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SUPPLY RESPONSES IN MILK PRODUCTION IN DODGE AND BARRON COUNTIES, WIS

CHRISTENSEN, R P ; MITCHELL, R L 1 OF 1

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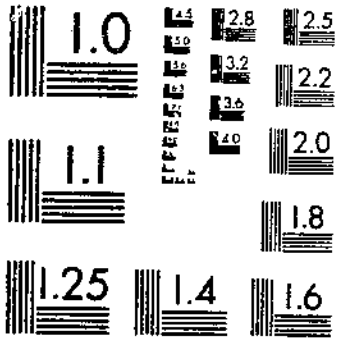


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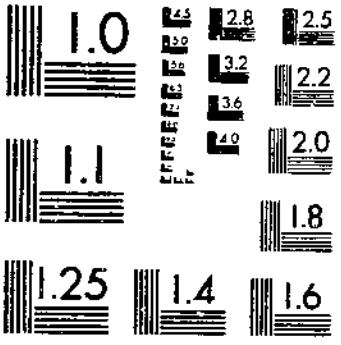


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NATIONAL BUREAU OF STANDARDS-1963-A

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**UNITED STATES**
**DEPARTMENT OF AGRICULTURE**
**WASHINGTON, D. C.**

# Supply Responses in Milk Production in Dodge and Barron Counties, Wis.[1]

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## INTRODUCTION

Studies of farmers' response to prices and other factors have been made for a considerable number of farm products during the last 15 years.[3] This problem has received considerable attention as an important factor in the effort to adjust agricultural production to prospective supply and demand conditions. The individual producer who would adjust his acreage and livestock numbers with due regard to what other producers are doing needs to judge in advance the probable total output that will compete with his production when it is ready for market. Similarly, in setting up the over-all production objectives of a national agricultural program, advance judgments

[1] Received for publication June 15, 1940.

[2] This study was planned by Sherman E. Johnson, representing the Bureau of Agricultural Economics, and Don S. Anderson, representing the Wisconsin Agricultural Experiment Station. The counsel of Asher Hobson and D. R. Mitchell of the Wisconsin Agricultural Experiment Station and Erling Hole of the Bureau of Agricultural Economics has been helpful throughout the study. Credit is due Mrs. Mona Goldschmidt for her careful handling of the details of the analytical work.

[3] WELLS, ORIS V. FARMERS' RESPONSE TO PRICE: A SELECTED BIBLIOGRAPHY. U. S. Bur. Agr. Econ. 26 pp. 1933 [Mimeographed].

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must be made not only of the probable effects of the program itself but also of farmers' response to price, technological changes, and other factors.

Of special interest in the case of milk are the researches carried out by Ezekiel, Rauchenstein, and Wells.[4] Among the more recent studies of milk are those of Parsons (*17*)[5] in New York and S. M. Johnson in Vermont (*11*).

It can be said of these, as of nearly all of the work on farmers' response that they have been related mainly to the short run. Despite passing references to the significance of longer-term phases of supply, little that has been done has given us any real basis for estimating the quantity of any farm product that will be forthcoming, say 10 years later, if its price should definitely rise or fall 20 percent relative to other prices and stay there.

This situation is not peculiar to studies of production and supply, but is found also in the field of consumption and demand research (*15*). Indeed, much of the research and thinking in the whole field of agricultural economics during the 1920's was focused upon a relatively short-time span.

There appear to have been two principal reasons for this situation. The first is related to the rapid development and widespread use by agricultural economists of statistical procedures (including multiple-correlation technique) for dealing with time-series data. These statistical procedures were most effectively applied to short-run problems. No correspondingly useful technique has been developed for longer run questions.

The second and more important reason for the concern of the public-research agencies with short-run problems was that they considered the most practical assistance could be rendered in this way to farmers and to the general public. The Federal and State programs of research, built around the annual agricultural outlook, for example, were designed to assist farmers to make as many economic adjustments as possible in order to meet market demands during the ensuing year, or at the most, in the next few years. Although it was recognized that farmers had important long-term decisions to make, it was generally felt that the most useful contribution could be made in developing information to aid in the year-to-year adjustments.

During recent years, with the wide recognition of the need for long-term adjustments, with fundamental changes in underlying conditions, and with the advent of public agencies with definite powers to shape long-term policies and programs, the situation has markedly changed. Today we need a long-term outlook as well as one for the next year, and research to support long-term planning is receiving relatively more emphasis.

A general basis for an appropriate attack on farmers' long-term response in relation to interregional competition has been described by Black (*2*). The approach suggested by the group with whom the present writers are associated is explained in the report entitled Analysis of Interregional Competition in Agriculture.[6] The general

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[4] EZEKIEL, MORDECAI, RAUCHENSTEIN, EMIL, and WELLS, ORIS V. FARMERS' RESPONSE TO PRICE IN THE PRODUCTION OF MARKET MILK. U. S. Bur. Agr. Econ., 16 pp., illus. 1932. [Mimeographed.]

[5] Italic numbers in parentheses refer to literature cited, p. 83.

[6] JOHNSON, SHERMAN E., HADY, FRANK T., MITCHELL, RONALD L., ALLEN, R. H., and HOLE, ERLING. ANALYSIS OF INTERREGIONAL COMPETITION IN AGRICULTURE. U. S. Bur. Agr. Econ., 74 pp., illus. 1939. [Mimeographed.]

procedure there suggested has been applied in detail in an actual study of an area in Vermont (*1*).

In very general terms, this procedure for determining farmers' long-term response is a twofold process of first analyzing developments and trends over the recent past and then estimating for each of several different levels of price for the commodity in question, what the normal level of production is likely to be at a time some years in the future. The final result may be presented in the form of a conventional supply schedule for the area in question and for the time-span considered. The analysis may be carried at several different levels of intensity, depending upon the available information and resources. With limited information and facilities an attempt to project broad economic trends by means of qualitative analysis might be made. At another level of intensity, farm-management analyses of past production changes and their reasons may be thoroughly explored and trends extended on a more certain foundation, although still perhaps in a largely qualitative fashion.

The method used in the study of the Cabot-Marshfield area in Vermont, referred to above, and in the study now reported, is on a still more intensive and penetrating level of analysis, both with respect to the examination of past trends, and also in the treatment of the probable future responses from different prices. Not only are county and area data for the last 10 to 20 years examined, but records of individual farms are carefully studied to explain net changes over the preceding decade. For the period ahead, individual farm-budget estimates are made for a considerable number of representative farms. Area estimates are reached by adjusting the individual farm estimates for factors which cannot be adequately treated by individual farms. The final results are presented as a long-term supply schedule for each area studied. These show the probable outputs of milk at each of the several levels of price for a time some years ahead.

Not many farm-management studies covering details of farm organization and practices have been repeated in particular areas in such a way that analysis could throw light on farmers' long-time price responses. Even those which have been repeated have paid relatively little attention to changes over time. For example, Chester County, Pa., has been studied using detailed farm-management records at three successive periods, 1912 (*19*) 1922 (*8*), and 1930–31 (*12*).

Each of these Chester County studies was mainly concerned with the factors affecting farmers' income in the year studied as determined by correlating various factors with some measure of financial success. Only passing attention in the most recent study was paid to the changes occurring over the entire period and these were not related to changes in price relationships or to other economic factors to which farmers undoubtedly were responding.

Some recent studies in Iowa of the effects of the Agricultural Adjustment Administration programs have utilized individual farm information on cropping systems by years for the period 1929-39 (*21*). In this Iowa study, however, the major attention is centered on the year-to-year responses to the changes in the Agricultural Adjustment Administration programs with only incidental analysis of responses to price over the longer period. Moreover, the farms are a representative sample scattered over the State, rather than being concentrated in a specific area.

In the present study, as in the parallel Vermont study, more attention is devoted to the processes by which changes in the production of an area come about.

Distinct transformations in the agriculture of Wisconsin have occurred at various stages in the history of the State since the initial settlement of significance, which occurred about 100 years ago. Early farming was largely self-sufficing. This was gradually replaced by a system of farming in which commercial wheat production was dominant, especially after 1850 with the advent of the railway network.

Beginning in the sixties, dairying came to assume commercial importance and its development since that time has been steady and continuous. Wheat became less profitable as the new wheat regions farther west opened up. Dairying expanded as urban populations grew and new market outlets developed. The invention of the cream separator and other dairy equipment and improved technique played a significant role in the long-term development which has been witnessed. In the course of several generations of dairying, a common fund of skill, discipline, and special knowledge has become a part of the social inheritance of farmers in Wisconsin.

Underneath the factors which are subject to change are certain fixed determinants which in the past have affected the choice between dairying and possible alternatives. These are the fundamental climatic, topographic, soil, and natural conditions.

This brief discussion should be sufficient to indicate that agriculture in Wisconsin has been continuously changing throughout its existence. Even at the present time forces are at work that tend toward further change. The agricultural conservation program has been focusing attention on practices that build up the productivity of cropland and pastures. Technological change continues to affect farm organization. Wisconsin agriculture appears to be moving inevitably in the direction of greater specialization in dairying as minor enterprises become less important.

What do all these changes that are under way mean in terms of our agriculture 10 years or more hence? What will be the relative competitive position of dairymen in Wisconsin and other competing regions? What adjustments should individual dairymen make during the next few years? It is toward questions of this nature that the work presented in this bulletin is directed. This is one step toward developing better answers than are now available.

The larger study of which this is a part relates to interregional competition in the production of dairy products in the Midwest and New England dairy regions taken as wholes. This particular part of the larger study relates to two separate selected areas, Dodge County and Barron County, Wis. Their location is shown in figure 1. Each of these is representative of a particular type of producing area. Barron County represents conditions in northwestern Wisconsin where other alternative enterprises are of minor importance. Dodge County, in southeastern Wisconsin, lies on the margin of the Corn Belt and has several alternative lines of production of significance.

Parallel studies are in progress in other types of producing areas elsewhere in the Lake States and in New England. As these studies are completed, the next step will be to combine the supply schedules into composite supply schedules for each region. By bringing together

these regional supply schedules and relating them to appropriate demand schedules, improved long-time estimates of production and price might be made. It might then be possible to speak with more assurance of the adjustments that dairy farmers in the several areas should make. Agricultural planning in these regions in all its phases, local,

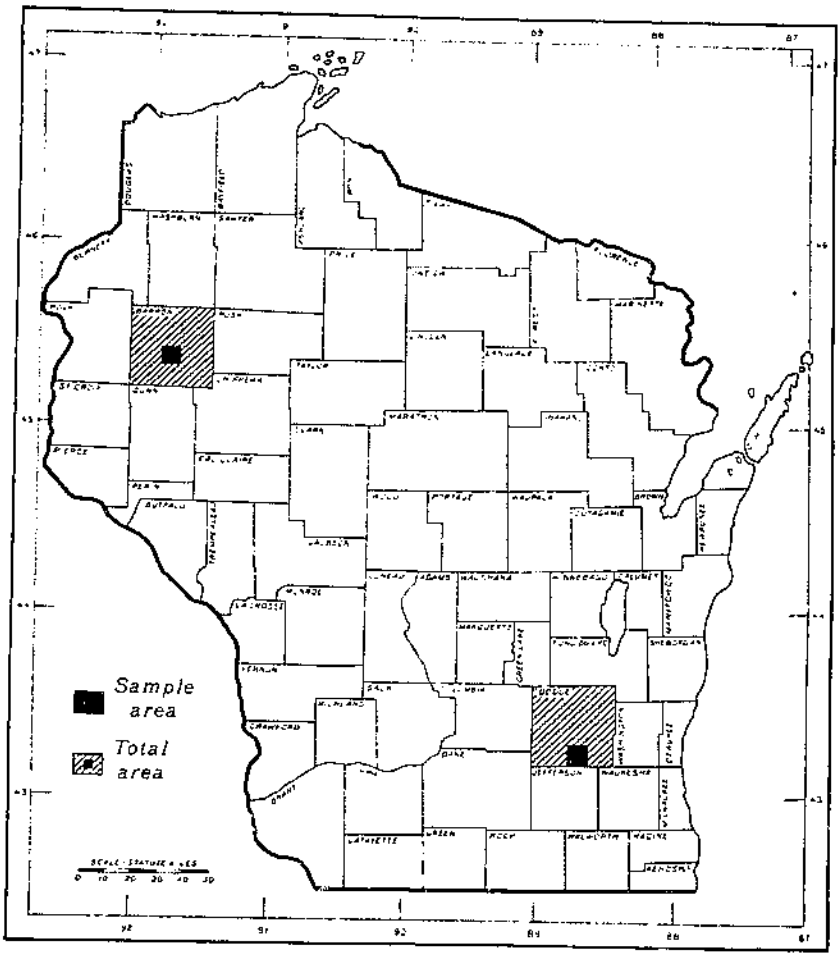


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FIGURE 1.—LOCATION OF THE AREAS STUDIED IN DODGE AND BARRON COUNTIES, WISCONSIN.

Detailed farm records were obtained from individual farmers in Emmet Township in Dodge County and Maple Grove Township in Barron County.

State, and national will be greatly aided by these long-time estimates. Both production and distribution programs will be assisted. Even though it may not be possible to attain the degree of perfection that some idealists dream about, whatever progress can be made in the direction of improving our judgment of future trends will have practical value.

## DAIRYING IN WISCONSIN

Wisconsin has been the leading dairy State for a number of years. Nearly three-fourths of its farms were classified as dairy farms in the 1930 census and about 60 percent of the gross farm income for the State during the 10-year period 1928–37 came from the dairy enterprise. Other farm enterprises are usually supplementary to the dairy enterprise. Climatic and natural conditions vary considerably in different portions of the State. From conditions closely comparable to the Corn Belt in the South, the average growing season becomes shorter as one moves north. Hay and forage crops have relatively more advantage over the grain crops in the north. The general background and description of types of farming in Wisconsin have been fully discussed by others (*13*).

Looking backward over the last 40 years several general observations about dairying in Wisconsin can be made. First, total milk production appears to have had a steady upward trend. Secondly, a significant shift from farm to factory production of butter, cheese, and other dairy products has occurred.

Let us first consider the trend in total milk production. The changes in dairy-cow numbers as estimated by the Wisconsin Crop and Livestock Reporting Service may be used for estimating the trend in milk production over the period since 1900. These data indicate a fairly rapid and continuous growth with only a few temporary interruptions. The number of dairy cows in Wisconsin is now (1940) at nearly the highest point on record. Only the very high number in 1934 was slightly greater.

Another and more direct source of information on milk production for the period since 1925 is the series of estimates of total milk production in Wisconsin prepared by the Wisconsin Crop and Livestock Reporting Service. These are based primarily on the annual reports of milk and cream received from farmers at Wisconsin dairy plants. Examination of this series as shown in figure 2 and table 21 for the period 1925–38 shows that the trend of production was upward except for a slight recession in 1927 and 1928 and again in the more recent drought and depression years. Production by 1938 had not only recovered but had reached the highest point in the period.

The second important change noted, namely, the shift from farm to factory production, may now be considered. The greater part of this shift occurred before 1920 and today there is very little farm-made butter or cheese. In addition to the shift from farm production to factory production, various sections of the State have shifted from the production of some products to others. Fluid milk for city consumption, especially in the southeastern part of the State, has become more important, condensed and evaporated dairy products have increased in quantity, and other minor products have become more significant.

From the point of view of the form in which milk leaves the farm for delivery at the local receiving plant, the most significant change in recent years has been a shift from cream deliveries to milk. In 1929 Wisconsin dairy plants received 31.3 percent of their milk (equivalent) deliveries in the form of cream and the remainder in milk (*5*). By 1936 the cream deliveries had declined to 22.7 percent of the total deliveries. Since 1936 there seems to have been a slight reversal of this trend.

Before entering upon the detailed analysis it will perhaps be worth while to call attention to a few of the underlying major trends that probably help to explain the continuing upward movement of milk production in Wisconsin. The first and most important of these is the trend toward an increased production of nutrients from forage crops, mainly through an increase in the proportion of higher-yielding legume hays in the tame-hay acreage. For the State as a whole it has been estimated that the normal yield of tame hay increased about 11 percent by 1938 as compared with the 1928–32 5-year average yield as a result of this type of shift (*13*). This change is still proceeding and may perhaps be expected to go farther under the impetus furnished by the agricultural conservation program.

Hybrid seed corn is another innovation that is affecting corn production, at least in southern Wisconsin. It has been estimated that

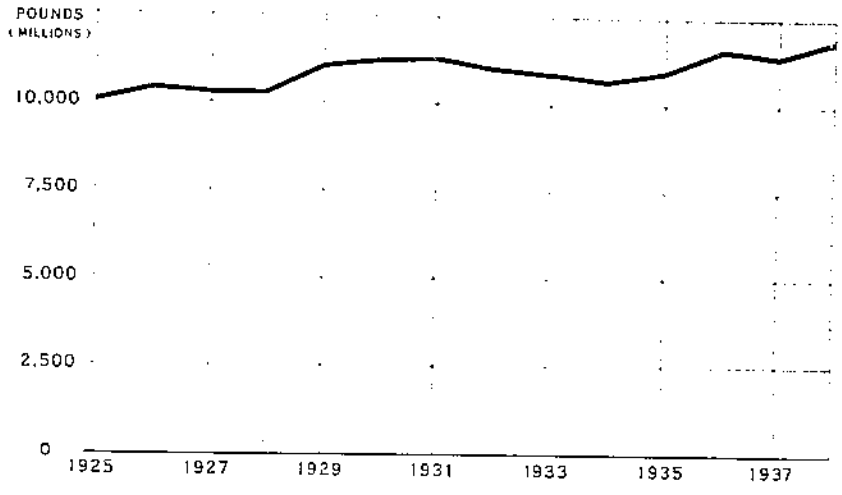


FIGURE 2.—TOTAL MILK PRODUCTION IN WISCONSIN, 1925-38.

The trend of milk production in Wisconsin has been upward since 1925 with one significant recession in the 4-year period following 1931 associated with depression and drought conditions. Production in 1938 was about 18 percent greater than in 1925.

the Wisconsin yield of corn has already been increased substantially by the use of hybrid seed and by 1945 will have been increased from 15 percent to 20 percent on 75 percent of the total State corn acreage (*4*). It may be said of this that acreage restrictions may affect the increase in corn production but this may only mean that more forage will be produced on the acreage released.

Other technological changes under way will no doubt have some effect on milk production. Possibly some further increase in the use of tractors may occur that will release some feed for dairy cattle through the displacement of horses. Recent improvements in silage- and hay-making equipment may make it possible to reduce greatly the labor involved in these operations and perhaps to increase the nutritive yield per acre. Artificial hay dryers, for example, produce a hay of higher average nutrient content. Yet mechanization has not proceeded so far in dairy farming as in other types of farming, and does not seem likely to do so. Perhaps more important are the possibilities of im-

proved breeding, feeding, and management of dairy herds. Artificial insemination, to take one example, promises to open the way to a more rapid improvement in average production per cow. Breeding rings based on this practice may be expected to exert a definite influence on future production. All of these and many other factors need to be considered carefully in appraising the future prospects of Wisconsin dairying.

## DODGE COUNTY—AN AREA WITH SOME ALTERNATIVES

### The Agriculture of Dodge County

A general consideration of the important features of the agriculture of Dodge County and of the factors responsible for the prevailing type of farming is essential in estimating what adjustments may be expected to take place in its agriculture with certain changes in production conditions or in prices for farm products. The adaptability of the county to dairying as compared with other lines of production is first examined. This involves a consideration of physical, as well as economic, factors which favor a certain type of farming in preference to others.

#### SOIL

Dodge County is in the southeastern part of Wisconsin. This general section has been classified by geologists as the southeastern glaciated limestone area. This part of the State is underlain chiefly by limestone and was covered by the Wisconsin ice sheet. Originally the land was relatively rough as in the unglaciated areas of the southwestern part of Wisconsin. The effect of glaciation has been to grind off the hilltops, and to fill up the valleys, producing an undulating or rolling topography. Drumlins and kettle holes are common. Surface drainage is fair to good. Most of the soils have been formed from the underlying limestone and are intermixed with gravelly and stony material brought in by the glaciers. The whole area shows considerable variation in soil character, including a wide range in texture from clay loam through silt loams to sandy loams. However, silt loams predominate. There are many marshes and shallow lakes scattered over this area, especially in the kettle-morraine country.

The upland soils, for the most part, are relatively low in organic matter. This is accounted for by the fact that the area was originally covered by forest consisting principally of oak, hickory, elm, and basswood. The leaves and other vegetable matter of the forest areas quickly decay and form a layer of leafmold over the soil but do not become incorporated into the soil itself. This layer is soon lost after the soil is broken for tillage operations. The soils of the prairie openings which are found in the extreme southern part of the region are darker in color and richer in organic matter than are the forest soils. The roots of the grasses which covered these areas penetrated the soils from 6 to 18 inches, where they decomposed. In this way the organic matter became incorporated in the soil and later was not lost so quickly following cultivation. Only a small proportion of the land in Dodge County was originally included in this prairie-soil classification.

The principal soil type in Dodge County is the Miami silt loam. The surface layer of this soil to a depth of 10 to 14 inches consists

of grayish-to-yellowish silt loam. This is underlain by a yellowish silty clay loam to a depth of 18 to 20 inches where a reddish-brown gritty clay loam is usually encountered. At depths of from 2 to 4 feet there is usually more sandy and gravelly material, a large part of which is limestone. This gravelly material in the subsoil is usually sufficient to give the Miami silt loam good underdrainage, and it is only on the more level areas where the proportion of the clay in the subsoil is unusually large that the underdrainage is inadequate. Soil of this latter type is classified as Miami clay loam but includes only a small fraction of the total land area.

Topographical and soil conditions in Dodge County are such that a relatively large proportion of the total land area is suitable for some type of crop production. Land too rough or too poorly drained for cultivated crops supports a vegetation which can be used for pasture. Although the soils of this area are not very high in organic-matter content, due to the nature of the original vegetative covering, crop yields can be maintained if good cropping systems are followed. The original fertility of the soils was less than that of the soils of the prairie regions of other States. A type of farming, such as cash-grain farming, in which large amounts of plant nutrients are removed from the farm, would result in a rapid decline in productivity. The application of large quantities of fertilizer would be necessary in order to prevent a reduction of crop yields. A livestock type of farming in which large quantities of roughage feed are used and relatively small quantities of plant nutrients are removed from the farm is most desirable from the standpoint of conserving the soil.

The soils of this part of the State have been affected by erosion in the last few years. In some cases where cultivated crops have been grown on sidehills or slopes, the surface has been removed and the productivity of the land reduced. Some evidence of erosion can be found on most farms. However, erosion is not as serious a problem in this area as it is in the rougher portions of southwestern Wisconsin.

### CLIMATE AND PRECIPITATION

The climate of Dodge County is typical of southern Wisconsin. It is important to note that the growing season is relatively longer than the State average. The frost-free period varies from 150 to 170 days, comparing favorably with many of the best agricultural areas of the Corn Belt. Temperature conditions are such that it is nearly always possible to obtain good yields of corn.

