40	.61	90.80
1920	2.15	1.23	.60	1.09	1.55	3.14	1.66	13.10	7.73	10.63	.22	.42	.62	93.00
1921	1.14	.46	.29	.46	.94	1.60	1.11	7.68	5.08	6.41	.17	.26	.38	59.00
1922	1.06	.51	.30	.47	.66	2.14	.78	8.58	5.04	9.21	.15	.24	.38	49.00
1923	1.01	.69	.35	.49	.61	2.28	.65	7.02	5.26	9.79	.15	.25	.46	51.20
1924	1.16	.78	.41	.66	.84	2.24	.62	7.72	5.84	10.06	.17	.24	.43	56.00
1925	1.43	.85	.37	.65	.94	2.50	1.01	11.20	6.25	11.89	.17	.28	.46	62.70
1926	1.36	.61	.35	.55	.81	2.11	1.53	11.97	6.73	11.30	.19	.27	.47	68.00
1927	1.21	.76	.43	.67	.85	2.01	1.13	9.66	7.16	11.03	.17	.22	.51	72.00
1928	1.07	.80	.42	.63	.92	2.01	.60	8.53	9.13	11.60	.19	.27	.51	90.00
1929	1.11	.76	.40	.54	.86	2.76	.99	9.57	9.37	11.01	.19	.28	.50	101.00
1930	.82	.68	.32	.46	.52	1.89	1.10	9.05	7.76	7.32	.15	.21	.39	81.00
1931	.54	.45	.22	.35	.30	1.27	.66	5.67	5.28	5.44	.13	.15	.29	54.00
1932	.46	.28	.18	.28	.27	.92	.32	3.42	4.13	4.40	.09	.12	.20	34.00
1933	.68	.36	.30	.43	.48	1.50	.75	3.58	3.60	5.06	.07	.12	.22	34.00
1934	.89	.56	.39	.71	.63	1.71	.86	4.24	4.08	5.85	.10	.14	.25	32.00
1935	1.00	.64	.24	.52	.39	1.50	.51	9.03	6.61	8.22	.14	.22	.30	55.00
1936 [2]	1.15	.70	.30	.68	.57	1.86	.82	9.53	6.37	8.00	.12	.19	.35	57.00
1937 [2]	1.12	.65	.30	.60	.72	2.11	.95	9.65	7.43	8.51	.15	.19	.36	61.00
1938 [2]	.64	.45	.22	.43	.37	1.63	.59	7.95	6.58	7.01	.13	.19	.30	61.00

[1] Average price for the State of Minnesota May 15 of each year. Milk cow prices for 1910-25 are from United States Department of Agriculture Statistical Bul. 15, p. 99, and for 1926-38 from the United States Department of Agriculture, Crops and Markets.
[2] The prices for 1936-38 are estimated from the average annual prices for the State for these 3 years.

Division of Agricultural Economics, University of Minnesota, data furnished by the Minnesota Federal-State Crop and Livestock Reporting Service.

TABLE 38.—*Ratios of sales prices of selected farm products to cost of feed to produce same and of milk-cow prices to prices of butterfat, southeastern Minnesota, 1927-38* [1]

Year	Butterfat-grain [2]	Eggs-grain [2]	Cattle-corn	Hogs-corn	Sheep-corn	Milk cows-butterfat
	Pounds	Pounds	Bushels	Bushels	Bushels	Pounds
1927	38	16	9.4	12.7	14.5	141
1928	38	20	11.4	10.7	14.5	176
1929	40	23	12.3	12.6	14.5	202
1930	37	20	11.4	13.3	10.8	208
1931	40	20	11.7	12.6	12.1	186
1932	36	22	14.8	12.2	15.7	170
1933	26	14	10.0	9.9	14.1	155
1934	20	11	7.3	7.6	10.4	128
1935	32	24	10.3	14.1	12.8	183
1936	31	16	9.1	13.6	11.4	163
1937	34	17	11.4	14.8	13.1	169
1938	39	25	14.6	17.7	15.6	203

[1] The number of pounds of grain required to buy 1 pound of butterfat or 1 dozen eggs; the number of bushels of corn required to buy 1 cwt. of cattle, hogs or sheep; and the number of pounds of butterfat required to buy 1 milk cow.
[2] The grain was in the proportion of 200 pounds of oats, 100 pounds of corn, and 100 pounds of barley.