Amount and seasonal distribution of rainfall is also similar to that for the entire State. The total rainfall of about 31 inches is well-distributed throughout the growing season, about 21 inches coming in the 6-month period, April to September inclusive. Climatic conditions are therefore favorable to a wide range of crops.

### POPULATION

Dodge County was settled largely during the decade from 1840 to 1850. The United States Census of 1840 reports 67 residents in this county but by 1850 the number of inhabitants had increased to 19,138. Population continued to increase rapidly until 1860 when the Census reported 42,818. The total in 1870 was about 47,035 but declined somewhat in the following decades. By 1930, the popula-

tion was reported to be 52,092. More significant in recent decades is the fact that the urban population has been increasing while the rural population has been decreasing. However, there has been no important change in the number or size of farms operated.

### IMPORTANCE OF FARMING AND CROPPING SYSTEMS

Relative importance of agriculture as compared with other lines of production in this county may be illustrated by the proportion of the total population classified as rural and urban. According to the 1930 census, 63 percent of the total population of the county was classified as rural. There are several small towns located within the county, but there are no very large centers. Watertown, near the southern boundary of the county, with almost 11,000 inhabitants, is the largest city. While there are a few manufacturing establishments in the county, most of the urban population is engaged in occupations concerned either with the marketing of agricultural products or with the distribution of goods and services to farmers. It is clear that this is primarily an agricultural area.

A large proportion, about 92 percent, of the total land area of the county is included within farms. There were 4,735 farms in the county in 1935, the average size being 111.2 acres. This is somewhat less than the State average of 117.4 acres. The proportion of the total land in farms devoted to crop production, according to the 1930 Census, was 63 percent as compared to 47 percent for the entire State. More than 28 percent of the farms in Dodge County were operated by tenants in 1935, while the percentage for the entire State was approximately 21.

A customary cropping system in this county consists of small grain, hay, corn, and sometimes canning peas, potatoes, or other cash crops. Nearly one-half of the cropland is used for small grains, including oats, barley, wheat, and rye, while slightly less than one-fourth is planted to corn. Over one-half of the corn acreage is used for silage. The remaining one-fourth of the cropland is used for hay production. About one-half of the hay grown is alfalfa. A small proportion of the cropland, usually less than 5 percent, is in cash crops such as canning peas or potatoes. The cropping system mentioned above is not followed in a very exact manner. Small grains may be grown on the same field for 2 or 3 years in succession. This is followed by hay for the next several years, then by corn and other cultivated crops for 1 or 2 years. Farmers adjust their cropping systems and production programs from year to year so as to obtain the desired amounts of the various feeds required for their livestock. Most of the land not in crops is used as permanent pasture. Only a small proportion of the land is wasteland.

### TYPES OF FARMING AND INCOME

Dairy farms are by far the most important type in this county. According to the 1930 census, 87 percent of the farms fall in this classification. By definition, this means that they obtain over 40 percent of their gross income from dairying. Other types of farming of minor importance are those farms classified as general, abnormal, crop-specialty, animal-specialty, and poultry. This does not mean that dairying is the only important enterprise on farms in Dodge County

for the production of hogs, poultry, eggs, and cash crops is responsible for a substantial part of the farmers' income. A better understanding of the type of farming can be obtained from the data in table 1 indicating the proportion of income obtained from various sources in 1936.

TABLE 1.—*Percentage of gross farm income obtained from specified sources, Dodge County, 1936*

| Income from— | Percentage of gross farm income | Income from— | Percentage of gross farm income |
|---|---|---|---|
| Livestock and livestock products: | *Percent* | Crops: | *Percent* |
| Milk | 48.3 | Grains | 6.4 |
| Cattle and calves | 10.1 | Potatoes | 2.7 |
| Hogs | 17.5 | Canning peas | 2.1 |
| Poultry and eggs | 9.2 | Other | 3.2 |
| Other | .5 | | |
| Total | 85.6 | Total | 14.4 |
| | | Total all sources | 100.0 |

Wisconsin Crop and Livestock Reporting Service (5, pp. 18-19).

The total gross farm income for the county as reported for the year 1936 was almost 14 million dollars. Of this nearly 12 million dollars came from the sale of livestock and livestock products while slightly more than 2 million dollars resulted from the sale of crops. As indicated above, almost 60 percent of the total gross income, or over 8 million dollars, came from the sale of milk, cattle, and calves. Income from the sale of hogs amounted to almost 2½ million dollars, while income from poultry and eggs amounted to more than 1 million dollars.

It is apparent from these data that there are important farm enterprises other than dairying. As most farms in the county are classified as dairy farms, this suggests that they must include a combination of enterprises. Most of them must produce some hogs, poultry, and cash crops, as about 40 percent of all farm receipts are obtained from these sources. General observation, as well as detailed information from individual farms, supports this conclusion. The most common type of farm is that which includes a combination of enterprises consisting of dairying as a major line of production and hogs, poultry, and cash crops as supplementary sources of income.

The type of farming found in this area and described above is the result of the operation of a combination of physical and economic factors. Soil and climatic conditions are such that a wide variety of crops can be grown. But in order to maintain the present fertility and productivity of the soil, it is necessary to follow a fairly definite cropping system and to devote a large proportion of the land to alfalfa, clover, and other soil-conserving crops. Yields of most crops may thus be maintained with the use of manure and moderate applications of lime, phosphorus, and potash. As the soil is of limestone origin, alfalfa can be grown over much of the area without the application of large quantities of lime. Liming is usually a profitable practice, however, where the natural lime content has been reduced by long-continued cropping, or has been leached out of the surface layer of the soil.

The crops most adapted to this area favor a livestock type of farming. Roughage crops such as hay, corn silage, and pasture have little

value except for feeding livestock. A higher return from the use of land can be realized when a rotation of grain, hay, corn, and perhaps some cash crops, is followed and when the feed produced is utilized for keeping livestock. A cropping system of the kind indicated above is also of aid in preventing erosion as well as in conserving the fertility of the soil. One must, of course, recognize that the alfalfa in such a cropping system draws heavily on the soil minerals and will tend to deplete the phosphorus and potash of the soil unless these are supplied in fertilizer.

Dairying is a livestock type of farming which provides a market for the crops best adapted to this region. The typical farmstead presented in figure 3 shows how the buildings have been adjusted to

FIGURE 3.—A TYPICAL FARMSTEAD IN DODGE COUNTY.

Dairy farms in this area are well equipped with buildings for specialized dairying. The barn in this picture is larger than the average of the area. It has been enlarged by building a second structure at the rear of the first.

the dairy enterprise. Other types of livestock farming such as hog production and fattening of beef cattle require larger quantities of concentrated feeds than do dairy cattle. Dairy cattle make good use of large quantities of roughage feeds such as silage and hay and also provide a source of income from pasture land which is either too rough or too poorly drained for crop production. Enough small grain or corn for grain can be grown to supply most of the concentrate needs of dairy cattle. However, farmers do find it economical to purchase some additional grain feed in order to obtain a more nearly balanced dairy ration and to devote a larger proportion of their cropland to the production of roughage feed.

It appears profitable to combine dairying with hog production or with some poultry and cash crops, as these combinations permit the most complete utilization of available resources. Production of hogs provides a source of income for milk byproducts, such as whey and skim milk which otherwise would have little or no value. A large proportion of the farmers have whey available, as almost three-fourths of the milk produced in the county is used in making cheese.

Some poultry, mostly chickens, are kept on nearly all farms, and there are a few commercial poultry farms. While the poultry enterprise does not furnish a very large proportion of the total income, it does provide an important part of the family food supply. The poultry flock is usually allowed to roam around the farmstead and utilize waste feed.

Cash crops grown include grain, canning peas, and potatoes besides some others which are of minor importance. Barley is the most important small grain sold for cash. Climatic and soil conditions are relatively favorable for the production of these crops, but the quantities which can be grown on individual farms are distinctly limited. Cash crops provide important supplementary sources of income when combined with dairying and hog production, but com-

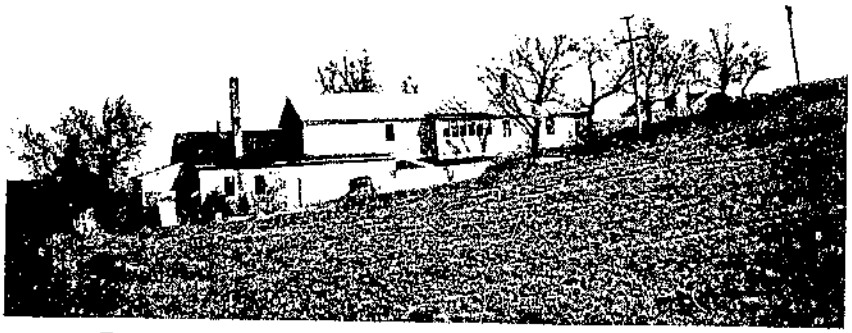

FIGURE 4.—A TYPICAL CHEESE FACTORY IN DODGE COUNTY.

Many cheese factories in Dodge County are owned cooperatively by local dairymen. The upper part of the structure shown is used as a residence. The milk-receiving and cheese-making rooms are in the excavated lower portion.

plete specialization in the production of these crops would be less profitable than a combination in which dairying is the main enterprise.

A combination of enterprises such as that found on most farms in the county is also desirable from the standpoint of providing a source of income for the available labor throughout a greater part of the year. Labor on crops is fairly continuous throughout the spring, summer, and fall months. The care of dairy and other livestock demands attention throughout the year but more labor is required during the winter period than any other. Most of the farm labor is done by the farm operator and his family. On the larger farms in the area a man may be hired during the summer season or may be kept during the entire year.

## MARKETING FARM PRODUCTS

Facilities for marketing the various farm products produced in this area are well developed. Most of the milk produced is used in the production of some manufactured product such as cheese, butter, or evaporated milk. In 1936, over 70 percent of all the milk produced in this county was used for making cheese (*6*). About one-half the cheese ordinarily produced is of the foreign varieties of Brick and

Munster. Other important varieties are American and Cream. Cheese is produced in numerous small factories throughout the area like the one shown in figure 4. Many of these factories are owned by farmers or farmers' organizations. The remainder of the milk produced in this county is used for the manufacture of butter or condensery products or is shipped out of the area as fluid milk or cream. About 14 percent of all milk produced in 1936 was used for the manufacture of condensery products, while approximately 11 percent was used in making butter. The other 5 percent was sold as fluid milk or cream, or was devoted to other uses.

Livestock, dairy products, poultry and eggs, and other farm products are usually marketed in the nearby central markets of Milwaukee or Chicago. Only a small proportion of the total production of these products is withheld for local consumption. Barley, the most important grain grown as a cash crop, is used by the brewing industry. Canning peas and other canning crops are delivered to privately owned canning plants located in the area.

## POSSIBILITIES OF ADJUSTMENT

The description of the type of farming in Dodge County and its physical and economic basis indicates in a general manner the position of dairying in the area and the nature of the supply of dairy products. Although no very precise estimate of the change in milk production that may be associated with a certain change in production conditions, or in the prices of farm products, is provided by this analysis, some things concerning the nature of supply can be pointed out.

It may be noted that the nature of the individual farm organization in this area is such that changes in the relative output of the various products can be made, should farm operators find this desirable. This is true, since the organizations of most of the farms consist of a combination of enterprises. Farmers may either increase or decrease the quantity of milk produced by shifting resources from one enterprise to another. For example, a farmer, by reducing the size of his hog enterprise, may allow a larger proportion of his land to be used for producing feed for dairy cattle. Similarly, hog production might be expanded in place of dairying. The size of other farm enterprises also, including poultry and cash crops, can be changed, should farmers find it profitable to do so. The fact that most farm organizations consist of a combination of enterprises and that conditions are favorable to the production of a number of different farm products, means that it will be profitable for farmers to make changes in their production programs, should the cost-price relationship for the various farm products be changed.

For example, the loss in income resulting from a reduction in milk prices may be partly offset by increasing production of alternative products. On the other hand, if prices should rise, farmers may increase their net income by more than the amount due to the price increase by utilizing a larger proportion of their resources in dairying. Assuming that they have organized their farms to the best advantage insofar as they know at the present time, some change in the program of production would then be desirable from the standpoint of realizing the maximum income.

A general consideration of the type of farming followed, together with the factors responsible for the existing type, indicates some degree of elasticity in the supply of milk for this area. This is evident because there are alternative lines of production which might either be expanded or curtailed with profit as milk prices become either more, or less favorable as compared to the prices of other farm products. In order to determine more precisely how elastic the milk supply is in this area, it is necessary to study individual farms with respect to the adjustments which will be profitable and which are apt to be made with various prices for milk. However, before making such an analysis, it is desirable to study the changes which have taken place in the agriculture of this area over a period of years in the recent past. Such a study will indicate how the supply of milk has changed and will provide some explanation for this change.

## PAST TRENDS IN PRODUCTION IN DODGE COUNTY

### General Considerations

One method of obtaining an estimate of the competitive position of an area in a certain line of production, such as dairying, is to study the changes that have taken place in its agriculture in the recent past, and to evaluate the factors responsible for these changes.

The analysis of the elasticity of milk supply requires a determination of the quantities of milk which will be produced and offered for sale at various prices. In deriving a long-time supply schedule from historical data a long enough period of time must have elapsed for production to have become adjusted to each price. This suggests an important deficiency in the historical or past-experience method of determining long-time elasticity of supply, namely, that the prices of farm products are constantly changing. As a result, the adjustments that farmers make in their production programs or in the total quantities of the various farm products produced in an area are made in response to a combination of changing factors, rather than to a single price. Moreover, there are few occasions in the past when the level of milk prices has changed without the price of other farm products also changing. Hence it is difficult to build up a long-time supply schedule with the use of this method.

The other aspect of supply which needs especially to be studied historically is that of changes in the quantity supplied which are not due to price responses. These occur as a result of changes in production conditions that affect the costs of producing the various farm products. Technological advances in agriculture may make it profitable for farmers to modify production programs even though prices may remain the same. Information concerning developments of this character that are continuing to affect the conditions of production and their operations in the past is helpful in estimating future supplies. Here again, study is limited to those conditions of production which have actually been experienced.

Milk production in Dodge County has increased since 1925. Figure 5 shows the trend in milk production for the period from 1925 through 1938. Comparing the first 3 years of the period with the 3 years 1935-37, the increase amounted to about 18 percent. The quantities produced from year to year fluctuated considerably, falling off especially in 1932, following a year of exceptionally low feed production.

An examination of the changes in prices of alternative farm products since 1925 does not indicate that prices of dairy products have changed much relative to those of other farm products. Prices for hogs, milk, and eggs are shown in figure 6. The prices of these three

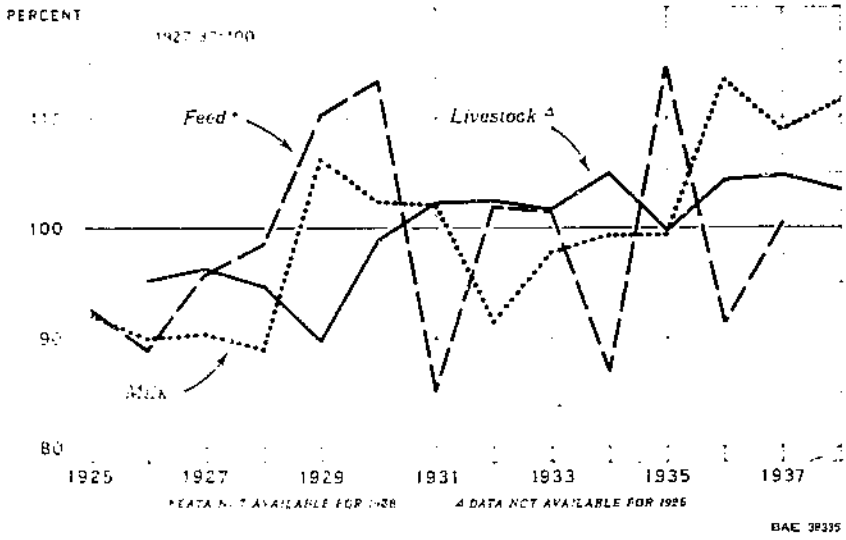


FIGURE 5.—TOTAL LIVESTOCK UNITS, MILK PRODUCTION, AND FEED PRODUCTION, DODGE COUNTY, 1925-38 (1927–37=100).

Total livestock units, milk production, and feed production all increased during the period. The increase in milk production from the 3 years 1925–27 to the 3 years 1935–37 was about 18 percent. Feed production fluctuated much more than livestock units and milk production.

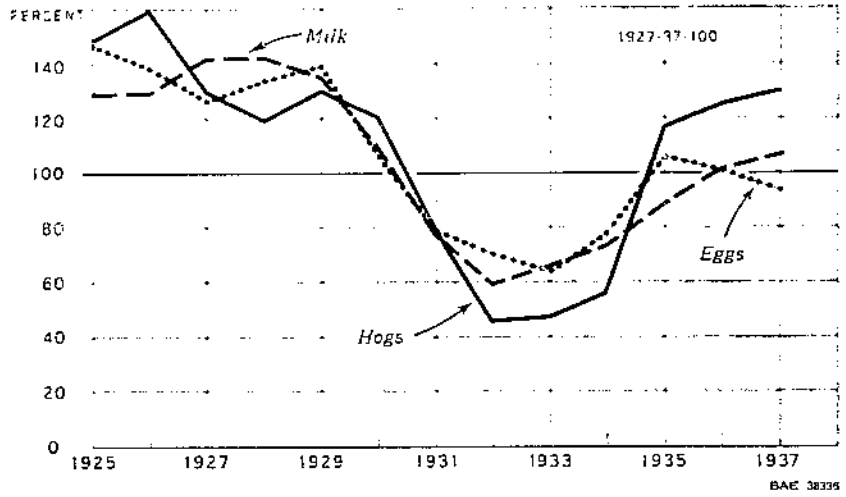


FIGURE 6.—PRICES OF THREE PRINCIPAL FARM PRODUCTS, WISCONSIN, 1925–37 (1927–37=100).

The prices of hogs, milk, and eggs seems to have followed the same general course during much of this period. Hog prices were relatively lower during 1932–34 and were somewhat higher in 1935–37.

important products have followed approximately the same course. They declined after 1929 to a low in 1932 and 1933, and have recovered substantially in recent years, although still below their former level. The price of milk was over 30 percent higher during the 3-year period 1925–27 than during that of 1935–37. Hog prices were nearly 20 percent higher during the earlier period than in the latter. Eggs were nearly 40 percent higher in the earlier period. It is apparent that the expansion in dairying, rather than in other lines, cannot be explained by changes in farm prices alone.

A more tenable explanation, as will be shown presently, was the production of additional feed that could be used profitably in dairying.

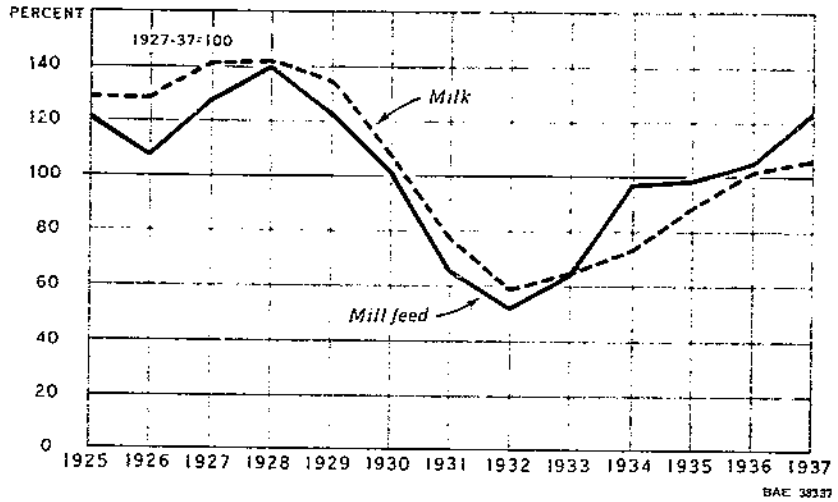


FIGURE 7.—PRICES OF MILK AND MILLFEED IN WISCONSIN, 1925-37 (1927-37=100).

No significant change in the relationship between milk prices and purchased-feed prices occurred during the period. Millfeed prices were only slightly less favorable in the latter years.

It may be said, of course, that the additional feed was produced because dairying was more profitable than any other enterprise. But it remains true that farmers in this area were learning how to produce more alfalfa, for example, and this was one of the main reasons why dairying was more profitable.

Although no data on changes in the amount of feed purchased by farmers in this county have been obtained, it does not appear that milk production has been increased by purchasing more feed than formerly. The index of prices of feed purchased by farmers in this area for dairy cattle does not indicate that it is much more advantageous to purchase feed and convert it into milk now than it was formerly. Figure 7 shows that concentrate prices have followed the same general course as milk prices, although the price relationship was slightly less favorable in the latter years.

A careful examination of the changes in resources and farm organization in the area must be made to explain the increase in milk production. As far as prices of milk in relation to other farm products are concerned there does not seem to have been any significant

change during this period. First the number and size of farms in Dodge County will be considered.

The census data for the period since 1900 on number of farms, average size of farms, and total acreage of land in farms are shown in table 2.

TABLE 2.—*Number and average size of farms, total land in farms, cropland harvested, and land available for crops, Dodge County, 1900–35*

| Year | Farms | Average size of farms | Land in farms | Cropland harvested | Land available for crops [1] |
|---|---|---|---|---|---|
| | *Number* | *Acres* | *Acres* | *Acres* | *Acres* |
| 1900 | 4,994 | 106.0 | 531,049 | (2) | (2) |
| 1910 | 4,741 | 109.5 | 519,172 | (2) | (2) |
| 1920 | 4,633 | 112.7 | 522,217 | (2) | (2) |
| 1925 | 4,509 | 108.9 | 500,620 | 287,299 | 352,674 |
| 1930 | 4,586 | 112.4 | 515,455 | 314,122 | 370,427 |
| 1935 | 4,735 | 111.2 | 526,465 | 327,511 | 377,533 |

[1] Includes harvested, failure, idle, fallow, and plowable pasture.
[2] Data not available.
United States Census.

No important trends in number and size are indicated. The changes between the various dates might easily be due to variations in the manner in which the census is taken or in its completeness. There is some evidence that the various censuses are not directly comparable (*8*). The data indicate that as the number of farms for which reports are obtained increases, the average size of farm decreases. The changes in the average size of farm may have been caused by changes in the number of farms, especially small farms, included in the enumeration. For example, the total number of farms in this county was increased by 149 from 1930 to 1935. However, nearly one-half of these 149 farms were less than 20 acres in size. It is probable that these small farms were there in 1930 but were not counted. By including them in the 1935 census, the average size of farm was reduced 1.2 acres.

A significant change in cropland is shown in table 2. The total acreage of cropland harvested increased nearly 15 percent from 1925 to 1935. It appears that most of this increase has come about as a result of bringing more land on individual farms under cultivation. This increase in the total acreage of crops harvested has been accompanied by an increase in the total quantity of farm-produced feed or cash crops.

A more precise estimate of the changes in the quantity of feed produced on farms in this county can be obtained from a study of the changes in the acreages and production of various crops grown. Data furnished by the Wisconsin Crop and Livestock Reporting Service may be used for this purpose. According to these data, the total acreage of all important crops grown increased approximately 15 percent between 1927 and 1937. This is the same percentage increase reported by the United States Census from 1925 to 1935.

The changes in the acreages of various crops grown from 1925 to 1938 are shown in figures 8 and 9. There has been little change in the proportion of land devoted to the important classes of crops such as small grain, hay, corn, or cash crops. Approximately 24 percent

of the cropland is used for corn, about 41 percent for small grain, 30 percent for hay, and 5 percent for cash crops.

Although the proportion of all cropland used for producing each of the important classes of crops has not changed much, there have been

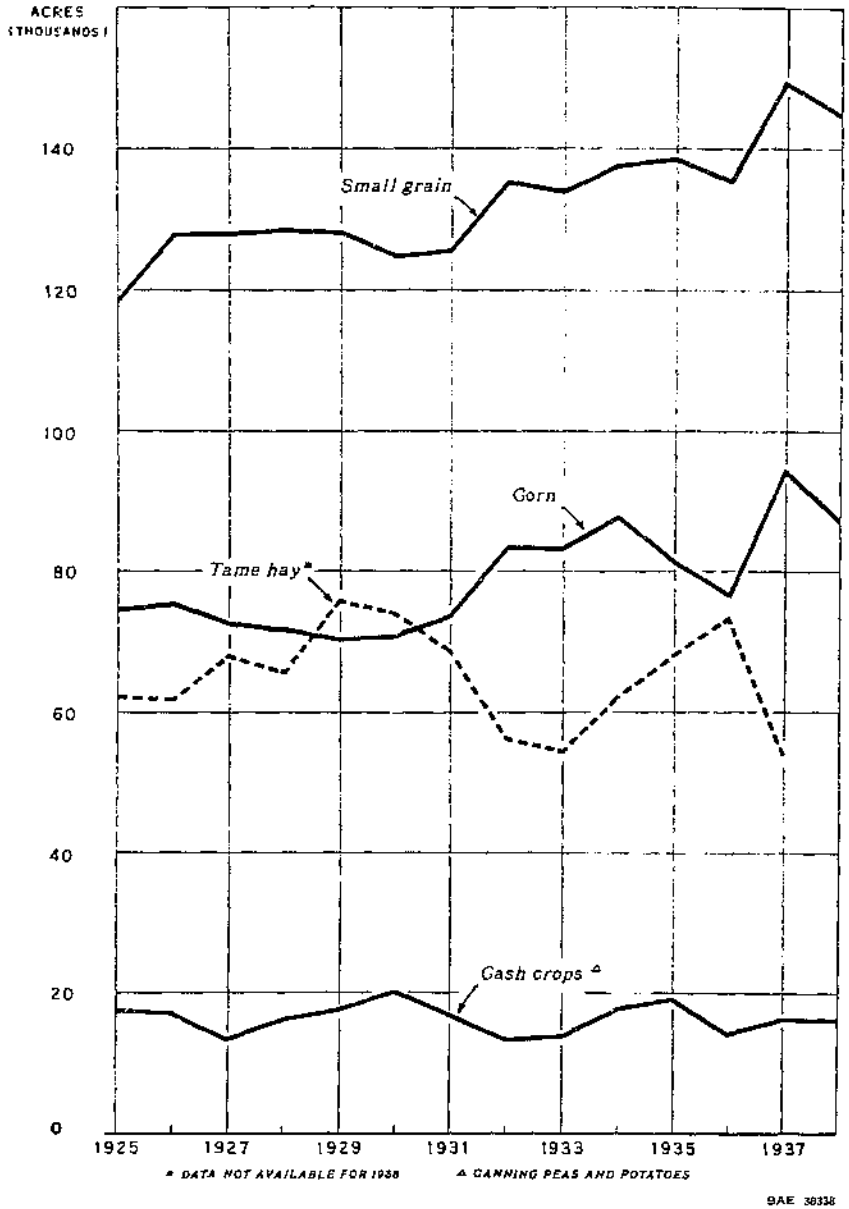


FIGURE 8.—ACREAGES OF CROPS HARVESTED, BY MAJOR CLASSES, DODGE COUNTY, 1925–38.

Disregarding temporary disturbances related to weather conditions there appears to have been little net change over the period in the normal proportion of the crops in these major classes.

some important changes within these classifications. In the case of small grains, the barley acreage has been increased at the expense of oats. There has been almost continuous increase in the alfalfa acreage while that of clover and timothy has been reduced. The acreages of other crops grown have fluctuated some from year to year, but aside from corn, which has increased, there are few changes of a permanent character. The production of more alfalfa and barley

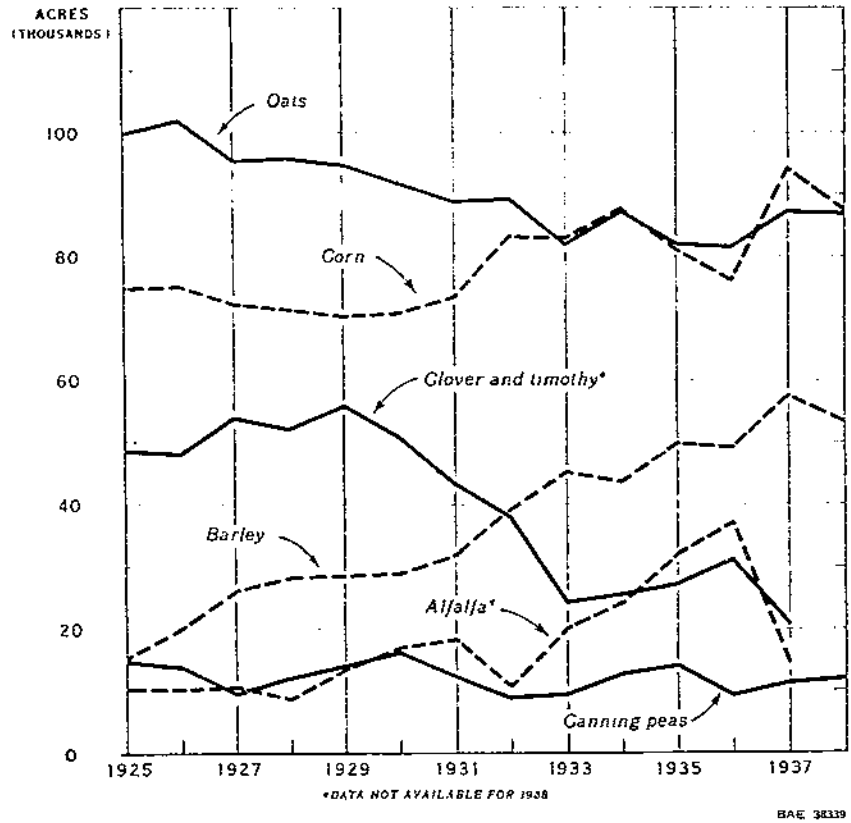


FIGURE 9.—ACREAGES OF PRINCIPAL CROPS HARVESTED, DODGE COUNTY, 1925–38.

Corn, barley, and alfalfa show substantial increases during this period. Oats and clover and timothy hay decreased.

in place of oats and clover and timothy should result in a permanently larger supply of feed, as they produce more nutrients per acre than the crops they displace.

The changes in the total quantity of feed available during the recent past have been determined by computing a feed-production index. This shows the variations in the total quantity of digestible nutrients produced on farms in the county from year to year, since 1925. In computing the index, digestible-nutrient rates were applied to the production of each of the important crops produced during each year.

The resulting index of feed production is shown in figure 5. The trend during this period has been upward. The years 1926, 1931,

1934, and 1936 were exceptions. These were years of especially dry weather and low crop yields. Feed production was relatively low in 1937 due to winter injury to alfalfa fields. Despite the relatively unfavorable climatic conditions during some of the recent years, this index of feed production indicates that farm-produced feed supplies averaged approximately 11 percent higher for the 3-year period 1935–37 than for the 3-year period 1925–27. It appears that had weather conditions been normal from 1935 to 1937, feed production would have been even higher.

A complete index of feed available from farms in this county should also take into consideration the nutrients obtained from pasture. However, it is difficult to obtain an exact measure of the quantity of feed provided in this manner. It is probable that pasture-feed production parallels that of other farm-produced feeds, since both are affected by the same variations in climatic conditions. Some reduction in the amount of pasture feed available probably has been caused by the expansion in the acreage of harvested crops, but the net effect of this change in use of land, no doubt, has been an increase in feed production.

It appears, therefore, that there has been a substantial increase in the total amount of feed available on farms in this county during the period 1927–37. The increase in actual feed production does not appear to be as great as the 15-percent increase in the acreage of crops grown. Considering the actual increase of 11 percent in combined feed supplies between the 1925–27 and 1935–37 periods and the relative increase in higher yielding alfalfa and barley, and allowing for the recent unfavorable weather conditions, an estimate of close to 20-percent increase in feed-production capacity for the county would seem conservative.

There has been little change in the acreage devoted to the production of the cash crops, potatoes, and canning peas. Farmers in this area usually sell a small proportion of their barley. There are no available data to indicate the exact proportion sold. It appears that the quantity that farmers sell in any one year is dependent to a considerable extent upon whether the barley is of malting grade and can command a premium. Unfavorable weather may injure the quality so much that it can only be used for livestock feed. If prices of purchased feed are relatively high and farm-feed supplies low, a larger proportion may be kept for livestock feed.

An examination of the data on livestock numbers in figures 5 and 10 and table 22 indicates some important changes since 1925. Total livestock units increased. Most significant are the constant increases in the numbers of other cattle and milk cows. Swine numbers have fluctuated throughout the entire period, and it is difficult to discern any trend. There has been a slight reduction in horses since 1925. Sheep have increased since 1925, but this is of little significance as sheep make up a very small proportion of all livestock. There has been a steady increase in the total number of poultry on farms in this county but this has taken little additional farm-produced feed, as much of the poultry feed is purchased.

It is apparent that the trend toward more milk cows and other cattle is the most significant change in the livestock picture. The number of milk cows increased 11 percent from the level of 1925–27 to that of 1935–37 (fig. 10). It will be remembered that milk pro-

duction increased 18 percent during this same period, which indicates that there has been an improvement in the productivity of the cows. Either the cows have improved in inherent productive ability or more probably they have simply responded to increased feeding. During this period other cattle increased about 14 percent. "Other cattle" include young stock, bulls, and dry cows, and occasional beef animals.

The livestock numbers reported for each of the various classes of livestock have been converted to a common livestock-unit basis as shown in figure 5. There has been a constant upward trend in the total number of livestock units. From the 1926-27 period to that of

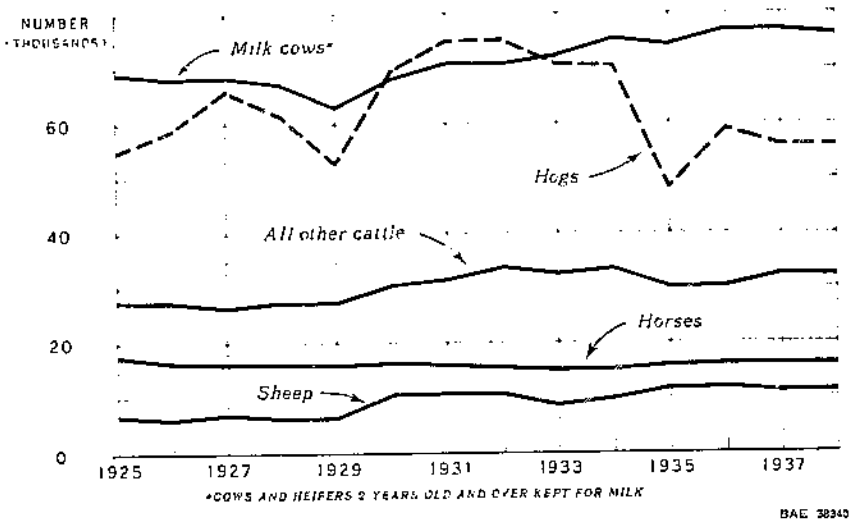


FIGURE 10.—NUMBERS OF LIVESTOCK IN DODGE COUNTY, 1925-38.

Milk cows include cows and heifers 2 years old and over kept for milk. A significant upward trend in milk cows and other cattle is apparent. Hogs appear to have declined in importance.

1935–37, this increase was approximately 8 percent. Most of this was the result of the increase in milk cows and other dairy cattle.

## INDIVIDUAL FARM TRENDS

Continuous records of the quantity of milk sold from 41 farms in this county for each year from 1927 to 1937 were obtained for the purpose of determining how milk production on individual farms fluctuates from year to year and what changes take place in the levels of output over a period of years. Milk production on these 41 farms has been totaled and relatives indicating changes in production from year to year for the entire group have been computed. These data on milk production, together with prices paid for milk during the same period of years, are shown in figure 11.

It will be observed that there has been some upward trend in the total quantity of milk produced on these farms although this trend has not been constant. Milk production was reduced after years of low crop production caused by droughts such as those of 1932 and 1936. Milk production averaged approximately 8 percent higher

during the 3-year period 1935–37, than it did in the years 1927 and 1928. This is a somewhat smaller increase than was noted for all farms in the county, 18 percent, from the period 1925–27, to that of 1935–37. In order to make a direct comparison, it would be necessary to have additional data on milk production from the 41 farms for the years 1925 and 1926.

The manner in which production fluctuates on individual farms is indicated by data presented in table 3. Changes in milk production for the 41 farms, together with an enumeration of the number which decreased and the number which increased production, is shown here. All farms do not change their milk production in the same direction from year to year. The total change in production which occurs on a group of farms from one year to the next is the net result of

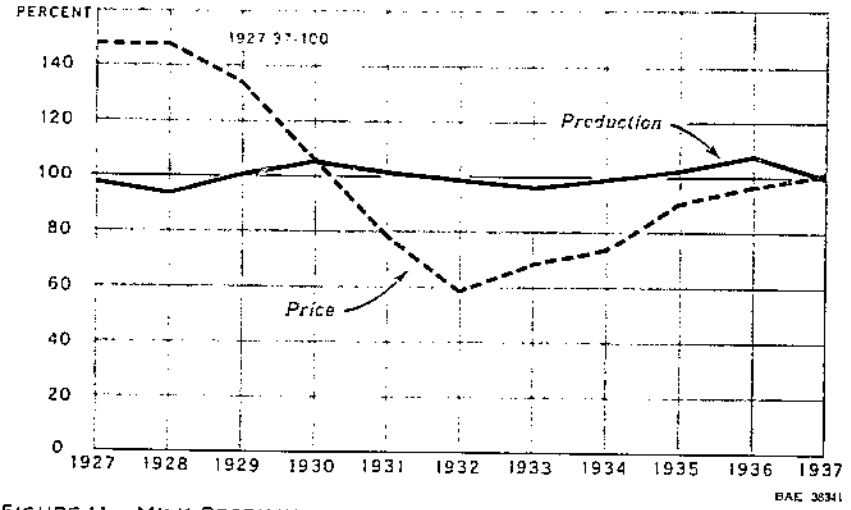


FIGURE 11.—MILK PRODUCTION FOR 41 SELECTED FARMS AND PRICES RECEIVED BY A TYPICAL DAIRYMAN, DODGE COUNTY, 1927–37 (1927–37=100).

A slight upward trend in milk production may be observed for these selected farms. There is no direct relationship between production and prices received.

both increases and decreases on the individual farms in the group. This indicates that the factors which determine what quantity of milk is produced in an area in any one year do not influence all farms in an area in the same manner.

TABLE 3.—*Milk production on 41 selected farms and number of farms showing increases or decreases in milk production from preceding year, Dodge County, 1927–37*

| Year | Milk production (1927–37=100) | Farms | | Year | Milk production (1927–37=100) | Farms | |
|---|---|---|---|---|---|---|---|
| | | Increasing | Decreasing | | | Increasing | Decreasing |
| | | *Number* | *Number* | | | *Number* | *Number* |
| 1927 | 97.5 | | | 1933 | 95.1 | 17 | 24 |
| 1928 | 93.8 | 16 | 25 | 1934 | 98.9 | 27 | 14 |
| 1929 | 100.6 | 31 | 10 | 1935 | 102.0 | 27 | 14 |
| 1930 | 105.0 | 21 | 20 | 1936 | 107.5 | 26 | 15 |
| 1931 | 101.5 | 16 | 25 | 1937 | 99.5 | 8 | 33 |
| 1932 | 93.6 | 17 | 24 | | | | |

There is more uniformity in the direction of change in production over a period of years than between 2 successive years. The slight net increase in production noted for these 41 farms from the years 1927–28 to those of 1935–37 was the net effect of increases on 32 farms and decreases on 9 farms.

### Shift in the Supply Position of this Area

The information gathered concerning past trends in production both for the county and for individual farms indicates that a rather permanent increase in milk production has occurred in this area. This increase has taken place despite the fact that milk prices have been reduced. Milk prices relative to prices of other farm products have changed little during the period. It is, therefore, apparent that the output of milk from this area has been increased because of factors other than price.

There has been a substantial increase in the feed-production capacity of farms in this county, as a result of an increase in the acreage under cultivation and the introduction of new techniques in production.

It cannot be concluded from this analysis that prices do not influence the quantity of milk produced on farms in this area. Changes in price relationships of alternative farm products would almost certainly cause farmers to make some adjustments in their production programs. Farmers in this area have alternative enterprises such as hogs, poultry, and cash crops in which production might either be contracted or expanded in order to allow for a change in the size of the dairy enterprise. Change in price relationships of farm products which are relatively permanent in character would make certain adjustments in farm organization and production programs profitable.

The study of trends in production in this county indicates that changes in milk production in the recent past have been mainly the result of changes in the resources available to carry out the production process. Changes in the quantities of farm-produced feed available are especially important. Further changes which take place in the quantity of feed and other resources needed in production in the future may be expected to influence the supply of milk. Future changes in the price relationships of farm products making dairying either more or less advantageous than at present may also be expected to influence the supply of milk from this area.

## PROSPECTIVE TRENDS IN PRODUCTION IN DODGE COUNTY

The analysis undertaken in the preceding sections indicates that the quantity of milk produced by a single farm as well as by a group of farms is dependent upon the operation of a combination of factors. The description of the agriculture of the area and of the factors affecting the prevailing type of farming provides information that is helpful in determining the adaptability of the area to dairying and to other lines of production. This is essential background information and indicates in a general manner the adjustments that can be made profitably with changes in the relative prices of various farm products or with other changes in production conditions. Analysis of farmers' production responses in this area over the past 10-year period shows that there has been a shift in the supply position of the area and that

certain trends are in progress. While these two approaches are valuable in making an appraisal of the competitive position of an area, they do not provide all the desirable information concerning supply. The description of the area indicates, in a general manner only the quantity of milk that would be produced under price and production conditions different from those of the present. A study of supply by statistical analysis of historical data may also be of limited value since analysis necessarily covers only situations that have occurred. There is no indication of what production will be in the future under conditions that have not been experienced in the past. Another limitation is the difficulty of isolating the net influence of any one factor such as price, since other factors are constantly changing.

It is apparent that other methods of analysis are required in addition to those already explored, if a very complete understanding of the nature of the long-time supply curve of milk in these two areas is to be obtained. In other words, it is desirable to know what quantities of milk will be produced and sold in an area at several levels of milk prices which are of rather permanent character. In addition to the influence which such changes in the level of milk prices will have on milk production, it is important to know how the supply of other farm products and farm income will be affected since these are indicative of changes in the agriculture of the region.

## Analytical Procedure

An approach to the problem designed to compensate for the shortcomings of the descriptive, historical, and statistical methods of analysis has been developed. In brief, the method consists of analyzing a number of individual farms in each of the areas and of determining, by the use of what has been termed in farm-management literature the budget method, the most probable farm organization and production program for various milk prices. These individual farm estimates of milk production are then combined into a supply curve for a group of farms or for the entire area.

The main criterion used in determining what production program probably will be followed at each price for milk is that of profitableness but other considerations also are important. A detailed description of the analytical procedure followed in studying individual farms and in arriving at the most likely farm programs is given later. It is sufficient to indicate at this point that changes in price relationships of farm products as well as changes in the cost of producing them cause it to be profitable for farmers to make adjustments in their production programs. The adjustments, when made, influence the quantities of the various farm products produced. While it would be an endless task to locate all the points on a supply schedule of a certain product for an area, the general nature of the supply curve can be determined by locating a few points.

In the discussion of past changes, it was emphasized that primary attention must be given to the long-time trends since these are most indicative of the permanent changes in supply. The present analysis is therefore concerned with developing a supply curve for milk that is applicable to a relatively long-time period. A period of 10 years is considered to have elapsed and the farm organizations that probably will develop with each of several prices for milk are estimated. Three price situations with respect to milk are studied. In the first are con-

sidered the adjustments likely to be made in production, if no changes in price relationships of farm products occur. Next are estimated the changes in production that will be made, if the price of milk rises by a substantial amount while the prices of other farm products remain at their present levels. Finally, consideration is given to the production that will be most likely if milk prices fall to a lower level while no changes occur in other prices.

The area changes that are made in the total production of a farm product with the passage of time and in response to changes in the relationships of prices received for farm products are the result of the decisions made by numerous individual farmers to make changes in their farm organizations. The individual farm is the smallest action agency that needs to be considered in determining what adjustments will be made in production as a result of changes in production conditions or in prices of farm products.

To a considerable extent, the adjustments that individual farmers will make in their farm organizations in response to these factors depend upon what it is profitable for them to do. However, it is not sufficient to know the production adjustments that it is economically advantageous for individual farmers to make. It is also necessary to determine those that are most probable, considering particular limitations related to the control of various factors of production. It is necessary to consider the situation existing on each farm with respect to managerial ability, available labor, capital equipment, and other influencing factors such as age of operator, amount of debt, and tenure status. Based on all the information that can be obtained concerning each farm and the profitableness of making certain changes in farm organization with the prevailing price conditions, the most probable farm program can be estimated.

To estimate with accuracy the changes in production that individual farmers will make with the passage of time and in response to changes in price relationships, much information concerning the individual cases is needed. In the summer of 1936, farm-management records were obtained from 100 farms in Emmet Township, Dodge County. These contain a farm-business record for the 12-month period May 1, 1935, to April 30, 1936. In the subsequent discussion this 12-month period will be referred to as 1936. It must be kept in mind, however, that the crop-production year involved is that of the preceding calendar year 1935. In addition, other pertinent information concerning the usual crop and livestock practices, conservation practices, and past changes in production were obtained. An additional schedule of information was obtained for 24 of these 100 farms in the fall of 1937. A record of the crop and livestock programs followed in 1936 and 1937, together with additional data about labor, debt, and other factors, was obtained for each of these farms. Some additional information concerning crop and livestock programs for a number of years in the past for these farms was available from assessors' data. Records of the quantity of milk produced on these farms for previous years were obtained in those cases in which they were available.