Division of Agr. Econ., Univ. of Minn., data furnished by the Minnesota Federal-State Crop and Livestock Reporting Service except prices of milk cows which are from U. S. Dept. Agr., Crops and Markets.

TABLE 39.—*Dairy cows, butterfat production per cow, and total annual butterfat production on 24 accounting farms, and total butterfat production on 42 survey farms, southeastern Minnesota, 1927–38* [1]

| Year | 24 accounting farms | | | 42 survey farms |
	Dairy cows	Butterfat per cow	Total butterfat production [2]	Total butterfat production [3]
	Number	*Pounds*	*Pounds*	*Pounds*
1927				100,757
1928	352	236	83,173	95,761
1929	336	263	88,320	104,529
1930	300	260	93,429	108,106
1931	381	247	94,116	115,810
1932	422	244	102,851	118,135
1933	413	250	103,226	119,915
1934	440	235	103,411	119,976
1935	441	222	98,007	106,152
1936	406	257	104,353	114,245
1937	401	250	100,084	106,778
1938	384	258	99,075	105,970

[1] 24 accounting farms, 1928–38.
[2] Quantities produced for all uses.
[3] Quantities for sale.

TABLE 40.—*Normalized 1935 prices for selected items in southeastern Minnesota*

Item	Unit	Price	Item	Unit	Price
		Dollars			*Dollars*
Butterfat	Pound	0.35	Whey	Hundredweight	.08
Corn, shelled	Bushel	.54	Pasture charge	Animal unit	1.00
Corn, ear	Bushel	.50	Alfalfa seed	Pound	.23
Wheat	Bushel	.89	Red clover seed	Pound	.21
Oats	Bushel	.28	Sweetclover seed	Pound	.07
Barley	Bushel	.44	Timothy seed	Pound	.06
Rye	Bushel	.62	Millet seed	Pound	.02
Flax	Bushel	1.67	Phalaris seed	Pound	.20
Potatoes	Bushel	.74	Rape seed	Pound	.10
Soybeans	Bushel	1.16	Hogs	Hundredweight	7.08
Alfalfa hay	Ton	11.27	Lambs	Hundredweight	8.55
Red clover hay	Ton	9.40	Fat ewes	Hundredweight	4.18
Sweetclover hay	Ton	6.67	Cutter and low cutter cows.	Hundredweight	2.74
Timothy hay	Ton	7.00			
Clover and timothy hay	Ton	8.30	Veal calves	Hundredweight	7.63
Phalaris hay	Ton	7.80	Slaughter steers and yearings.	Hundredweight	7.30
Soybean hay	Ton	9.48			
Oat hay	Ton	7.34	Slaughter heifers	Hundredweight	5.75
Millet hay	Ton	5.58	Milk cows	Head	53.00
Sudan grass hay	Ton	5.58	Chickens	Pounds	.13
Wild hay	Ton	6.85	Turkeys	Pounds	.19
Corn silage	Ton	3.38	Eggs	Dozen	.19
Pea silage	Ton	2.80	Wool	Pounds	.22
Sweet corn-stalk silage	Ton	2.51	Baby chicks	Chick	.09
Corn fodder	Ton	5.26	Twine	Pounds	.08
Corn stover	Ton	1.98	Salt	Hundredweight	.90
Shredded corn stover	Ton	3.19	Labor (day labor)	Day	1.50
Sugar-beet tops	Ton	1.66	Labor (season laobr)	Month	35.00
Bran	Hundredweight	1.14	Threshing, oats and barley.	Bushel	.03
Middlings, standard	Hundredweight	1.19			
Middlings, flour	Hundredweight	1.30	Threshing, wheat, rye, flax, buckwheat, and soybeans.	Bushel	.04
Linseed-oil meal	Hundredweight	2.07			
Cottonseed meal	Hundredweight	2.04			
Tankage	Hundredweight	2.55	Silo filling	Ton	.30
Meat scraps	Hundredweight	2.75	Potato picking	Bushel	.04
Skim milk	Hundredweight	.17			