The 24 farms chosen for detailed study were selected on the basis of exhibiting various characteristics or combinations of characteristics assumed to be related to production responses as shown in table 32. The factors considered in this selection were productivity of

land, size of farm, family labor, tenure status, age of operator, and debt. The purpose of selection on this basis is to obtain farms representative of the different production situations found in the area. Having determined how farms representing these different farm situations are likely to adjust their production programs with the passage of time and in response to certain price changes, it is possible to obtain an estimate of the production response which can be expected for the entire area. In order to make such an estimate, it is necessary that the importance which may be attached to each of the 24 case-farm production responses be determined.

One method is to classify the 100 farms for which detailed information is available into each of the 24 farm subgroups for which representative cases were selected. An estimate of the supply position for the 100 farms can then be made by giving each of the 24 farms a weight in proportion to the production of the farms included in its classification. Another method is to compare the 24 farms with the 100 farms in order to determine how representative they are of the 100 farms with respect to size of farm, productivity of soil, number of milk cows, and other factors that may be related to response.

The extent to which the results obtained from detailed analysis of the 24 farms may be extended to the 100 farms is dependent upon how representative the 24 farms are of the 100. The general applicability of the results obtained from these detailed studies of farms located in this area to those which are located in other areas is dependent upon similarity in the type of farming practiced and factors affecting the prevailing type.

It is evident that the reliability of a supply curve of a product for an area which is obtained by following a procedure such as that described above is dependent upon the accuracy with which the individual farm-production estimates are made. For this reason, the procedure followed in determining the farm organizations and production programs that can be expected with various prices for milk will be described in some detail.

### Adjusting Actual Data for Average Expectancy

The analytical method followed in arriving at an estimate of the production response which logically can be expected on individual farms as a result of certain changes in production conditions is similar to the budget method used in determining what changes a farmer should make in his farm organization in order to increase his net income. This is a modified form of budgeting, as the farm organizations that are finally set up under the various situations may not be the best from the farm-management viewpoint, but represent those which the farmer is most likely to adopt, taking into consideration all that is known concerning his ability and the resources available on the farm. Rather than merely determining what the farmer *should* do in each of the production or price situations, it is necessary to estimate what he actually *will* do. What he will do depends not only upon his ability to make adjustments within his farm organization that will increase his net cash income but also upon the extent to which profit is a motivating factor. The individual farm analysis begins with a study of the present farm organizations with respect to the quantities of various farm products produced, the manner in

which production of these products is carried out, and the resources that are used in the process. This requires that a budget of the normal farm operations of the present time be computed. With this information as a basis, the influence which certain changes in the prices paid for farm products can be expected to have on the normal farm organizations of the present are estimated. Several possible alternative farm organizations are drawn up for each production or price situation in order to compare the advantages of the various plans that may be put into operation.

Profitableness of various production programs can be determined by comparing the net cash income which logically can be expected from the operation of these various plans. Taking into consideration the profitableness of the various possible alternative programs of production as well as other important factors, the farm organization that most probably will be adopted is determined. In this manner, an estimate of the production from each farm with various price relationships for farm products may be obtained.

The first step followed in analyzing the individual farms was to work out a complete budget of the farm operations on each from the farm-management record obtained in the summer of 1936. This detailed analysis of each farm record is made to determine the actual practices on each farm and is termed the actual 1936 budget. It forms the basis from which the usual situation or the normal farm budget may be determined. Having analyzed the actual farm record, the next step is to determine the usual or normal budget for 1936.

In many instances, the schedule of information obtained in 1936, or the actual farm budget, does not adequately represent the usual or normal situation. For example, the acreages of various crops grown or the crop yields reported for a farm in any one year may not indicate the usual situation. This is also true with respect to livestock numbers and livestock production. Based on information collected in 1936, and the supplementary information obtained in 1937, what is considered to be a normal budget of farm operations is worked out. The normalizing procedure also involved some adjustment of feed and other input factors in cases where very abnormal practices were reported. In general, the rule followed was not to do any more normalizing of this character than was absolutely essential as it is desirable that the individual peculiarities of each farm be maintained. Only those adjustments of the data of individual farms that were required for the removal of marked irregularities and that were justified by other information concerning each farm were made.

The object of making these normalizing adjustments is to obtain the farm organization that may be considered normal for the particular farm for the 1936 period. This normal 1936 budget forms the basis from which the other budgets of each farm are projected for each price situation.

Besides these adjustments in production data, some changes in various expense and income items reported for each farm frequently are required. Abnormally high or low outlays may be made for various items in any one year. Only those expenditures that can be charged against the year's operations are included in this budget of normal operations. Similarly, the income received from particular sources may be abnormally high or low in any one year due to depletion or

building up of inventory values or other reasons and may require some adjustment.

Prices received for some farm products sold during the record year of 1936 may be out of line with normal prices for the period and may be the cause of abnormally high or low receipts for certain items. The determination of what prices should be used in making the budget computations is an important problem that requires some further discussion.

In selecting prices for the various farm products to be used in making the normal 1936 budget computation, it is important to use prices representative of recent and currently normal price relationships. If the price of hogs, for example, is abnormally high relative to prices of other farm products, an undue advantage would be given to hog production. Farm organizations would then appear to be out of adjustment at present and farmers would find an adjustment in farm enterprises involving a shift to more hogs profitable. As we are interested in determining what shifts or changes in production will become profitable with the passage of time and in response to certain price changes of milk, it is important that the initial prices used be reasonably representative of the 1936 period.

Prices used in the 1936 budgets are those received by farmers in 1936 with some adjustments in those instances where abnormally high or abnormally low prices were reported. As the milk prices received by farmers in 1936 seem representative of the period and as accurate records of the prices paid to individual farmers in 1936 were obtained, no changes are required in the case of this product. On the other hand, the prices reported by some farmers for hogs, poultry, or crops are out of line with the average price for 1936. Moreover, in the case of some of these products, 1936 prices are not representative of the period. In either case adjustments in the actual prices reported by individual farmers are necessary in order to obtain that relationship between prices of the various products which may be considered normal. As the period 1921–30 appears to be the most recent period when prices were reasonably stable, price relationships for this period are used as a general guide. As in the case of production data, no more adjusting of individual farm prices than absolutely essential was done as it is desirable that the individual differences between farms be maintained insofar as these are normal differences.

### Trends Under Way Not Directly Related to Changing Price Relationships

The description of the changes occurring in this area during the period since 1925 illustrates the adjustments in production that are likely to occur over any period of that length. Many of the year-to-year changes are the result of responses to prices, others to changing weather conditions. Some are due to changing technology and the modification of customary farming practices. Adjustments on individual farms are usually even more varied in character than the net changes for an entire area, as the differences in individual resources are reflected in responses. Some of the changes, like weather conditions, may be significant at particular times but tend to average out over time, leaving little net effect. Other influences tend to operate persistently in one direction so as to result in long-time trends in production.

At this point in the discussion the trends that act persistently over a period of at least 10 years and are not necessarily related to price changes are of greatest interest. In technical language these are the trends that cause the long-time supply schedule to shift rather permanently to the right or left. In a preceding section, several important related trends in this area that appear to be of this general character have been noted. These were an increase in the acreage under cultivation in Dodge County, an increase in the number of dairy cows, and a change in the cropping system with increasing emphasis upon alfalfa and barley and less on oats and clover and timothy hay. The feed-producing capacity of the area has increased considerably and although adverse weather conditions appear to have prevented actual feed production from reaching this capacity, milk production in the area has expanded 18 percent.

To what extent may these trends be expected to persist in the ensuing 10-year period and what other new developments may enter the picture during this time? The trends mentioned above are considered first. Will land under cultivation be likely to increase further? The possibilities in this direction must be examined on individual farms but they would seem to be somewhat limited in this area, especially when viewed in connection with other developments. The trend toward more cows is, of course, related to the increased feed-producing capacity of the area. If additional land under cultivation cannot be expected, we must look elsewhere for the prospect of additional feed. First of all, more normal weather will result in more normal yields and a higher production from the existing crop acreage. The full impact of the increased crop acreage has not yet been felt. Moreover, there is considerable evidence to support the view that further increases in alfalfa acreage may be expected in this area. This will add to the total feed available.

Two relatively new factors in the general situation tend to add support to the expectation of increased feed supplies available for dairy production. These are the agricultural conservation program and hybrid corn. The practices that are being encouraged by Federal conservation payments are increasing both the yield and quality of hay produced. This encouragement tends to reinforce and strengthen the trend toward alfalfa production already in progress.

Even should payments for these purposes be eliminated, the stimulus resulting from the program and related factors would probably have a continuing effect. In a previous study of the probable effects of the agricultural conservation program in this area, it was estimated that the program would result in a net increase of about 3 percent in total digestible nutrients in Dodge County.[7] This estimate was made in accordance with the provisions of the agricultural conservation program of 1936 and 1937 and assumed a shift from depleting to conserving crops, but did not allow for any increase in the proportion of alfalfa or higher yielding legumes within the conserving classification. Neither was any consideration given to the effect of the introduction of hybrid corn or other changes which may affect feed production. Although the acreage of corn for grain in this area is small and the gains to be expected from hybrid seed corn therefore limited, some

[7] JOHNSON, SHERMAN E., MIGHELL, RONALD L., HADY, FRANK T. PROBABLE EFFECTS OF THE AGRICULTURAL CONSERVATION PROGRAM ON LIVESTOCK PRODUCTION IN THE MIDWEST DAIRY REGION, PT. I, A SUMMARY OF THE STUDIES OF SELECTED AREAS. U. S. Bur. of Agr. Econ. 24 pp., illus. 1940. [Mimeographed.]

net increase in feed production might be anticipated from this source. Additional restrictions on corn acreage would have the effect of causing the increase to show up in the form of roughage instead of grain.

For the most part the effect of these various trends can be treated in dealing with the individual farm plans and budgets in the light of the situations actually prevailing on each farm. In budgeting a limited number of representative farms, it may also be necessary to check the estimated area changes by independent over-all estimates at a later stage in the analysis.

### Estimating the Effect of Increased Feeding

It will be noted from the discussion that by far the most significant of the persisting trend elements is related to the problem of utilizing increased roughage feed which is expected to become available in this area.

How will the additional roughage affect feeding practices, number of cows, and production per cow? The problem involves not only estimating the additional milk that will be obtained from feeding more roughage per cow, but also learning the quantity of roughage that can be substituted for grain. How much grain will it be profitable to feed with different prices for milk and grain? Would it pay better to add more cows or to feed more to the same cows? These questions must be worked out by a comparison of returns from alternative systems of feeding. To do this the best available data about rates of feeding and milk production is needed.

The most readily accessible data that seem to be of this kind are those contained in feeding standards. Doubt has arisen concerning the applicability of accepted feeding standards to this problem, or perhaps it would be more accurate to say that the generally accepted feeding standards have never recognized the existence of an economic problem of this nature and were not designed to cope with it. The dairy technicians who constructed the standards believed that the dairy cow was an animal not particularly affected by diminishing returns unless taxed beyond her capacity. In fact, because of the "maintenance requirements," it was believed that the average cow's efficiency in both physical and economic terms increased up to a maximum point beyond which body weight increased or other undesirable results occurred. Feeding standards therefore are intended to show the requirements for maintaining production at the technically most efficient point in view of the individual cow's capacity for performance.

The Morrison feeding standards (*16*, p. 1004) recommend for good cows under usual conditions 0.324 pound of total digestible nutrients per pound of 4-percent milk produced, in addition to the requirements for the maintenance of the animal. As we have said, this is intended to tell the dairyman how much he should feed a cow when she is producing a given quantity of milk. It does not tell him how much he can increase production by increasing feed. It has frequently been implied, however, that for each additional 0.324 pound of total digestible nutrients fed, milk production will be increased by 1 pound up to the limit of the cow's capacity, after which there will be no further increase in production. Many agricultural economists in the field of farm management have long suspected that beyond a certain point there is a gradually decreasing rate of increase in milk production

rather than an abrupt limit. Experience with other types of production and also the observation of actual farm-feeding practices in situations when different price relationships have prevailed strongly suggest that this is the case.

A number of empirical studies have been made in the effort to establish the curve of marginal relationships between feed and milk production by the statistical treatment of data obtained from farm-survey records, dairy-herd-improvement books and supervised farm accounts (*7, 18, 10, 30*).

In many of these studies, particularly of the farm-record type, only herd averages have been available and the findings have to be discounted to some extent because it was not possible to measure differences in the inherent productivity of the herds. In all of these the data on feed inputs have been subject to inaccuracies arising from the difficulty of measuring and estimating inputs of feed and in reducing feeds of widely different quality to a common basis. In spite of some inconsistencies between these studies, they have furnished valuable evidence supporting the view that diminishing returns do operate in dairying in an economically significant way. The results have not been sufficiently consistent, however, to be applied directly to economic problems. Furthermore, technical dairy specialists, who are accustomed to reasoning from controlled experiments, have been unwilling to accept statistical findings based on data from farm records.

Research on input-output relationships in dairying now being carried on by the United States Department of Agriculture in cooperation with a number of State agricultural experiment stations is expected to remove most of the difficulties described above and to provide accurate technical data useful in treating the economic questions. This fundamental research is under the direction of Einar Jensen in the Bureau of Agricultural Economics and is conducted jointly with the Bureau of Dairy Industry (*9*). Both experimental and statistical technique are being applied in these studies. The cows are being fed under controlled experimental conditions and the data are treated statistically.

Final results from Jensen's research are not yet available, but tentative conclusions from his first year's records have served to guide our feeding analysis. The most important of the preliminary findings may be stated as follows:

(1) Near the feeding-standard level the average milk return for all feed consumed is in close accord with the feeding-standard requirements.

(2) Increases or decreases in feeding above the level indicated by the commonly accepted feeding standards appear to cause a response only about one-half as great as has been so far assumed from the feeding standards.

(3) Although the principle of diminishing returns appears to hold good in dairy feeding, the rate of decrease in returns is very slow so long as very heavy or very light feeding is not approached. Within a considerable range around the level indicated by the feeding standard, the curve of diminishing returns comes close to being a straight line.

(4) Cows differ in their inherent productive capacity and those with higher productive ability show a higher marginal response to a given increment of feed.

These findings verify the feeding standards insofar as average requirements for a given level of milk production are concerned, when cows are fed in accordance with milk production. They also support the statistical studies in showing that some diminishing returns are present and that as any cow approaches the maximum

production of which she is capable, the additional output per unit of feed decreases.

To apply these experimental results to the budgeting problem, it is necessary to have some measure of the productive capacity of the cows. The available data are all in the form of herd averages and it is assumed that production responses for the herd are the same as though each cow behaved as shown by the herd average. In the absence of any better measure of productive capacity, present (1936) production has been used. Although they are not dependable for any given herd, the herds that are overfed may be offset by those that are underfed so that a reasonably correct estimate may be obtained for the whole group. A larger response to a given increase in feed is therefore estimated for a herd producing 7,000 pounds of milk per cow than for one producing 5,000 pounds, because the cows in the former herd would be expected to have more productive ability.

The above refers to differences in marginal output between herds with different inherent productive ability. The Jensen experimental studies, as stated, indicate that the rate of decrease in marginal outputs of milk within usual ranges of feeding is very slight. This means that there is probably a considerable range within which feeding per cow may be varied without any appreciable change in physical or economic efficiency. When all the possibilities in these individual farm situations are reviewed, it appears that the variation in rates of feeding will seldom exceed 15 percent of the present total ration under the conditions considered in this study. Within changes of this magnitude, it appears that diminishing marginal outputs may be ignored without serious loss of accuracy.

A rather simple rule for estimating the effects of different rates of feeding seems to give reasonably satisfactory results. This rule is that a given percentage increase in total digestible nutrients in the entire ration (maintenance and production) will result in the same percentage increase in milk production. This allows for differences in inherent capacity in a manner which may be best explained by an example. A cow producing 5,000 pounds of 4-percent milk might be fed 5,000 pounds of total digestible nutrients. According to this rule a 50-pound increase in feed would result in a 50-pound increase in production. On the other hand, a cow producing 6,000 pounds of milk might be fed 5,500 pounds of total digestible nutrients. Here a 55-pound increase in feed would be estimated to result in a 60-pound increase in production. This procedure attributes to increased capacity approximately the same effects that were found in the Jensen studies. It does not allow for diminishing marginal returns from increased rates of feeding the same cows, but for the reasons given above, this appears not to be necessary in this analysis.

One more point with respect to the estimates of changes in feeding upon production should be noted. This concerns variations in the proportion of roughage and concentrates in the ration. Ordinarily it would not be safe to assume that additional roughage could be utilized so effectively as concentrates or even so well as the roughage already consumed. But under the expected conditions in Dodge County there is anticipated an increase in the average quality of the roughages, as nearly all the increase is expected to be alfalfa or high-quality legume hay. Care has been taken in every case to keep total roughage feed-

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ing within reasonable limits with respect to total quantity and proportion of the entire ration. With these precautions it has not been considered necessary to make further allowance for changes in the proportion of roughage and concentrate feeding. Within these limits total digestible nutrients from concentrates and from improved roughage have been treated as equivalent.

The preceding discussion deals with the method of treating the increased feed available as it affects rates of feeding and production per cow. Additional roughage may be used to increase total feed per cow, as a substitute for part of the grain ration or both. It may also be used to increase the number of cows when limitations of barn space and labor do not stand in the way. In actual practice, changes in the number of cows may sometimes come about more readily than changes in customary feeding ratio which may become rather rigid and resistant to change.

This raises some interesting questions about whether it is really more profitable to feed additional roughage to the same cows or to more cows. From the point of view of the most efficient utilization of the feed, it should be pointed out that the general rule we are following—that of estimating that given percentage increases in total digestible nutrients will result in the same percentage increases in milk production—leaves this a matter of indifference. That is, a given quantity of additional feed is estimated to produce the same additional quantity of milk whether it is used to increase feeding rates or fed to additional cows. This will be true, of course, only within the limits indicated.

Although this is substantially in accord with the preliminary findings from Jensen's input-output studies, and will apparently result in reasonably accurate estimates of increased production from additional quantities of feed, something more needs to be said with respect to the marginal returns to be expected from grain fed to dairy cows and to other competing classes of stock. In estimating whether it will be more profitable to expand the hog enterprise or dairying, for example, the marginal return to be expected from grain fed to hogs and to dairy cows is of primary interest. For the purpose of this estimating, the data contained in the farm records are frequently inadequate and the percentage rule that is sufficiently good for reasonable estimates of production will not be reliable for estimating relative profits. In making comparisons of the relative returns from several alternatives, it is necessary to form input-output judgments, based not only on the farm records but also upon the best outside experimental evidence bearing on the problem to be found. For this evidence in the case of dairy cows, we have turned to the preliminary marginal-return data for cows of different capacity as shown by Jensen's preliminary findings. For other classes of stock, it has been necessary to refer to Morrison (16) except when more recent experimental data have been available. This must all be interpreted in the light of the input-output rates shown on the actual farm records, as real differences between farmers in feeding efficiency actually exist and are reflected, even though imperfectly, in the records.

### Effects of Prices on Production Trends

So far the trends in production that may be expected with a continuance of existing price relationships have been discussed. The

rate at which these changes occur and even their direction may be greatly affected by changes in price relationships. An increase in milk prices relative to other prices may be expected to accelerate all those trends associated with increases in production. A decrease may have the contrary effect. Consideration needs to be given each trend separately, as there are many differences.

In general, higher prices for milk would be expected to encourage an increase in dairy-cow numbers. Some feed would be withdrawn from other classes of stock. The upward trend in legume acreage might be accelerated. Some concentrate feed would be purchased. Additional facilities in the form of barns and equipment would presently be provided.

A decrease in milk prices would have some opposite effects, but many rigidities might stand in the way of decreasing production. Barns and equipment already available would not be left idle, although they might be converted to other uses. The introduction of improved crops and practices might continue, although more slowly. Many problems that arise here cause special difficulties. It may be possible to show conclusively that a given increase in alfalfa acreage or in rate of feeding would be profitable under lower price conditions, but many individual farmers may not be informed of the advantages of the new arrangement, or may be uncertain of its benefits. Lack of information, uncertainty, and insufficient financial credit may be more significant limitations with lower prices than with higher. Such public programs as the Agricultural Conservation Program, especially when implemented with cash payments for improved practices, may go far toward removing these difficulties.

The method of handling this point has been to recognize the educational influence of existing public programs but to leave out of budget calculations the payment features and likewise the particular restrictions on the acreage of individual crops. These features are well deserving of separate study, but it was felt that a first approach to the supply schedule for an area should hold in abeyance the restrictions imposed by programs which may themselves need to be reconsidered in the light of the findings of such studies.

One of the most important factors causing variation in production may be variations in production per cow caused by changes in the rate of feeding, particularly of grain. Higher rates of feeding are almost certain to result from higher prices and lower rates from lower prices. This point has already been considered to some extent in the preceding section on feeding. The best judgments possible have been made in each case in the light of the information available.

### Constructing Farm Plans and Budgets

The general considerations which have served as a guide in approaching the individual and area estimates of probable future production trends have been discussed up to this point. The detailed mechanics of testing the individual farm data are now presented.

Based on the normalized farm record for 1936, three groups of farm plans or budgets have been constructed for a time about 10 years later. The first of these, called A, is in terms of present price relationships; the second, called B, is in terms of milk prices 20 percent higher relative to all other prices; and the third, called C, is in terms of milk prices 20 percent lower relative to all other prices. From the alter-

native plans within each group, the most probable plan has been selected.

To reduce the subjective element, the estimates for each farm have been examined in detail by several persons working on the project and familiar with the areas studied. Differences in judgment with respect to estimated changes in organization and production were discussed and reconsidered. The final estimate therefore represents the combined judgment of two or more persons, at least one of whom was familiar with the area and the farm in question.

Procedures followed in arriving at the most probable farm organization in each of the three projected situations are very similar. The method is essentially one of considering the various alternative farm-organization or production programs which are feasible on each farm and then determining which plan is most probable. Several trial budgets or farm plans which include various combinations of enterprises are computed for each of the three production situations. After taking into consideration the profitableness of the various farm plans or budgets which are appropriate to each situation as well as other determining factors, the most probable farm budget is selected for each of the price situations. The factors, other than profitableness, which are considered, have to do with the general adaptability of the farm plan to the farm and to the farm operator. The degree of change in farm operations and organization from the present normal organization that is required by the various plans is a criterion which needs to be considered in determining what plan finally will be followed. All the information which has been obtained concerning the operation of the farm in the past and the past experience of the farmer is considered in selecting the most probable set-up.

Detailed procedure followed in making the individual farm analyses and in arriving at estimates of production may best be illustrated by referring to the computations made for one farm. Table 4 presents a summary of the computations made for a typical farm in the area.

There are 120 acres in this farm, about 90 of which are usually under cultivation although some additional land was rented in 1935. The rest is pasture, farmstead, and wasteland. The land is naturally fertile and good crop yields can be obtained, if proper farm practices are followed. The present operator purchased the farm in 1926, paying a small amount in cash and giving a mortgage for the balance. Some improvements have been made to farm buildings and land since then, but the property still is heavily mortgaged. At the present time, the owner is employed in work off the farm and a son who is 21 years old is the active operator. Another son who is 20 years old and other members of the family work on the farm part time. Enough family labor is available so that hired help is required for only a part of the year. Both the owner and the son who is the active operator are interested in making changes in the farm organization that will increase income.

As is shown in the actual farm plan for 1936 in table 4, dairying is the most important enterprise, but hogs, poultry, and canning peas also are significant sources of income. The average number of milk cows for the year was 17. More than enough young stock were kept to provide replacements for the dairy herd. The operator plans to increase the size of his dairy herd. If normal crop yields are realized, enough feed can be produced with the present cropping program to

maintain about 18 milk cows and some other livestock without purchasing much feed. Some concentrated feed usually is purchased in order to obtain a more balanced feed ration.

TABLE 4.—*Summary of budget computations for a typical farm, Dodge County*

| Item | Data for farm plans indicated [1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1936 | | A | | B | | C | |
| | Actual | Normal | Selected | Alternative | Selected | Alternative | Selected | Alternative |
| Farm acreage.....acre.. | 202 | 120 | 120 | 120 | 120 | 120 | 120 | 120 |
| Crops: | | | | | | | | |
| Alfalfa.....do... | 11 | 14 | 16 | 16 | 18 | 18 | 15 | 13 |
| Clover and timothy.....do... | 6 | 6 | 5 | 5 | 6 | 6 | 5 | 4 |
| Corn silage.....do... | 13 | 13 | 15 | 14 | 17 | 18 | 13 | 11 |
| Corn grain.....do... | ..... | 5 | 7 | 8 | 5 | 4 | 8 | 11 |
| Barley.....do... | 20 | 18 | 12 | 12 | 10 | 10 | 14 | 14 |
| Oats.....do... | 30 | 22 | 18 | 18 | 18 | 18 | 18 | 17 |
| Wheat.....do... | 7 | 3 | 3 | 3 | 3 | 3 | 3 | 4 |
| Rotation pasture.....do... | 11 | 10 | 10 | 10 | 12 | 13 | 10 | 10 |
| Canning peas.....do... | 20 | 4 | 4 | 4 | 1 | ..... | 4 | 6 |
| Other.....do... | 11 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Livestock: | | | | | | | | |
| Milk cows.....number.. | 17 | 18 | 22 | 19 | 24 | 25 | 18 | 16 |
| Heifers.....do... | 13 | 7 | 8 | 8 | 10 | 10 | 6 | 6 |
| Calves.....do... | 4 | 4 | 4 | 4 | 5 | 5 | 3 | 3 |
| Hogs produced, hundredweight | 24 | 20 | 20 | 42 | 10 | ..... | 42 | 62 |
| Poultry.....number.. | 133 | 133 | 139 | 139 | 139 | 139 | 264 | 264 |
| Sales: | | | | | | | | |
| Livestock: | | | | | | | | |
| Milk.....dollar.. | 1,829 | 1,855 | 2,307 | 1,953 | 3,191 | 3,334 | 1,500 | 1,327 |
| Dairy cattle.....do... | 220 | 245 | 330 | 310 | 385 | 385 | 265 | 245 |
| Hogs.....do... | 158 | 150 | 135 | 300 | 60 | ..... | 300 | 450 |
| Poultry.....do... | 60 | 150 | 250 | 250 | 250 | 250 | 250 | 250 |
| Eggs.....do... | 187 | 187 | 187 | 187 | 187 | 187 | 350 | 350 |
| Crops: Canning peas....do... | 50 | 120 | 144 | 144 | 36 | ..... | 144 | 216 |
| Other.....do... | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| Total-cash income.....do... | 2,520 | 2,762 | 3,378 | 3,199 | 4,134 | 4,181 | 2,834 | 2,863 |
| Total-cash expense.....do... | 1,545 | 1,521 | 1,570 | 1,499 | 1,775 | 1,793 | 1,482 | 1,565 |
| Net-cash income.....do... | 984 | 1,241 | 1,808 | 1,700 | 2,359 | 2,388 | 1,352 | 1,298 |
| Net-cash income with A plans under B and C prices.....do... | ..... | ..... | ..... | ..... | 2,260 | 2,097 | 1,347 | 1,303 |
| Net-cash income with B plans under A and C prices.....do... | ..... | ..... | 1,827 | 1,832 | ..... | ..... | 1,295 | 1,277 |
| Net-cash income with C plans under A and B prices.....do... | ..... | ..... | 1,727 | 1,630 | 2,102 | 1,962 | ..... | ..... |

[1] Several alternatives were considered for each price situation in addition to the one shown.

It is apparent that some adjustments in the data showing the actual farm operations for the year 1936 are needed in order to find the normal or usual farm program for that period. A normal farm plan is the basis from which the projected A, B, and C farm plans are computed. The farm plan considered to be normal for this farm for the 1936 period is shown in table 4. While some land in addition to the home farm was rented in 1935, this is not a usual practice. No land has been rented by this farmer since 1935. The usual acreage planted to crops as shown in the normal plan is about 93. Records of the acreages of various crops grown in 1936 and 1937 and the crop yields realized in these years indicate that some adjustments are needed in the crop program. According to the 1936 record, the canning-pea crop was almost a complete failure, but this is not a usual occurrence. In estimating what crops are normally grown and the acreages of each, the requirements of the livestock program also are considered.

More than enough young stock were kept during 1936 to provide replacements for the dairy herd. A normal livestock program includes fewer young stock and more milk cows. The number of milk cows

estimated to be normal is 18. No changes in the number of poultry indicated by the actual budget are required. A slight downward adjustment in hog numbers was made in the light of usual practices. Detailed calculations indicate that enough feed of a suitable kind is available to carry out this livestock program. In estimating the quantity of feed required to maintain livestock and to obtain the given production, information concerning feed requirements on this farm in the past is used. Some use is made of normal feed-requirement standards where very abnormal practices are reported.

Both expense and income data, as shown in the actual budget, require adjustments in order that a normal statement may be obtained. Receipts from the sale of milk cows, poultry, and canning peas were unusually low for the year covered by the 1936 report. Only a few dairy cattle were sold as this farmer was concentrating on increasing the size of his dairy herd. The canning-pea crop was a failure so income from this source was small. Some expense items also require adjustment. An amount of $200 was paid for rent of land during 1936, but it is not a usual practice to rent land. Several other items require minor changes. The net result of these revisions in the crop and livestock programs and the receipt and expense statements is to obtain a higher net-cash-income figure. It is the influence that changes in organization and production will have on this income figure that is considered in estimating whether they are profitable and are likely to be made.

It should be explained at this point that the net-cash-income measure used is simply the difference between cash receipts and cash expenses. For the actual 1936 plan these include only actual cash items. For the 1936 normal, as indicated above, adjustments have been made for normal yields and normal inventories. Similar adjustments have been made for the A, B, and C plans. Normal annual cash expenses have been estimated for items like insurance, repairs to buildings and equipment, and the like. These are expenses that must be met in cash within the period contemplated, even though they may not occur regularly or every year. Interest is included only when it is a cash expense.

Having determined the normal farm plan, the next step is to consider what changes are likely to be made in this plan during the next 10 years if prices of farm products remain the same as at present. This requires a detailed consideration of the management and the resources which will be available for production 10 years in the future. The present operator, who was 21 years old in 1936, plans to continue to operate the farm and it is reasonable to assume that he will do so. Both the owner, who is the father of the operator, and the son, who is the active operator, are anxious to make improvements in their farm organization which will increase their net cash income. An expansion in the size of the dairy and poultry enterprises is taking place on this farm at present and is expected to continue during the next 10 years. The operator intends to maintain his hog, and cash-crop enterprises at their present sizes.

Improvements in crop production which are now in progress on this farm can be expected to provide most of the additional feed required by the additional dairy cattle. These include estimates of higher crop yields resulting from the use of lime and better seed and the growing of more alfalfa and other high nutrient-producing crops.

The quantity of farm-produced feed available is one important factor which limits the size of the dairy enterprise. More family labor will be available in the future so no additional expenditures for hired labor will be required. Since there is unused barn space on the farm at present, the number of dairy cattle kept can be increased without much additional outlay on buildings.

From a comparison of the various farm plans which might be followed, it appears that a plan which includes 22 milk cows, or an increase of 4 over the present normal number, is most likely to be put into operation. Some increase in the size of the poultry enterprise also is involved in this plan, but production of hogs and cash crops are about the same as at present. No drastic changes will be required for the adoption of this plan. In fact, it is well-suited to the resources that will be available. A substantial increase in net cash income over that being realized on the farm at present will result.

Instead of increasing the size of the dairy herd to 22 milk cows, this farmer might decide to maintain the present number and to expand production in alternative enterprises such as hogs or cash crops. It is also possible that he might decide to increase the number of milk cows to more than 22 and to reduce production of other products. Several alternative farm plans have been computed to test the profitableness of these possibilities. One of these alternative plans, shown in table 4, includes 19 milk cows, an increased production of hogs, and some reduction in cash expenditures. It is found that net cash income will be considerably less with this alternative plan.

Some indication of the advantage of increased specialization in dairying is provided by projecting the plans drawn up for the B situation under A conditions. The B plans include more than 22 milk cows. It is shown in table 4 that the B plans are approximately equal to the A plan so far as profitableness is concerned. A production program which includes more than 22 milk cows is not considered probable in this situation as it would require additional changes in farm organization but would not cause an appreciable increase in net cash income. A consideration of the advantages of these various alternative production plans suggests that the A plan is most likely to be followed.

It must be recognized that there are differences in the resources and limitations under which the farmer operates that are associated with each price situation so that plans appropriate under B prices would not always be possible under A. To take one example, differences in availability of credit impose definite restrictions upon the alternative plans that may be considered in a given price situation.

Some additional expansion in the size of the dairy enterprise can be expected if milk prices increase 20 percent and if prices of other farm products remain the same as at present, as is contemplated in the B situation. According to the estimates it is most probable that a farm plan that includes 24 milk cows or an increase of 6 over the present normal number will be followed. A reduction in the size of the hog and cash-crop enterprises is expected in order to allow a greater proportion of the resources to be used in milk production. Some adjustments in the present crop program will be required in order to carry out this livestock program. More feed, especially roughage feed, is needed. Therefore, more land is devoted to alfalfa,

corn silage, and rotation pasture in place of corn for grain and canning peas.

The main reason for believing that these changes in the present production plan will be made during the next 10 years, providing a substantial increase in the price received for milk takes place, is that they are economically advantageous. Net income will be increased by more than the amount caused by the increase in milk price. The advantage of making these changes in farm organization is illustrated by the comparison of the net cash incomes which would be realized with various farm plans made in table 4. It is demonstrated that if the A plans which include fewer milk cows but more hogs and cash crops are followed in this situation, net cash income will be considerably less. On the other hand, if the size of the dairy enterprise is increased to more than 24 milk cows and if production of hogs and cash crops is discontinued altogether as is done in the alternative B plan, net cash income will be increased only a small amount. Since there is little advantage in expanding the size of the dairy enterprise to more than 24 milk cows, it is improbable that more than this number will be kept.

Another reason for believing that dairying will be expanded on this farm by the amount indicated in the B plan is that the required adjustments in organization can be made readily. Barn space is available for keeping more cattle. No difficulty would be encountered in making the necessary changes in the crop program. Enough family labor will be available so that little additional hired labor will be required. This farmer has indicated a willingness to make changes in his production program if such changes result in an increase in net cash income. He will probably make use of the opportunity to increase his income by following a plan much like that selected as most probable under B in table 4.

It is now necessary to consider what plan of operation will be followed on this farm at a period 10 years in the future if milk prices fall 20 percent, the prices of other farm products remaining the same as at present. Examination of several plans which might be followed reveals that a plan which includes only 18 milk cows, or the present normal number is most probable. Production in the alternative enterprises—hogs, poultry, and cash crops—is expected to increase as is indicated in table 4. Instead of utilizing the increase in feed production expected during the next 10 years in dairying, as is done in the A and B plans, a larger proportion is devoted to production of hogs and poultry. More of the cropland will have to be used in producing small grain and corn for grain and less in production of roughage feed, but no major changes in the crop program are required.

Reduction in the price of milk will cause this farmer to consider the possibility of maintaining his present income by expanding production in other enterprises. The estimates summarized under C in table 4 show that the farm plan selected as most probable is the most profitable of a number of alternative plans. Net cash income would be considerably less if the number of milk cows were reduced to 16 and still greater emphasis given to production in enterprises other than dairying. This is shown by the alternative C plan. The profitableness of production programs with more than 18 milk cows in this situation can be determined by projecting the A and B farm plans in

the C situation. The farm plans with more than 18 milk cows are relatively less profitable.

There should be no difficulty in making the changes in farm organization required by the C plan. The necessary farm buildings for hogs and poultry are available on the farm so no additional outlay will have to be made for this purpose. The shift in the crop program to the production of more corn for grain and small grain in place of roughage feeds can be made readily. Somewhat less labor will be required, and it should be possible to reduce expenditures for hired labor by a small amount. The adjustments in farm organization required by the selected C plan are those that are most natural and logical for the farmer to make in this situation. At least a part of the reduction in net cash income caused by the reduction in the price of milk will be avoided with this plan of production.

A procedure similar to that described above is followed in making each of the 24 case-farm analyses. Based on a knowledge of the resources available for use in production, the profitableness of various alternative production plans, and the character of the farm operator, the most probable farm organizations are selected. Estimates of the quantities of milk and other products that are most probable under the three price situations for farm products are thus obtained.

## Results of the Individual Farm Budgets

Results obtained from the individual farm analyses form a basis from which an estimate of the supply schedule of the area may be made. The probable quantity of milk that will be produced by a number of representative farms under each of three price situations has been estimated. By adding the productions for each of these farms, the total production expected from the entire group of 24 farms may be determined. Although budgets have not been made for all prices, the positions of three points on the supply curve have been estimated. Some indication of the nature of the supply curve for the area is therefore provided by a knowledge of the location of these 3 points for the 24 selected farms.

The milk production estimated for each of these projected situations for the entire group of 24 farms has been expressed as a percentage of the actual production in 1936. The normal production for 1936 may also be expressed as a percentage of the actual 1936 production. These percentages are as follows:

| Price situation: | *Milk production for sale* |
|---|---|
| 1936 actual | 100. 0 |
| 1936 normal | 100. 2 |
| A | 107. 8 |
| B | 119. 9 |
| C | 93. 0 |

These estimates mean that an increase of about 8 percent in the total quantity of milk produced by the 24 farms can be expected in the next 10 years even though no changes in price relationships of farm products occur. If milk prices increase 20 percent and the prices of other farm products remain the same as in 1936, milk production will be increased approximately 20 percent. On the other hand, if milk prices fall 20 percent, other farm prices remaining the same, the total quantity of milk produced will probably be reduced 7 percent.

The influence of price changes alone may be more clearly seen if production in the B and C situations is compared with that expected in the A situation. With milk production in the A situation expressed as 100 percent, 111.2 percent was obtained in B and 86.2 percent in C. These relationships are shown in the form of a supply curve in figure 12. An increase of 20 percent in the price received for milk is estimated to result in an increase of 11 percent in the total quantity of milk produced. A reduction of 20 percent in milk prices is estimated to cause a 14-percent reduction in milk production. This suggests that the supply of milk is less elastic for an increase in

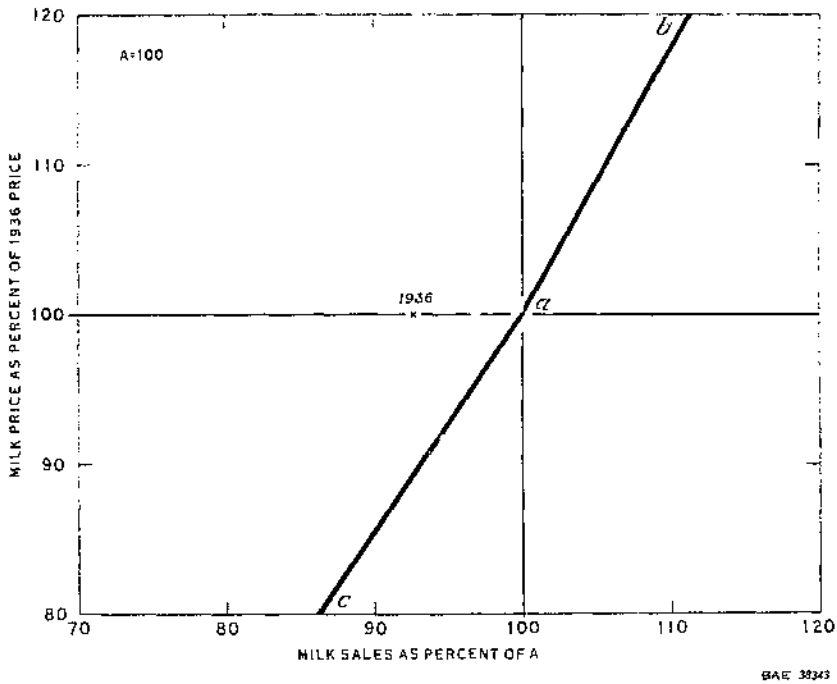


FIGURE 12.—ESTIMATED QUANTITIES OF MILK FOR SALE AT THREE PRICE LEVELS, 24 SELECTED FARMS, DODGE COUNTY (A=100).

A 20-percent decline in milk prices, relative to other prices, would in 10 years bring about a contraction in quantity sold only a little more than the expansion that would result from a similar price increase. The distance between the point marked 1936 and A represents changes that are estimated for a 10-year period with no change in price relationships.

price than it is for a decrease on these farms. In either case, less-than-unit elasticity will be noted.

The continuing advantage of dairying over other lines of production for this group of farmers is suggested by these findings. They have been obtained after a careful analysis of the adjustments which individual farmers can and seem most likely to make in their farm organizations. It should be remembered in this connection that a major consideration in determining what changes in production can be expected was the profitableness of making these various changes.

The net cash income estimated for these 24 farms in the A situation is about 3 percent above that realized in 1936. Net cash income will

be increased more than 32 percent in the B situation as compared with that realized in 1936 for this group of farms. It will be reduced about 20 percent in the C situation.

The advantage of making the shifts in production expected in the B and C situations may be shown by comparing the net cash income which will be realized in each of these situations with that which would be realized if no changes in the present farm-production programs were made. If the selected A-farm plans are continued in the B situation (with the 20-percent increase in milk prices), net cash income will be increased nearly 30 percent. With the selected B farm plans in the B situation, net cash income will be increased more than 32 percent. If the selected A-farm plans are continued in the C situation (with the 20-percent reduction in milk prices), net cash income will be reduced approximately 24 percent, while with the operation of the selected C plans it will be reduced only 20 percent. By making the changes in farm organization required by the selected C farm plans, a 4-percent reduction in net cash income will be prevented. It is evident on the basis of these estimates that the expected shifts in production will be profitable. It is probable, furthermore, that the cash advantage of the shifts has been underestimated and that the real difference would be still greater.

TABLE 5.—*Averages of individual estimates of important factors at different prices, 24 selected farms, Dodge County*

| Factor | | Data for price situation indicated | | | |
|---|---|---|---|---|---|
| | | 1936, actual | A | B | C |
| Milk cows | number | 18.6 | 19.6 | 20.7 | 17.3 |
| Milk production (sold) | pounds | 130,041 | 140,243 | 155,891 | 120,942 |
| Milk sales | dollars | 1,741 | 1,882 | 2,510 | 1,200 |
| Other income | do | 1,012 | 930 | 791 | 1,118 |
| Total cash receipts | do | 2,753 | 2,812 | 3,301 | 2,438 |
| Total cash expenses | do | 1,341 | 1,358 | 1,435 | 1,302 |
| Net cash income | do | 1,412 | 1,454 | 1,866 | 1,136 |

[1] Actual data for 1936 are used as these are nearly identical with the normalized data.

Some general differences between the farm plans which are expected in each of the price situations may be observed in table 5. Averages of various important factors for the 24 selected farms have been computed and are presented in this table. It will be noted that some increase in the number of milk cows is expected on these farms during the next 10 years, even though the prices of farm products remain the same as at present. This will cause some increase in the quantity of milk produced. Few other changes in production are expected in this situation. If milk prices increase 20 percent, as is contemplated in the B situation, a somewhat larger increase in the number of milk cows kept is expected. Income from milk production will be increased $769 on the average, while income from other sources will be reduced $221. Cash expenses will be increased $94. As a result, net cash income will be increased about $454. In the event of a 20-percent decrease in the price paid for milk, as contemplated in the C situation, dairying will become less important while other lines of production will receive more emphasis. As indicated in table 5, the average number of milk cows and the quantity of milk produced will be

decreased. Income from milk will be reduced $451, but income from other sources will be increased $136. Cash expenses will be reduced $39 per farm. As a result of these changes, net cash income will be reduced approximately $276.

It is apparent from the data cited above that no major change in the type of farming practiced is to be expected as a result of either a 20-percent increase or decrease in the price paid for milk. Some increased specialization in dairying will follow an increase in the price paid for milk but other enterprises will continue to be important. Farmers will find it advantageous to expand production in alternative enterprises such as hogs, poultry, or cash crops with a reduction in the price of milk, but dairying will continue to be the most important source of income. Despite the limitations to the changes which are profitable and which can be expected in response to price changes and production conditions, some degree of elasticity in milk supply for these farms is apparent.

### Normalizing Adjustments

It has been explained that the first step followed in making the individual case-farm analyses was to normalize the actual farm-budget data in order to obtain what might be considered the normal farm organizations for the year 1936. This is necessary since data describing farm operations on a single farm in any 1 year are not always typical of the usual or normal situation. For example, the number of young stock raised on a farm in any 1 year may be abnormally high while on another farm it may be abnormally low. The cropping plan followed on a farm in 1935 as indicated by the 1936 farm-business record may not be typical of the usual practice. All the historical information collected for each of the farms was considered in detail in order that a budget of the normal or most usual farm operations might be computed. This normal budget formed the basis from which the budgets for the various projected situations were determined.

It is now necessary to determine whether the normal for the entire group of farms can be obtained by combining the individual farm plans. In other words, it is necessary to determine whether the individual farm data have been adjusted adequately. This may be done by determining to what extent the record year of 1936 was a normal year for the area and how well the 1936 data and the normal data for this group of farms correspond. If it is found that 1936 was a normal year with respect to various factors affecting milk production and if the normalized data for the entire group of farms closely approximate the actual data for the entire group, no adjustments need be made in estimates of milk production in the projected situations. If this is not the case, some corrections in the estimated responses need to be made.