Division of Agricultural Economics, University of Minnesota, data furnished by the Minnesota Federal State Crop and Livestock Reporting Service and data from records in same Division. Prices on product other than butterfat in 1935 are adjusted according to relationships prevailing during 1921–30.

TABLE 41.—*Average seed and twine requirements per acre for selected crops in southeastern Minnesota, and average yield per acre in specified counties*

Crop	Requirements per acre		Average yield per acre in—				
	Seed	Twine	Dodge County	Freeborn County	Rice County	Steele County	Waseca County
	Bushels	*Pounds*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Wheat, winter [1]	1.50	2.50	18.0	17.6	20.1	19.1	18.4
Wheat, durum	1.50	2.50	15.7	17.9	18.9	14.8	16.8
Wheat, spring [1]	1.50	2.50	14.3	15.3	16.3	15.7	14.2
Oats [1]	3.00	3.00	33.6	39.4	38.3	37.6	35.7
Barley [1]	2.25	2.25	25.0	30.8	29.9	30.0	25.9
Rye [1]	2.00	2.50	15.2	19.3	19.2	18.0	18.1
Flax [1]	.60	1.00	9.5	10.6	10.5	10.1	10.2
Buckwheat	.90	2.00	11.6	12.5	16.1	16.2	16.4
Soybeans	.75	2.00	12.0	13.0	13.0	13.0	13.0
Oats and barley	1.25 / 1.25	3.00	(²)	(²)	(²)	(²)	(²)
Oats and wheat	1.00 / 1.00	3.00	(²)	(²)	(²)	(²)	(²)
Wheat and flax	.90 / .60	2.50	(²)	(²)	(²)	(²)	(²)
Potatoes [1]	13.00	----	93.0	118.0	86.0	95.0	82.0
	Pounds						
Corn, grain [1]	8.50	----	33.5	39.1	39.2	38.5	39.2
			Tons	*Tons*	*Tons*	*Tons*	*Tons*
Corn, silage	13.25	4.50	7.8	9.0	9.5	7.9	9.3
Corn, fodder	27.00	4.00	2.2	2.5	2.3	2.5	2.4
Sweet corn	8.00	4.00	2.5	2.5	2.5	2.5	2.5
Sugar beets	15.00	----	7.3	8.0	8.3	8.6	8.5
Canning peas	240.00	----	.9	.9	.9	.9	.9
Alfalfa	14.00	----	2.7	3.2	2.6	2.8	3.0
Sweetclover	15.00	----	1.2	2.0	1.6	1.7	2.2
Red clover	10.00	----	2.0	2.3	1.9	1.9	2.0
Clover and timothy	8.00 / 6.00	----	1.5	1.8	1.5	1.6	1.7
Alsike and timothy	6.00 / 6.00	----	1.5	1.8	1.5	1.6	1.7
Sweetclover and timothy	5.00 / 10.00	----	1.5	1.8	1.5	1.6	1.7
Phalaris	7.00	----	3.0	3.0	3.0	3.0	3.0
Alsike clover	11.00	----	2.0	2.3	1.9	1.9	2.0
Timothy	10.00	----	1.5	1.8	1.5	1.6	1.7

[1] The 1917–36 average yields as computed from data furnished by Minnesota Federal-State Crop and Livestock Reporting Service and Division of Agricultural Economics of University of Minnesota were used for these crops. All other yield data are from records in Division of Agricultural Economics of University of Minnesota.
[2] Data not available.

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