Milk production in Dodge County in 1936 was slightly above that for 1935 and 1937, but not particularly out of line with the apparent long-term trend. Feed production in the crop year 1935 was higher than in the adjacent years but was in agreement with the apparently increased feed-producing capacity of the county. It therefore seems reasonable to regard 1936 as about a normal year for milk production for Dodge County in this particular period. The total normal production of milk on the 24 farms should be approximately equal to the total actually produced if the individual farms have been normal-

ized adequately. A comparison of the total quantity of milk actually produced on the 24 farms and the total normalized production shows that the normal production is only 0.2 percent higher than the actual production for 1936. This is true even though milk production on individual farms had to be revised either upward or downward in most cases to obtain the normal production for each farm. As there is no important difference between the total quantity of milk actually produced by these 24 farms in 1936 and the normalized total, and, since the 1936 year has been determined to be normal with respect to milk production for this county, no adjustments need be made to the total normal production of milk or to the estimated production for the projected price situations.

### Extension of the Estimates to Dodge County

How the results obtained may be applied to a larger area may now be considered. It will be remembered that the 24 farms we have budgeted were selected from a group of 100 Dodge County farms for which complete farm-management records were obtained in 1936. The farms were selected on the basis of certain characteristics or combinations of characteristics which were thought to be related to production response. The characteristics considered were size of farm, age of operator, indebtedness, tenure status, productivity of the soil, and available family labor. For example, one farm classification might be: Large farm, operator between 35 and 50 years of age, small debt, owner, good land, and little family labor. There are 24 such classifications for each of which 1 farm was selected. The production responses to be expected from the farm in each classification were estimated as has been explained.

We may now examine our findings to see whether there is any relation between certain factors such as size of farm, number of milk cows, age of operator, and others, and the estimated production response. Scatter diagrams were constructed in order to observe the relationship between each of these factors and the percentage change in production on the 24 farms in each of the 3 projected price situations. No significant relationships between these various factors and changes in production could be found. There appears to be a slight tendency for farms with a large amount of family labor to increase milk production more than others, and this is true under all three price situations. The owner-operated farms seem to increase their production of milk somewhat more than the rented farms. No correlation was found when size of farm, age of operator, indebtedness, and other factors were related to percentage changes in production. From these tests, the conclusion appears warranted that production response in this area is dependent upon a large number of factors, no one of which is dominant. In making changes in their farm plans, farmers are probably influenced by varying combinations of factors.

As there are no fixed relations between certain single factors and the percentage change in production expected in the projected situations, it is impossible to determine how other farms are likely to respond to the use of this type of approach. Responses in production which logically can be expected on farms with particular combinations of factors have been determined for the 24 selected farms. The larger group of 100 farms can be distributed, on the basis of available infor-

mation, among the 24 groups. The percentage changes in production expected for the farm selected for one classification can then be applied to all the farms which fall into this classification. It would be assumed that farms which are similar with respect to several important factors will respond in a similar manner. The responses in production for the individual farms may then be combined in order to determine what changes can be expected for the entire group of farms.

An estimate of the production response which may be expected for the entire group of 100 farms for which detailed information is available has been obtained by following this procedure. Percentage changes in production expected for the farm selected for each classification have been applied to all the farms falling in the group. Other factors besides the 6 listed above have been considered in determining what classification each of the farms best fits. These include such things as the number of milk cows and other livestock, the proportion of income obtained from various sources, total expenditures, and total receipts on these farms in 1936.

TABLE 6.—*Estimates of milk production (for sale) at different prices for 24 selected farms and 100 record farms, Dodge County*

| Price situation | Milk production for sale | |
|---|---|---|
| | 24 farms | 100 farms |
| 1936 actual | 100.0 | 100.0 |
| A | 107.8 | 107.7 |
| B | 119.9 | 120.5 |
| C | 93.0 | 93.0 |

Milk production (as percentages of 1936 actual production) obtained for the 100 farms by following this procedure, as compared to those for the 24 farms are shown in table 6. It should be clear that the results obtained for the 24 farms for which detailed budget computations have been made are included in the results given for the 100 farms. The changes in production for the entire group of farms are expressed as a percent of the total production in 1936. The productions for the individual farms have been totaled in order to obtain the total change in production for the entire group of farms.

According to the above computations, approximately the same production response is estimated for the 100 farms as for the 24 farms. These results would be expected, if the 24 farms are representative of the 100 farms with respect to single factors and combinations of factors considered to be important in influencing production responses. It is not sufficient to determine how representative this selected sample is of the larger sample with respect to certain single factors, but it is necessary that it be representative of the various factor combinations. Some combinations of factors may be more important than others and should be given more weight than others in determining the production response for the larger group. In distributing the 100 farms into the 24 groups, it was found that some classes were more important than others. Three classes had only 2 farms while 6 classes had 6 farms. Seven classes had 4 farms which is nearer the average.

Some further indication of the extent to which the results obtained from the budget analyses of the 24 farms may be applied to the 100

farms can be obtained by determining how representative the 24 farms are of the 100 farms. This may be done by comparing the 2 groups of farms with respect to various important factors. Those which can be expressed as numerical averages are listed in table 7.

According to this comparison the 24 farms are similar to the 100 farms in most respects. There is little difference between the average of the 2 groups with respect to total income and its distribution between various sources. The 24 farms are slightly larger than the 100 farms, on the average, and realized a larger gross income in 1936.

As a further step in determining the significance of the results obtained from the budgetary analysis of the selected farms as well as the group of 100 farms, it is desirable to determine how adequately these two groups of farms represent all farms in the county with respect to important factors which influence production. The sample group of 100 farms may be compared with all farms in the county with respect to various important factors as has been done in table 7.

TABLE 7.—*Averages of important factors for 24 selected farms, 100 record farms, and all farms, Dodge County, 1936*

| Factor | | 24 farms | 100 farms | All farms [1] |
|---|---|---|---|---|
| Average size of farm | acre | 127 | 117 | 111 |
| Cropland | do | 82 | 78 | 69 |
| Percentage of land owner-operated | percent | 77 | 82 | 72 |
| Milk cows | number | 19 | 17 | 16 |
| Gross farm income | dollars | 2,753 | 2,550 | 2,941 |
| Source of income: | | | | |
| Milk | percent | 63.2 | 62.8 | 48.8 |
| Cattle and calves | do | 11.1 | 11.4 | 10.1 |
| Hogs | do | 8.6 | 7.3 | 17.6 |
| Poultry and eggs | do | 7.6 | 8.1 | 9.2 |
| Other livestock | do | .6 | .7 | .5 |
| Crops | do | 6.7 | 6.0 | 11.4 |
| Other | do | 2.2 | 3.7 | [2] |
| Total | do | 100.0 | 100.0 | 100.0 |

[1] Data on all farms in Dodge County are from Wisconsin Agriculture (7).
[2] Less than 0.05 of 1 percent.

Although some differences between the sample 100 farms and all farms in the county may be noted, the type of farming followed and the average size of operations are much the same. The 100 farms average slightly larger in total size and have more crop acres than all farms in the county. This makes it possible for the sample group of farms to keep more livestock and to realize a larger gross income. The differences between the 2 groups of farms in this respect are not large. Hog production appears to be relatively less important on the sample group of 100 farms in the county but this may be due to differences in methods of estimating incomes.

The comparisons that have been made between the 2 sample groups of 24 and 100 farms and all farms in the county by noting the averages with respect to various factors indicate that the selected farms may be considered representative. It will be recalled that a township which was thought to be representative of the agriculture of Dodge County and of the surrounding area was selected and then insofar as possible the 100 farm-management records were obtained from farms located in this township. The object was to obtain records from a solid block of farms in order that all types of situations might be represented. The

next step was to select 24 farms for more intensive study on the basis of exhibiting various factors and combinations of factors. It is logical to expect that with this type of procedure a representative sample would be obtained. Comparison of the data for the 100 farms with that for the county indicates that the 100 farms are representative of the county. The fact that there are few differences between the 2 sample groups of farms and all farms in the county means that the results may be applied to other farms in the county within certain limits.

### Reliability and General Applicability of the Findings

The discussion presented in the preceding section provides some evidence that the results obtained from the 24 farms and the 100 farms may be applied to other farms in this county. Both groups of farms are representative of other farms in the area with respect to several important factors which probably influence the production adjustments made on individual farms. There is also some indication that these 2 sample groups of farms are representative of all farms in the county with respect to the importance of different combinations of factors or farm situations which influence production adjustments made by a group of farms. It is significant that when the 100 farms are placed in the 24 farm classifications for which detailed budget computations were made, approximately the same production estimates are obtained for the 100 as for the 24 farms.

To determine more precisely the significance which may be attached to these findings, it is necessary to study the variation in production responses expected for the sample group of 24 farms. It will be recalled from discussion in the preceding section that no significant relationship between certain factors such as size of farm, age of operator, productivity of the soil, and others, and the estimated production responses could be found. This suggests that the changes in production which farmers are likely to make with the passage of time and with certain changes in prices of farm products are dependent upon a number of factors, no one of which is dominant. If this is true, the estimates of change in milk production for all farms in the area should approximate the form of a normal frequency distribution. From the way in which the sample of 24 farms was selected and from what has been learned of its characteristics, it seems reasonable to consider that we have the equivalent of a random sample from a normal universe. Although the sample was not obtained by random methods, the lack of correlation between response and any of the factors upon which the selection was based, together with our knowledge of the area, permits us to use the sample as though it were random.

Changes in milk production expected between the actual production in 1936 and the A, B, and C situations for the 24 farms have been grouped into the frequency distributions shown in table 8. The distributions of changes in milk production for these 24 farms have some of the characteristics of normal distributions.

The fact that the estimates of changes in milk production seem to approximate a normal frequency distribution suggests that the standard error of the mean may be applied to the series of actual changes in production to determine the reliability of the results obtained from analysis of this sample group of 24 farms. It is desirable to know what

the probable range of the average change in production would be if additional random samples of 24 farms were selected for study in this area. This is indicated by the results obtained from sampling error computations summarized in table 9.

TABLE 8.—*Number of farms with specified changes from 1936 actual milk production, at different prices, 24 selected farms, Dodge County*

| Change (pounds) | Data for price situation— | | |
|---|---|---|---|
| | A | B | C |
| | *Number* | *Number* | *Number* |
| −30,000 to −20,001 | | | 4 |
| −20,000 to −10,001 | | | 7 |
| −10,000 to −1 | 2 | | 10 |
| 0 to 9,999 | 11 | 3 | 3 |
| 10,000 to 19,999 | 6 | 8 | |
| 20,000 to 29,999 | 3 | 4 | |
| 30,000 to 39,999 | 2 | 4 | |
| 40,000 to 49,999 | | 2 | |
| 50,000 to 59,999 | | 3 | |
| Total | 24 | 24 | 24 |

Since it seemed desirable to express the estimated changes in milk production that would be likely to occur under situations A, B, and C as percentages of the actual production in 1936, consideration was given to the dispersion in the 24 figures for actual production. It was found that the distribution of actual milk-production figures for the area approached a normal frequency distribution and it was assumed that we had a random sample of 24 items from the whole area. The standard error of the mean was computed and applied to the average production to determine maximum and minimum mean values within which findings from additional samples of 24 drawn from the area would fall. These probable ranges in absolute and percentage terms are shown in tables 9 and 10.

The sampling-error measures shown in these tables tell us what the probable range in results would be if additional samples of 24 farms were selected for study in this county or in other areas where conditions affecting farmers' production responses are similar. It needs to be emphasized, however, that these measures of error assume that the individual farm estimates of production are accurate. The accuracy of the individual farm-production responses is dependent upon the reliability of the analytical method described in a previous section.

TABLE 9.—*Estimated average milk production (for sale) at different prices and change from 1936 normal, 24 selected farms, Dodge County*

| Price situation | Production | Mean change from normal | Standard error of mean change |
|---|---|---|---|
| | *Pounds* | *Pounds* | *Pounds* |
| 1936 normal | 130,011 | | |
| A | 140,243 | +10,202 | ±2,137 |
| B | 155,891 | +25,850 | ±3,218 |
| C | 120,942 | −9,099 | ±1,666 |

TABLE 10.—*Estimated milk production (for sale) at different prices, 24 selected farms, Dodge County*

| Price situation | Production | Range of probable production[1] | |
|---|---|---|---|
| | | Minimum | Maximum |
| 1936 normal | 100.0 | | |
| A | 107.8 | 106.2 | 109.4 |
| B | 119.9 | 117.4 | 122.4 |
| C | 93.0 | 91.7 | 94.3 |

[1] This is the range included by the standard error of the mean change within which estimates from additional samples of 24 farms might be expected to fall 2 times out of 3.

The type of farming followed in this county and the factors affecting the prevailing type appear to be similar to a large section of southeastern Wisconsin. Before the results of these investigations are applied to other areas, similarities and differences in fundamental conditions affecting the existing agriculture need to be considered.

## SUMMARY FOR DODGE COUNTY

A general consideration of the agriculture of Dodge County and the factors affecting the prevailing type indicates that some changes in the quantity of milk produced may be expected with changes in price relationships of farm products. Natural resources and market outlets are such that production of a number of farm products is economical.

Most farm organizations consist of a combination of enterprises which include dairying, hogs, poultry, and cash crops. Changes in price relationships of farm products cause production in some enterprises to become more advantageous than in others, and some shift in resources becomes profitable. As there are lines of production alternative to dairying from which substantial amounts of income are being obtained at present, it is apparent that it will be possible for farmers to make changes in production with changes in price relationships of farm products. The extent to which such changes in production are profitable and are likely to be made with certain changes in price relationships can be determined only by examination of actual farm plans. This has been done as is described in the prospective-trends section.

Detailed study of changes in milk production in this county during the preceding 10-year period reveals that there has been a general trend toward increased milk production amounting to 18 percent. As prices of all farm products were at a lower level at the end of the period than at the beginning and as the price of milk was not relatively more favorable, it is evident that there has been a substantial shift in the position of the supply schedule. This has not been caused by a shift in resources, for the production of hogs, poultry, and cash crops has not been reduced. In fact, there has been a noticeable increase in poultry production. The increase in milk production has been made possible by an increase in the feed-production capacity of farms in the county.

According to an index of feed production which has been computed, approximately 11 percent more feed nutrients were produced during the years at the end of the 10-year period than during those at the beginning. Crop production in 1935, which was least affected by

adverse weather, was about 20 percent above that at the beginning of the period. It is estimated that this represented the real increase in normal feed-production capacity. This increase in feed production has resulted from the introduction of more high-nutrient feed-producing crops, such as alfalfa and other legume hay, as well as an expansion in the total crop acreage. It is not known definitely whether farmers are purchasing more feed now than formerly, but the ratio of milk prices to concentrated-feed prices indicates that it is no more profitable to purchase feed for milk production now than formerly. It appears that farmers determined to utilize the additional feed which became available in dairying rather than in any other line of production because the type of feed which could be produced most easily was best suited for dairying. No doubt, the expansion in crop production as well as in livestock production was made in an attempt to obtain more income.

The present upward trend in milk production in this county is expected to go on, with present normal prices continuing, during the next 10 years, although at a lower rate than in the preceding decade. Detailed study of the individual farm organizations indicates that there will be a further increase in the quantity of farm-produced feed and that it will be most profitable to use this feed in dairying. The sizes of other farm enterprises may not change much. If milk prices increase 20 percent, and if prices of other farm products remain the same as at present, production of milk can be expected to increase about 20 percent. On the other hand, if milk prices are reduced 20 percent, and no changes in prices of other farm products occur, production of milk can be expected to decrease about 7 percent. A higher price for milk will cause a greater specialization in dairying to be profitable while a lower price for milk will cause a shift to production of more alternative products.

The trends of production expected under each of the price conditions as well as the trend of normal milk production during the past 10 years for this area are shown in figure 13. The trend line from 1925 to 1936 is not statistically fitted but represents the trend in normal production. It was drawn after adjusting actual production data for the years at the end of the period to what would normally be expected in view of the changes that have taken place in cropping systems. Drought and adverse weather conditions prevented actual production from fully reflecting these changes. It is estimated that the actual milk production in 1936 was about normal. The trend line is therefore drawn to end at the 1936 production point. The broken lines from 1936 to 1946 represent the trends to the probable future productions in the A, B, and C situations. No changes in price relationships of farm products are contemplated under A. The influence of a 20-percent increase in the price of milk on production is considered in B while a 20-percent decrease in the price of milk is considered in C.

In each of these projected production situations a period of 10 years is allowed in order that production on individual farms may become adjusted to the change in price relationships. The differences in the quantities of milk produced in the A, B, and C situations are those which are expected to arise as a result of the price changes. Some degree of elasticity in milk supply of this area is indicated from a study of individual farm organizations.

Location of these supply points is also shown in figure 12 (p. 42). The essential difference between the figures 12 and 13 is that the former emphasizes information concerning the shape of the 10-year supply schedule whereas the latter emphasizes the information on its shifting over time. The budget method has made it possible to take into account the influence of present and probable future changes in techniques of production as they affect individual farmers and has made possible an estimate of supply points for this area at a moment of time 10 years in the future. The influence that important changes in the price of milk relative to other farm products is likely to have

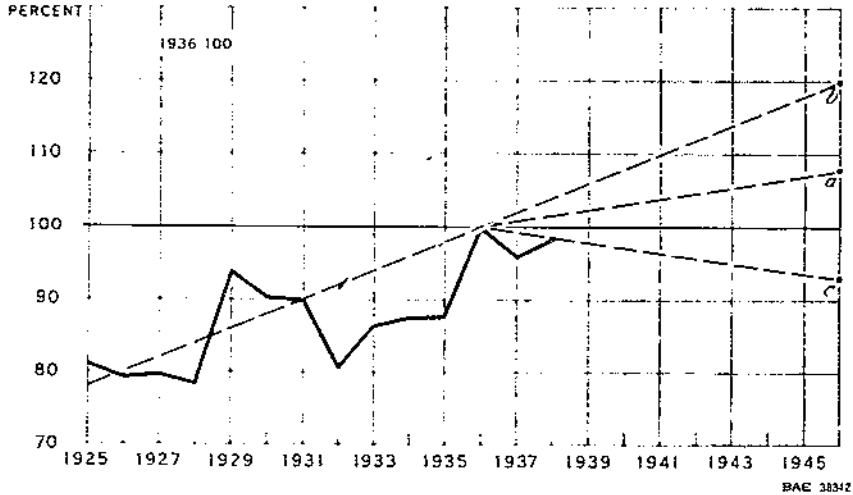


FIGURE 13.—MILK PRODUCTION AND PROBABLE FUTURE TRENDS, DODGE COUNTY (1936=100).

Milk production fluctuated considerably between 1925 and 1936 but was at a definitely higher level at the end of the period. The trend line for normal production is drawn so as to end at the 1936 production point as this has been estimated to be normal for 1936. The estimated trend to 1946 for A conditions (continuation of 1936 normal price relationships) has somewhat less slope than that from 1925 to 1936, the trend for B conditions (higher prices) about the same slope. For the lower price C conditions the estimated trend is downward.

on production on individual farms has been estimated and the results obtained provide information concerning the location of other supply points at the same period of time 10 years in the future. Actually what has been obtained is an abbreviated supply curve that applies to a relatively long period of time and to production conditions that are most likely to be experienced in the future.

## BARRON COUNTY—AN AREA WITH FEW ALTERNATIVES

### THE AGRICULTURE OF BARRON COUNTY

Barron County lies in the northwestern part of Wisconsin. Its agriculture differs considerably from that of Dodge County. Natural conditions do not favor nearly as much diversification. Consequently, the area is more highly specialized in dairying and few alternatives

become very profitable even with considerable changes in relative prices.

Before proceeding with an analysis of individual farm plans, the general type of agriculture will be considered in some detail. The soil resources of the county are examined first.

## SOIL

The topography and the soil of the area have been influenced by glaciation and in more recent years, by erosion. A considerable part of the county is included within one of the older glaciated regions of Wisconsin. The topography is level to distinctly rolling with few areas too rough for agriculture. Some of the land is underlain by a clay pan that causes poor drainage. The soils are naturally low in organic-matter content because the area originally was heavily wooded with mixed white and Norway pine and hardwood timber. The soils of the county are inherently low in calcium carbonate and require liming for good crop growth. Farmers will have to use more lime and fertilizer if crop yields are to be maintained or increased.

One of the principal soil types in Barron County is the Colby silt loam which is derived essentially from the old glacial drift. The surface soil consists of a smooth silt loam to a depth of about 6 inches and is dark gray in color. The subsoil includes more clay material and is colored buff or yellow. Another important soil type, the Kennan loam, is formed from more recent glacial material. This soil is variable in character including fine sandy loams, loams, and silt loams. The surface soil is gray or gray-brown in color to a depth of 8 to 10 inches while the subsoil is reddish-brown in color but includes more clay material. A third soil type, Dallas loam, is of less extent. The surface soil varies from a sandy to a silt loam while the subsoils are usually sand or sand and gravel.

## CLIMATE, PRECIPITATION, AND CROPS

The rainfall during the growing season for hardy crops, such as hay and pasture, ranges from 22 to 24 inches, and is favorably distributed throughout the growing season. Four-fifths of the total annual rainfall comes from April to October inclusive. The mean annual temperature ranges from 41° to 42° F., as compared with an average of about 43° for the State. The frost-free season is from 110 to 120 days in length, or more than a month shorter than that of the southern portions of the State.

Soil and climatic conditions favor the production of such crops as small grain, hay, and pasture. Corn is a valuable crop for use as silage, but it is difficult to obtain good yields of corn for grain regularly. The possible development of improved hybrid varieties with a relatively short growing season may cause production of corn for grain to become more advantageous in the future. From the standpoint of maintaining the present soil fertility and crop yields, however, it is essential that farmers devote a large proportion of their land to soil-conserving crops, such as hay and pasture. These feeds are ordinarily used by livestock on the farm and a considerable portion of the plant nutrients are returned to the soil. The soils of this area as well as those in the surrounding territory do not contain large quantities of plant nutrients as is the case with the prairie soils of the Corn Belt.

Farming systems that include relatively large acreages of such cash crops as canning peas, potatoes, or grains cannot be practiced over a period of years unless generous quantities of fertilizer are applied to the soil.

### POPULATION

Barron County was settled mainly during the decades immediately following the Civil War. The United States Census reported only 13 residents in 1860 and 538 in 1870, but by 1880 the number had increased to 7,024. Total population more than doubled during the next 10 years and continued to increase rapidly until 1920 when the census reported 34,281 inhabitants in the county. There has been little change in population since that time. It is important, however, to note that during the period from 1920 to 1930 urban population increased slightly whereas rural population decreased. It is apparent from these data on population growth, and from data concerning increase of land in farms which will be cited shortly, that much of the land has not been in cultivation for more than 30 or 40 years.

### IMPORTANCE OF FARMING AND CROPPING SYSTEMS

The relative importance of agriculture as compared with other occupations is indicated by the proportion of the total population classified as rural and urban. According to the 1930 census, 85 percent of the total population are rural residents. Rice Lake, with a population of 5,177 in 1930, was the only city in the county included in the urban classification of the census. There are several small towns in the county including Barron, the county seat, the residents of which might be classified as urban since many of them do not obtain a living directly from the farm. But there is very little industry other than that concerned with processing and marketing agricultural products. Most of the people not actually working on farms in this county either are retired or are employed in occupations dependent upon agriculture. It is apparent that agriculture dominates the productive activity of the people of this area.

Of a total land area of 566,400 acres in the county, 483,896 acres, or 85 percent, are included in farms according to the 1935 census. There were 4,639 farms in the county in 1935, the average size being 104.3 acres. This is somewhat smaller than the average size of farm for the State which was 117.4 acres in 1935. The proportion of the total land area in farms devoted to crop production, according to the 1930 census, was 43 percent compared to 47 percent for the entire State. This means that on the average there are 45 acres of crops on each farm. The remainder of the land in farms is used for pasture or is wasteland. About 20 percent of the farms in this county were operated by tenants in 1935. This percentage may seem low, yet it is about the same as the State average of 21 percent. There has been a significant growth in number of tenant-operated farms, however, for in 1920 the percentage was only 10.5. Most of the rented farms represent tracts that have been foreclosed by credit agencies.

A cropping system, consisting of small grain, hay, corn, and sometimes canning peas, potatoes, or other cash crops is usually followed. Approximately 40 percent of all the land in crops is devoted to hay production, about 35 percent to small grain, less than 20 percent to corn, and the remainder to minor crops. The cropping system de-

scribed above is not followed in an exact way. Small grains may be grown on the same field for 2 or more years in succession. The land may then be seeded to hay for the next 2 or 3 years after which it may be plowed and planted to corn or other cultivated crops for 1 or 2 years. The acreages of various crops grown on individual farms may be changed from year to year in response to various disturbing factors and in order to obtain sufficient feed for the livestock program.

### TYPES OF FARMING AND INCOME

Dairy farms with farmsteads similar to the one shown in figure 14 make up four-fifths of all farms in the county according to the United States Census in 1930. Other types of farms of minor importance are

FIGURE 14.—A TYPICAL FARMSTEAD IN BARRON COUNTY.

This winter scene reveals the adequate farm buildings with which this representative Barron County farm is equipped.

those classified as general farms and crop-specialty farms. This does not mean that dairying is the only enterprise on most farms in Barron County, as hogs, poultry and eggs, and cash crops are substantial minor sources of income. A better understanding of the type of farming followed may be obtained from data presented in table 11 indicating the percentage of income obtained from various sources in 1936.

Total gross income for the county amounted to more than 6 million dollars in 1936 (*5*). Over 5 million dollars came from the sale of livestock and livestock products while about 800 thousand dollars were from the sale of crops. Over 4½ million dollars of income resulted from the sale of milk and dairy cattle.

These data indicate that farmers in Barron County are mainly dependent upon dairying as a source of income. Apparently a high degree of specialization in dairying is most profitable, although some hogs, poultry, and cash crops like potatoes and canning peas are produced on many farms in the county. The existence of this prevailing type of farming in Barron County can be explained by the operation of

physical and economic factors characteristic of this area as was done in the case of Dodge County. Some reasons for the greater specialization in dairying may be pointed out.

TABLE 11.—*Percentage of gross farm income obtained from specified sources, Barron County, 1936*

| Income from— | Percentage of gross farm income | Income from— | Percentage of gross farm income |
|---|---|---|---|
| Livestock and livestock products: | *Percent* | Crops: | *Percent* |
| Milk | 64.4 | Potatoes | 6.2 |
| Cattle and calves | 11.6 | Canning peas | 1.6 |
| Hogs | 3.4 | Other | 5.1 |
| Poultry and eggs | 6.9 | | |
| Other | .8 | Total | 12.9 |
| Total | 87.1 | Total all sources | 100.0 |

Wisconsin Crop and Livestock Reporting Service (5, pp. 18–19).

This general area is relatively well adapted to dairying, but not well suited to hog or beef production. Soil and climatic conditions favor the growth of pasture, hay, and small grain. Corn for grain and other concentrated feed required for a system of farming that includes hogs and beef cattle cannot be grown advantageously. In fact, the soils of this county have been depleted to such an extent that more land may have to be devoted to production of soil-conserving crops, if the soil productivity is to be conserved.

It would be possible for farmers to devote more cropland to production of cash grains such as barley, corn, or wheat, but this would not be profitable. Only low yields of these crops can be obtained unless considerable quantities of fertilizer are used. On the other hand, relatively good yields of oats, hay, and silage corn can be obtained if these crops are grown as part of a livestock system of farming in which a considerable portion of the nutrients are returned to the soil. To maintain soil productivity in Barron County, even with this system, appropriate applications of lime, phosphorus, and potash, in addition to farm manure, will also be necessary.

Roughage crops such as hay, corn silage, and pasture have little value except for feeding livestock. Hog raising and beef-cattle fattening which might compete with dairying require larger quantities of concentrated feed, especially corn, than do dairy cattle. Dairy cattle make good use of large quantities of roughage feed such as silage and hay and provide a source of income from pasture land which is either too rough or too poorly drained for crop production. It is important to remember that over one-half of the land in farms is in permanent pasture. Some small grain is included in the cropping systems and provides most of the concentrated feed required by the dairy cattle. Usually it has been the practice to purchase considerable quantities of concentrate feed in order to obtain a more balanced ration and to devote a larger proportion of the cropland to production of roughage feed.

Only a small degree of diversification in production appears profitable on most farms in this county. This is accounted for by the fact that the available resources are relatively well adapted to dairying but not well suited to cash-grain, hogs, beef, or other lines of produc-

tion. Farmers produce some hogs, poultry, and eggs for home use. A substantial amount of income is also realized from the sale of poultry and eggs, but a large part of the feed required in this enterprise is purchased from outside the region. Income from the sale of cash crops, mostly potatoes, also is important, but much expansion in this line of production would not be profitable because large expenditures are now necessary for fertilizer and disease control. In some instances byproducts, like skim milk, may furnish the basis for a moderate expansion in hog or poultry production. But these opportunities are frequently limited as many farmers deliver whole milk rather than cream, and the skim milk is not available except at some expense or trouble.

### MARKETING FARM PRODUCTS

Facilities for marketing farm products are well developed in this area. A local creamery is shown in figure 15. About 65 percent of the milk marketed in the area is used for making butter, about 25

FIGURE 15.—A COOPERATIVE CREAMERY IN BARRON COUNTY.
This plant is representative of the many large cooperative creameries located in northern Wisconsin.

percent for cheese, about 5 percent for condensery products, and the remaining 5 percent for other uses (5). Most of the butter is manufactured in a large farmers' cooperative creamery located in the area, while cheese is manufactured in small factories scattered throughout the area. Many of the latter are owned by farmer organizations. As there are no large population centers in this area, only a small proportion of the farm products produced are withheld for local consumption.

### POSSIBILITIES OF ADJUSTMENT

A general understanding of the type of farming followed in this area and its physical and economic basis is provided by the preceding discussion. Most of this information is helpful in providing a background for further analysis, but some things concerning the supply position of dairying in this area and the general nature of the supply of dairy products can be pointed out to advantage.

As most farmers in this area are now devoting a large proportion of their resources to dairying, it might seem that little increase in production of milk would occur with an increase in price of milk. On the

other hand, it might at first seem that a relatively large reduction in milk production could occur with a decrease in the price of milk. Whether there is a large or small shift to the production of other farm products in place of milk with a reduction in milk prices depends upon the suitability of the available resources for the production of these other products. Similarly, any expansion in milk production with an increase in milk prices is dependent upon the profitableness of a shift in the use to which resources are devoted, but this is dependent upon the suitability of resources to dairying as compared to other lines of production.

This general consideration of the type of farming followed in Barron County and the nature of the resources available for production indicate that the milk supply from this area may be relatively inelastic. The alternative enterprises in which production might either be expanded or contracted with profit in event of changes in the price received for milk are limited. Still, some products other than milk, such as hogs, poultry, and cash crops, are being produced in the area at present and some shifting in the use to which resources are put may be profitable with changes in price relationships of these products. Price changes also may be expected to influence the intensity of operations in the various enterprises. To determine more precisely how elastic milk supply is in this area, it is necessary to study individual farms with respect to the adjustments that will be profitable and that are likely to be made with various prices for milk, as was done in the case of Dodge County. Before doing this the changes which have taken place in the agriculture of the area over a period of years in the recent past will be studied.

## PAST TRENDS IN PRODUCTION IN BARRON COUNTY[8]

### General Considerations

There has been no apparent long-time trend in milk production in Barron County since 1925. Figure 16 shows the changes in production for the period from 1925 to 1938. It appears that the real changes which have taken place in the agricultural economy and the production capacity of the area have been masked by a number of poor crop years toward the end of the period. There was a continuous upward trend in milk production from 1925 to 1931, but this was interrupted in 1932 when production declined with poor pasture conditions and low crop yields caused by dry weather. Milk production continued to decline in 1933 and 1934 with continued drought. Production increased continuously from 1935 to 1938 with improvement in crop yields resulting from more favorable weather conditions. The total quantity of milk produced in the county at the end of the period was somewhat greater than at the beginning, and an even more substantial increase in production no doubt would have occurred had it not been for the adverse weather conditions.

Before turning to a more detailed consideration of changes in the resources of the area and their utilization, it is desirable to consider briefly other developments that may cause a shift in production, such as those concerned with prices received by farmers for products sold or prices paid for important essentials used in production.

[8] Most of the information presented in this section is from the following study: CHRISTENSEN, RAYMOND P. FORCES CAUSING DAIRY FARMERS TO MAKE CHANGES IN THEIR FARM ORGANIZATIONS IN BARRON COUNTY, WISCONSIN. U. S. Bur. Agr. Econ. in cooperation with Wis. Agr. Expt. Sta. 70 pp. 1939. [Mimeographed.]

Figure 6, referred to in the discussion of Dodge County, shows prices received by Wisconsin farmers for important products from 1925 to 1937. Although farm prices have fluctuated throughout the period, there has been no general change in price relationships which might have caused a shift in production to be desirable. Prices of all farm products declined from the beginning of the period to 1932 but had recovered somewhat by 1937. As prices of these farm products followed the same general course throughout the period, it is apparent that no significant changes in price relationship have

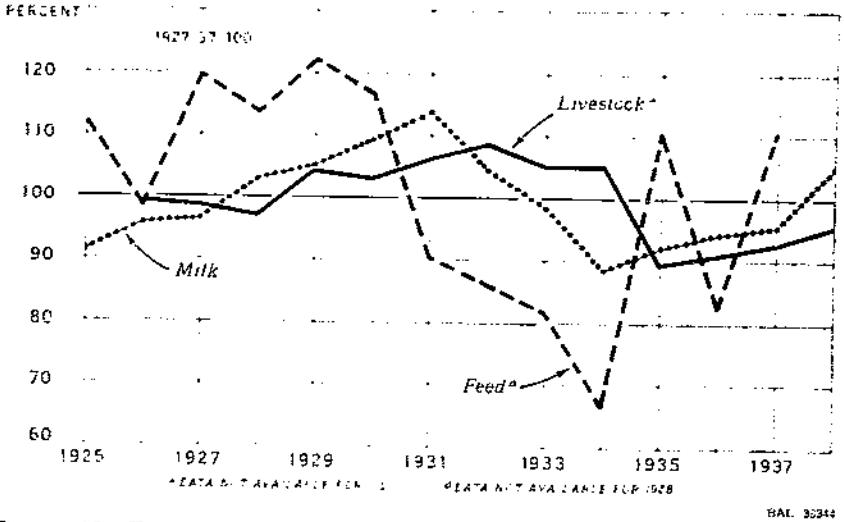


FIGURE 16.—TOTAL LIVESTOCK UNITS, MILK PRODUCTION, AND FEED PRODUCTION, BARRON COUNTY, 1925-38 (1927-37=100).

Both total livestock units and milk production show an upward trend until after 1931. Feed production declined earlier and more than livestock. Milk production has not yet fully recovered but is higher than at the beginning of the period.

occurred. Consequently, shifts in production cannot be explained by price changes.

No data on changes in the quantity of feed purchased by farmers from outside the area have been obtained, but it is well known that substantial quantities of feed were shipped into areas like this during the years of severe drought. This is important in explaining why milk production, as well as production of other farm products, did not decline more during the years of poor crop production. An examination of changes in the prices of concentrated feed, which is the most important kind purchased by farmers, shows that although feed prices in the latter years were less favorable there has been no marked change in the milk-feed-price ratio which might have caused either an expansion or contraction in milk production to be profitable. Figure 7, referred to in the study of Dodge County, indicates that Wisconsin feed prices have followed the same general course as have milk prices.

The most significant factors influencing production of various farm products in this area have been those concerned with changes in the farm resources causing it to be advantageous to expand the dairy

enterprise and to contract production in other lines. A complete understanding of the nature of these changes requires careful examination of crop- and livestock-production data, indicating trends in progress together with reasons explaining why these shifts in production are being made. It is logical to begin with a consideration of changes in the number and size of farms.

Census data indicating the number of farms, average size of farms and total acreage of land in farms are shown in table 12.

No very important trends in number or size of farms have occurred since 1900 although it is significant that the average size of farm has increased continuously since 1925. Moreover, it appears that the change would have been more marked had the 1925 and 1935 censuses been taken on a comparable basis. An examination of the changes which have occurred in the number of farms included within the various size groups discloses an important increase in the number of small farms. It is probable that these small farms existed in 1925 but were not included by the census. As a result of the inclusion of more small farms not counted in 1925 and 1930, a part of the actual increase in the average size of farms probably is not represented in the census data.

TABLE 12.—*Number and average size of farms, total land in farms, cropland harvested, and land available for crops, Barron County, 1900–35*

| Year | Farms | Average size of farms | Land in farms | Cropland harvested | Land available for crops [1] |
|---|---|---|---|---|---|
| | *Number* | *Acres* | *Acres* | *Acres* | *Acres* |
| 1900 | 3,001 | 106.7 | 320,659 | (2) | (2) |
| 1910 | 7,852 | 100.8 | 411,321 | (2) | (2) |
| 1920 | 4,576 | 99.6 | 419,305 | (2) | (2) |
| 1925 | 4,152 | 97.8 | 435,410 | 175,291 | 201,847 |
| 1930 | 4,480 | 102.3 | 458,124 | 194,199 | 219,216 |
| 1935 | 4,639 | 104.3 | 483,886 | 190,030 | 241,216 |

[1] Includes harvested, failure, idle, fallow, and plowable pasture.
[2] Data not available.
United States Census.

Census data cited in table 12 indicate that there has been an important expansion in the acreage of land available for crops. From 1925 to 1935 the total acreage increased almost 20 percent. In 1925 the average acreage of land available for crops per farm was 45, but it increased to 49 acres in 1930 and to 52 acres in 1935. Census data show that there has been an increase in number of farms during this period, but it is apparent from the above figures that most of the increase in cropland has resulted from bringing more land on the same farms under cultivation. Data from the Wisconsin Crop and Livestock Reporting Service indicates that the total acreage of important crops harvested increased about 15 percent from 1925–27 to 1935–37.

It is apparent that the expansion in cropland has resulted in an increase in feed-production capacity of farms in this county. However, a more precise estimate of the quantity of feed actually produced or the potential feed-production capacity requires a consideration of changes in acreages and yields of various crops grown. Data furnished by the Wisconsin Crop and Livestock Reporting Service may be used for this purpose.

Changes in the acreages of various crops grown from 1925 to 1938 are shown in figures 17 and 18. Some violent changes in acreages occurred during the drought years of 1934 and 1935, but if acreages of various crops grown for the 2 years 1925 and 1926 are compared with those grown in 1936 and 1937, some trends of a rather permanent character may be observed.

Only minor changes in the proportions of all cropland devoted to important classes of crops occurred from the 1925–26 period to that of 1936–37. The percentage of all cropland in corn increased from 15.5 to 16.5 while that of small grain was reduced from 35.2 to 34.4. Tame hay constituted 41.6 percent of all cropland in the 1925–26

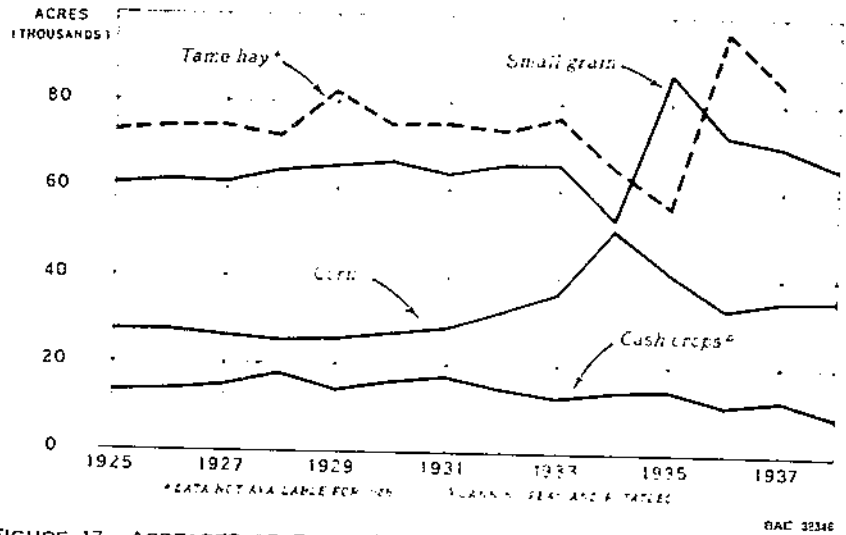


FIGURE 17.—ACREAGES OF CROPS HARVESTED, BY MAJOR CLASSES, BARRON COUNTY, 1925–38.

Acreages fluctuated considerably in the latter part of this period because of weather conditions. Tame hay, small grain, and corn show net gains for the period. Cash crops show a net decrease.

period but increased to 43.4 percent in 1936–37. On the other hand, cash crops which include canning peas and potatoes declined in importance, the proportion of all cropland devoted to these crops in the 1925–26 period being 7.7 percent, while in 1936–37 it was only 5.7 percent. Since the total acreage of land in crops has increased almost 15 percent, it is apparent that important increases in the acreages of some crops, especially corn and hay, have taken place.

More significant shifts in crop production are revealed when changes in the acreages of specific crops are considered. Within the classification of small grain, oats, and rye have become relatively more important, while barley is less important. The acreage devoted to alfalfa has increased markedly, especially in recent years, while the acreage in clover and timothy has declined. Perhaps most important from the standpoint of influence on farmers' income is the reduction in the acreage devoted to the cash crops, mainly potatoes.

Shifts in the proportion of cropland devoted to various crops as well as increases in the total acreage of land in crops such as those noted for this county have important effects on the kind and total

quantity of feed available. Production of more hay and corn, which is used for silage or fodder, in place of grain and cash crops means that a larger proportion of the feed produced is roughage. A shift to production of higher yielding crops such as alfalfa in place of clover and timothy will result in an increase in the total quantity of feed produced. On the other hand, a shift to production of more low feed-nutrient-producing crops, such as oats and rye in place of barley will result in a reduction in the total quantity of feed available. Obviously, an expansion in the total crop acreage of 15 percent such as occurred in this county will probably result in a marked increase in the total quantity of feed produced.

The influence of the expansion in total cropland and the changes in the acreages devoted to various crops grown, on the quantity of feed produced in this county, is partially indicated by an index showing the actual changes in feed production. As in the case of

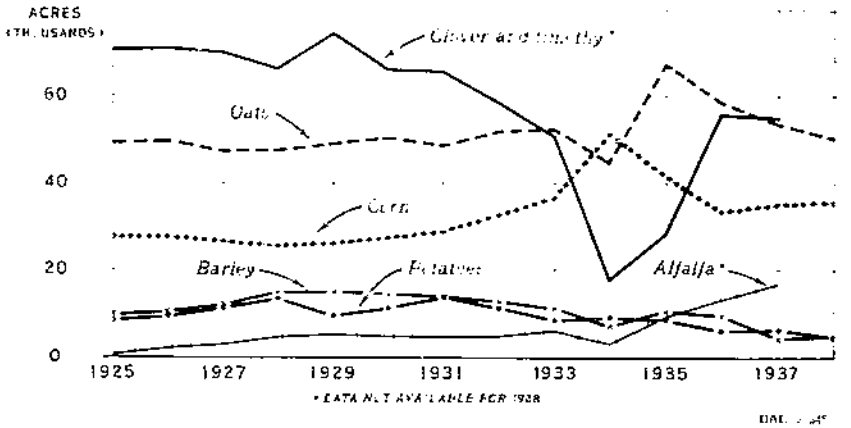


FIGURE 18. ACREAGES OF PRINCIPAL CROPS HARVESTED, BARRON COUNTY, 1925-38.

Corn, oats, and alfalfa gained in acreage. Clover and timothy hay and barley decreased.

Dodge County, this index shows the actual changes in the total quantity of digestible nutrients produced on farms in the county from year to year since 1925. In computing the index, digestible-nutrient rates were applied to the production of each of the important crops produced during the year. The resulting index of feed production is shown in figure 16.

As there has been a rather continuous increase in the total acreage of land in crops, a similar trend in the quantity of feed produced might be expected, but this is not the case. Some increase in feed production occurred for 4 years after the 1925-26 period, but beginning in 1930, the quantity of feed produced declined continuously until 1934. Feed production was relatively good in 1935 and 1937 but poor in 1936.

The failure of feed production to increase with the expansion of acreage in crops appears to be due in large part to adverse weather conditions causing poor crop yields and crop failures. Total annual rainfall varied from 10 percent to 30 percent below normal for the years from 1931 through 1934. It was above normal for 1935, but

declined to about 30 percent below normal in 1936.[9] Rainfall was especially low during the growing season for these years of poor crop production. The series of years of continuous drought had cumulative effect causing feed production to decline steadily from 1930 to 1934. With the return of normal weather conditions in 1935 and 1937 feed production did not increase to as high a level as would probably be expected, because a number of years are required for farmers to reestablish their normal crop programs. It also should be emphasized that continuous cropping has reduced the available plant food and lime from that present in the soil in the virgin state. Yields equal to those of a decade or so ago are not likely to be obtained unless appropriate quantities of lime and fertilizer are applied.

This study of the changes in total acreage in crops and the relative proportions of the various crops appears to warrant the conclusion that

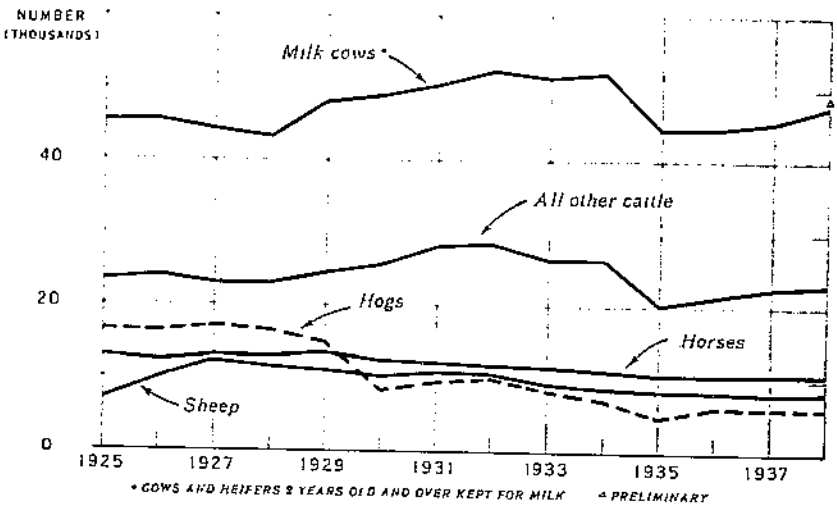


FIGURE 19.—NUMBERS OF LIVESTOCK IN BARRON COUNTY, 1925-38.

Milk cows include cows and heifers 2 years old and over kept for milk. Milk cows and other cattle show a distinct upward trend until the drought-affected years. Horses, sheep, and hogs have a definite downward trend through the entire period.

a substantial increase in normal feed-production capacity of the county occurred during the period 1925-36. As the total crop acreage increased about 15 percent during this period and the proportion of crops with higher nutrient yields per acre also increased, normal feed production must have increased more than 15 percent. This has been tested by applying 20-year normal yields to the acreages of crops that prevailed during the 1925-26 period and the 1935-37 period. In terms of total digestible nutrients this method of estimation shows that feed-production capacity in the county increased about 20 percent during the period.

Accompanying these changes in normal crop production have been some important changes in livestock numbers as is illustrated in figure 19. Here again, trends under way at the beginning of the period were interrupted and then resumed toward the end of the period. Most

[9] As measured by precipitation at the Amery, Wisconsin, station of the United States Weather Bureau.

significant is the upward trend in number of milk cows until 1932, the decline which occurred during the 1933-35 period, and the upward trend that has taken place since then. The number of other cattle has followed a somewhat similar course. Although other kinds of livestock and poultry have not contributed a very large part of farmers' gross income in the past, it is important to note that changes in numbers have taken the form of a continuous decline. Hog numbers decreased over 60 percent from the 1925-26 period to that of 1936-37. The decline in sheep numbers has been less pronounced. Poultry numbers have decreased more than 10 percent. There has been a rather constant decline in horse numbers amounting to about 15 percent.

The combined effects of changes in these various classes of livestock are shown by the changes in total number of livestock units presented in figure 16 together with the changes in feed production. As would be expected, changes in livestock units have lagged behind changes in feed production.

The increase in number of milk cows at the beginning of the period was made possible by an increase in feed production but with poor crop yields and crop failures over several years the number declined. As crop production improved toward the end of the period, cow numbers increased again and in recent years have been above the 1925-26 level. The reduction in numbers of horses, sheep, and hogs does not appear to be a drought phenomena, for the decline was in progress at the beginning of the period and has continued to the present time. Apparently farmers have found it advisable to specialize more in dairying. Either changes in the nature of the resources available, or the realization of the opportunity for improving returns, by devoting more land to hay and roughage for dairy cattle, are probably responsible for the increased emphasis on dairying. A more complete explanation of why the trends in agriculture have occurred is provided by the study of individual farms which follows.

## Individual Farm Trends

Continuous records of the quantity of milk sold on 41 farms for each year from 1926 to 1937 were obtained in this county to determine how milk production on individual farms fluctuates from year to year and what changes take place over a period of years. Milk production on these 41 farms has been totaled and relatives indicating percentage changes in production from year to year for the entire group computed. This measure of milk production for 41 farms and the prices paid by a representative creamery in the county are shown in figure 20.

Changes in milk production indicated for this group of farms are very similar to those noted for all farms in the county. Production increased continuously from 1926 to 1930 but then declined until 1934. There has been a rather steady increase in production for the years since 1934. Although there was no continuous trend in production for the entire period, it is significant that milk production on these farms averaged about 11 percent higher for the 2 years, 1936 and 1937, at the end of the period than it did for the 2 years, 1926 and 1927, at the beginning. It appears probable that the increase in production noted for the period 1926–30 would have continued had crop production not been reduced by abnormal weather conditions. With the return of better weather in recent years, crop yields have improved and milk

production has increased, but several years of normal production conditions are required before full recovery can be realized.

The way in which production fluctuated on individual farms is shown in table 13. The quantity of milk produced on all 41 farms, together with an enumeration of the number that either increased or decreased production from the preceding year is shown. All farms do not change production in the same direction each year and the net change in total production is the result of both increases and decreases on individual farms. Apparently the factors determining the quantity of milk produced on a farm in any one year do not influence all farms in the same manner.

More uniformity in direction of change in production is noted when production on these farms in 1926–27 is compared with that of 1936–37.

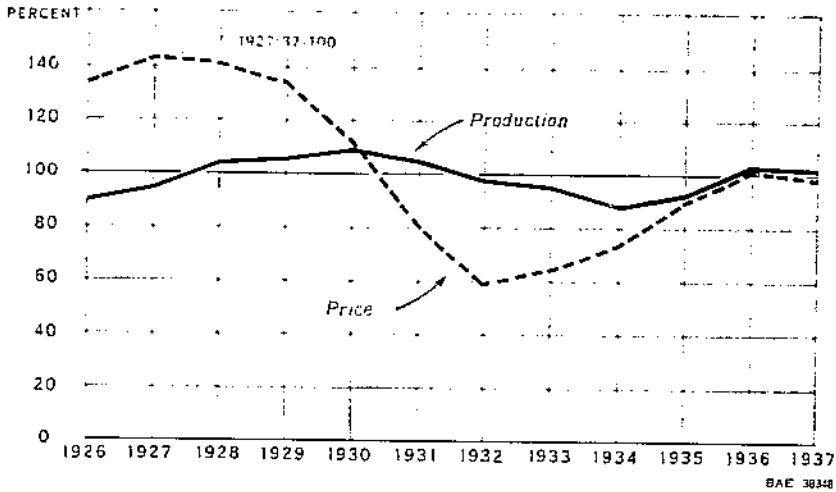


FIGURE 20.—BUTTERFAT PRODUCTION FOR 41 SELECTED FARMS AND PRICES PAID BY A REPRESENTATIVE CREAMERY IN BARRON COUNTY, 1926–37 (1927–37=100).

Production changes on these 41 farms are similar to those for the entire county. Production was higher at the close of the period than at the beginning.

The 11-percent increase in production noted for the 41 farms was the net result of increases on 26 farms and decreases on 15 farms.

To determine more precisely the forces causing farmers in this county to make changes, the farm-organization and production programs existing on 21 farms for which detailed cost records were available for the years 1927 and 1928 were compared with those on the same farms in 1937 and 1938 and farmers were asked to explain why the changes noted were made.[10] Records of milk production were obtained for these 21 farms and the operators were asked to give reasons for annual fluctuations and trends. These reasons given by the farmers, together with study of the economy of making the organizational changes, provide an explanation for the changes in production that have occurred.

[10] The results of this study have been presented in detail in a report by R. P. CHRISTENSEN. See footnote 8.

TABLE 13.—*Milk production on 41 selected farms and number of farms showing increases or decreases in milk production from preceding year, Barron County, 1926–37*

| Year | Milk production (1927–37=100) | Farms | | Year | Milk production (1927–37=100) | Farms | |
|---|---|---|---|---|---|---|---|
| | | Increasing | Decreasing | | | Increasing | Decreasing |
| | | *Number* | *Number* | | | *Number* | *Number* |
| 1926 | 90.0 | | | 1932 | 97.4 | 10 | 31 |
| 1927 | 91.8 | 21 | 17 | 1933 | 95.6 | 18 | 23 |
| 1928 | 101.4 | 25 | 16 | 1934 | 88.6 | 13 | 28 |
| 1929 | 105.8 | 20 | 21 | 1935 | 92.4 | 27 | 14 |
| 1930 | 109.2 | 21 | 20 | 1936 | 103.5 | 34 | 7 |
| 1931 | 105.7 | 18 | 23 | 1937 | 102.7 | 22 | 19 |

Shifts in production noted for these 21 farms seem typical of those described for the entire county. To a considerable extent, the reasons for change obtained from the study of these case farms may be applied in explaining the changes in the agriculture of the entire county.

The total acreage in crops on these 21 farms was increased about 12 percent both as a result of some increase in the average size of farm and as a result of bringing more land under cultivation. Most important of the changes in the acreages devoted to the various classes of crops has been a reduction in the proportion of land devoted to small-grain and cash crops, canning peas and potatoes, and an increase in the proportion of all cropland in hay. The proportion of all cropland devoted to corn remained practically constant at 22 percent, but the total corn acreage increased 12 percent as did the total acreage in all crops. The most significant changes in the case of specific crops was the increase in alfalfa acreage and the reduction in the acreages of barley and potatoes.

These farmers increased their total acreage of alfalfa gradually as they were able to lime the soil and get seedings established. Production of potatoes was reduced as it became more difficult to obtain good yields of high-quality potatoes owing to plant diseases and perhaps to some soil depletion. On the whole, conditions were such that it became advisable to shift to the production of more hay, pasture, and corn in place of barley and potatoes. After the crop pattern became so adjusted, the feed-supply structure was more suitable for cows than for hogs or other classes of livestock.

The total number of milk cows on this group of farms increased about 8 percent while the number of hogs and poultry was reduced. Because of the increased use of mechanized power, the number of horses kept also was reduced. The changes that occurred in livestock numbers released available feed supplies for use in dairy production. With natural and economic conditions such that roughage feed can be grown to a greater advantage than can the more concentrated feed, a shift is encouraged to a type of livestock that can best utilize the increased supply of roughage feed.

These changes in crop production and in livestock numbers are changes resulting from the operation of factors that have a long-time influence on production. The introduction of the tractor in place of horses and the use of other machinery and equipment are illustrative of changes in the technique of production. The increased use of alfalfa may have an important influence on long-time trends in production of agricultural products. The apparent decline in soil fertility related

to the long period of cropping seems to have made it desirable to devote more land to the production of soil-conserving crops. These general trends in production and the factors responsible for them are of consequence in ascertaining the competitive position of an area in the production of a product since they are indicative of shifts in the supply position of the area in dairy production.

### Shift in the Supply Position of This Area

Examination of milk-production data for this county reveals that there has been little change in the total quantity produced from the 1925-26 period to that of 1936-37 although data from individual farms indicate some increase in production. But, it is probably conservative to estimate that an increase of 20 percent would have occurred during these years had normal crop-production conditions prevailed. This is apparent since the total acreage in crops has increased about 15 percent and with the reduction in the acreage of cash crops a larger proportion of the cropland is used for feed production. Shifts to production of more alfalfa hay and corn for silage in place of small grain and cash crops would normally have resulted in more feed being available. The estimate of the probable increase in normal feed-production capacity places the increase at 20 percent for the period. The reduction in numbers of hogs, sheep, poultry, and horses allowed a larger proportion of the feed produced to be used for dairy production. Even after allowing for some possible decrease in normal crop yields because of a decline in soil fertility, it would seem safe to estimate that the normal milk-production level has increased 20 percent.

The expansion in the dairy-production capacity of farms in this county has resulted from the availability of the necessary resources and their adaptability to dairying. Farmers have found it desirable to increase the size of their farm operations as it has become possible with the passage of time. Additional resources that became available for use in production were in the form of land, unused physical plant, and unemployed labor. These factors contributed most to income when devoted to production of roughage feeds to be used in dairying. Adjustments in production, to a large extent, have been made in response to farmers' decisions of what is profitable.

A shift in the position of the supply curve of milk is suggested by the above discussion. More milk would now be produced with normal production conditions, than was the case 10 years ago. Since there have been no permanent changes in price relationships of farm products which might cause a change in production to be desirable, it is evident that the increased production of milk does not come from a change in position on the same supply schedule. Production of dairy products, or the capacity for production, has expanded as a result of factors influencing supply.

As a result of the changes in the agriculture of this county which have been observed, farmers are more dependent upon dairying as a source of income now than formerly, but the shift in production probably has been profitable. This appears to be true since the resources of the area are primarily suited to dairying and not so well adapted to other lines of production. The lack of any close alternatives suggests that dairy production is not likely to be diminished much by lower milk prices. Similarly, as most of the available resources already are

being employed in dairying no large increase in production of dairy products would be caused by more favorable milk prices.

More precise measurement of the elasticity of the supply of milk from this area requires detailed study of individual farm units in order to determine what shifts in production are desirable for farmers to make with either more or less favorable milk prices. Information obtained concerning supply on individual farms then needs to be combined in order to determine how production in the area is likely to be affected by either higher or lower prices for milk. This is the purpose of the following section on prospective trends in production.

## PROSPECTIVE TRENDS IN PRODUCTION IN BARRON COUNTY

As in the analysis of the Dodge County situation, the problem of prospective trends in Barron County is approached by considering two main types of forces that may affect production during the ensuing decade. These are the influences not directly related to prices and those that are connected with prices. The former includes all those technological changes affecting production that tend to operate persistently in one direction even though prices remain the same. To some extent these trends may be related to adjustments to price changes that occurred much earlier than the period we have examined and which farmers may have been slow to recognize.

The influences in the latter group, more directly related to prices, act through the shifting of resources between enterprises, by changing the intensity of operations and by modifying the rate at which the technological changes are proceeding.

### Trends Under Way Not Directly Related to Changing Price Relationships

First to be considered are those trends that seem to act persistently over a period of at least 10 years even though prices remain the same. As we have seen, most of the important trends over the preceding decade in this area seem to be of this kind as price relationships do not seem to have changed sufficiently to account for much change in production. The main trends observed were an increase of 15 percent in the crop acreage of the county, a change in the cropping system with more emphasis on alfalfa and silage corn and less on small grains and cash crops, and some reduction in numbers of hogs, sheep, poultry, and horses. The normal feed-producing capacity of the county has apparently increased about 20 percent despite some decline in soil productivity. Adverse weather conditions have prevented this from being realized in terms of actual production.

How many of these trends can be expected to persist in the coming 10-year period? Are others likely to appear? The increase in land under cultivation in Barron County may have occurred partly in response to the need for more feed under drought conditions. There are reasons for not expecting much further expansion along this line although these need to be checked against individual farm situations. With the increased emphasis on agricultural conservation and the advantage in alfalfa production over lower yielding hays, we would expect a continuation of the trend toward more alfalfa. Perhaps some slight further reduction in horses, sheep, and hogs may occur.

Most important of all, with normal weather conditions we may expect that the potential feed-producing capacity resulting from the changes of the preceding decade will show up in greatly increased feed supplies.

Just as in the prospect for Dodge County, the most significant of the trend elements turns around the problem of estimating the probable utilization of increased quantities of roughage feed. Even more than in Dodge County, it seems probable that most of this increase in feed will be fed to dairy cattle. As a smaller proportion of the total feed supply consists of grain, there is less flexibility as between roughage and grain-consuming livestock than in Dodge County.

Nearly all the discussion of the problem of estimating the effects of increased feeding as given in the analysis of Dodge County is applicable here, and it will not be necessary to repeat what has been said earlier. The same general rule of estimating that a given percentage increase in total digestible nutrients will result in the same percentage increase in milk production per cow has been followed within limits. As before, this means that the estimated effects of additional feed on milk production are the same whether fed to the same cows or to additional cows.

### Effects of Prices on Production Trends

A general consideration of the agriculture in Barron County and of the factors influencing the prevailing type of farming in a broad way indicates that relatively large changes in price relationships of farm products will be required to bring about much change in milk production. The high degree of specialization in dairying and the minor importance of the possible alternative enterprises suggest that resources would be shifted slowly over a 10-year period. The record of the preceding decade throws little light on the problem, simply because no significant changes in price relationships of a persistent character occurred.

There is also the very real possibility that higher or lower prices for milk relative to other products may change the rate at which various trends are proceeding. Higher dairy prices may stimulate the adoption of alfalfa or other higher yielding feed crops. Lower dairy prices may retard such changes.

These effects may come about in various ways. Availability of credit may be associated with favorable dairy prices. The family labor supply over a 10-year period may change in response to farm prices and incomes. If farm income is favorable, a son may continue as an active partner; if they are lower he may not stay on the farm. It should also be noted that in addition to changes in farm prices, the general industrial situation and the possibility of alternative opportunities for urban employment have an important influence on the available family labor supply. For example, the total farm-labor supply in the country has increased during the recent depression because large numbers of farm boys, who in periods of industrial activity would have moved to the city, have remained in the country.

It is now necessary to study the organization and production programs of a number of farms in greater detail. Individual farms are the smallest production units responsible for the supply of a product, and it is only by determining how production on individual farms is influenced by price changes that a supply curve for a number of farms or for an entire area may be obtained. In other words, something in

the nature of a supply schedule of milk for each of a number of individual farms is needed first and then these must be combined in such a manner as to represent a supply schedule for the entire area.

Determination of the quantities of milk that will be produced on individual farms with various prices requires detailed study of what changes are profitable with these prices. Only by considering in detail the economy of production for individual farm organizations is it possible to estimate the adjustments that can be made and those it is desirable for farmers to make. If it can be determined that there are changes in production or adjustments in farm organization which have become economically advantageous due to change in price relationships of farm products, production may be expected to be affected. Having determined in an objective manner what changes in production have become more profitable as a result of the price change (in this case, in the price of milk), it is then necessary to consider the various subjective elements which might influence farmers' decisions in order to determine what production program is most likely to be followed. It is apparent that to a large extent the adjustments which farmers will make in their farm organizations must be determined by what is profitable for them to do.

The analytical procedure followed in making the individual farm analyses is essentially the same as that followed for the Dodge County area. Several possible alternative production plans are computed for each farm in each of three price situations. Based on a detailed consideration of the returns from making various adjustments and what is known concerning the inclinations of the farm operator, the farm plan most likely to be put into operation is estimated. The various price or production situations considered are the same as those treated for Dodge County.

All three situations refer to a time about 10 years in the future, long enough for production to become fairly well-adjusted to the change in price. No changes in the present prices received for farm products are contemplated in the first production situation which is termed A. Only those changes in production brought about by influences not directly related to price are considered here. An increase of 20 percent in the price received for milk is introduced in what is termed the B situation, but all other prices are the same as at present. The difference between production in the A and B plans is that expected in response to the increase in price received for milk. In the third situation, termed C, the influence which a 20-percent decrease in the price received for milk, prices of other farm products remaining the same, is considered. The difference in production between the A and C plans is that expected in response to the decrease in the price received for milk. Estimates of milk production for three production situations that differ only in the price received for milk are thus obtained for all the farms studied in detail. These estimates of milk production form abbreviated supply schedules of milk for the individual farms.

Much information concerning operations on each of the individual farms is needed as a basis for making these analyses. The data collected for farms in this area are similar to those collected for the Dodge County farms. In the summer of 1936 complete farm-management records were obtained for 50 farms located in 1 township of Barron County. These records include a farm-business record for

the period May 1, 1935, to April 30, 1936, and covering the crop year of 1935, besides other important information concerning usual crop and livestock practices, conservation practices, and past production changes. An additional schedule of information for 24 of the 50 farms selected for detailed study was obtained in the fall of 1937. Information concerning crop and livestock production in 1936 and 1937, the amount of family labor available, farm indebtedness, tenure status of the operator, and other factors are included in this schedule. Records of the quantity of milk produced on these farms in the past were obtained in those cases in which they were available. All this information is used as a basis for making the individual farm analyses.

The 24 farms chosen for detailed study were selected in a manner similar to that followed in Dodge County.[11] Each of the 24 farms studied is representative of a different situation with respect to important factors which are considered to influence production. All the important production situations that are characteristic of the farms in this county should be included in this number. If the individual farm analyses are accurately made, the production responses which can be expected under various important production conditions should be available. It is then necessary to determine how important each of these farms which represent different production situations are in the area in order to know how much weight or significance needs to be attached to the results obtained from each of the individual farm analyses. Having done this, the estimated productions may be combined into a supply schedule which is representative of all farms in the area.

As the procedure followed in making the individual farm analyses in this area is similar to that followed in the case of Dodge County, it is not necessary that a detailed description of method be given here. The procedure followed in extending the results obtained from these individual analyses to all the farms for which farm-management records were obtained as well as to all other farms in the county also is similar to that followed for Dodge County. Therefore attention will be shifted directly to a presentation of results.

## Results of the Individual Farm Budgets

Information concerning the elasticity of milk supply on farms in this area and the influence which changes in prices received for milk are likely to have on farmers' income and the type of agriculture practiced is provided by the individual farm analyses. It is important to remember that these results apply to relatively long periods of time. The adjustments in farm organization and production are those which it is expected that farmers will make if the price relationships assumed remain prevalent over a relatively long period of time. It does not necessarily assume that seasonal or cyclical price fluctuations are nonexistent but only that prices fluctuate around certain levels.

Most important, from the standpoint of comparing this area with other areas with respect to the response of milk production to price changes, is the information obtained concerning elasticity of supply. Production estimates for the 24 selected farms have been computed and these have been combined in order to determine how the entire group of farms may be expected to respond. Estimates of milk

[11] A cross-classification table showing how the 24 farms chosen for detailed study were selected is included in table 32 (p. 89).

production have been obtained for the three price situations. Although it would be desirable to know the location of other points on the supply schedule, the three points located indicate the essential nature of the supply curve.

Milk-production estimates for the 24 farms have been added and the totals are expressed as percentages of the normal production as shown in the following tabulation:

| Price situation: | *Milk production for sale* |
|---|---|
| 1936 actual | 91.1 |
| 1936 normal | 100.0 |
| A | 108.6 |
| B | 118.2 |
| C | 100.8 |

Actual milk production for the record year of 1936 was much lower than it would have been had normal crop-production conditions existed. This is evident from information contained in the individual farm records. Milk production on individual farms has been normalized at that quantity which would have been produced if production conditions normal for the farm had existed. The result is that total normal production for the 24 farms is substantially higher than the actual 1936 production.

These results indicate that milk production on these farms can be expected to increase more than 8 percent from the present normal level during the next 10 years although no change in price relationships of farm products occurs. If milk prices increase 20 percent, as is contemplated under B conditions, milk production will probably increase as much as 18 percent. No decline in quantity of milk produced is expected although milk prices are reduced 20 percent. In fact, a small increase in production is indicated.

These estimates of change in quantity of milk produced include those changes expected to occur with the passage of time and in response to factors other than price. The way in which milk production varies with price may be more clearly shown if the quantities of milk produced in B and C are expressed as a percentage of A. The following percentage figures are obtained when this is done: A, 100.0; B, 108.9; C, 92.8. A slightly greater percentage change in production can be expected from a 20-percent increase in price received for milk than from a 20-percent decrease.

A major consideration in determining what shifts in production will be made with the passage of time and in response to changes in prices received for farm products is the profitableness of making various changes. Other factors such as the operator's desire for more income versus his desire for leisure time, the ability of the operator to make desirable adjustments in his production plans, and other individual considerations limit the extent to which profitableness is a determining factor. Still, the profit motive seems to be dominant and certainly is essential to economic action. It is important to point out that the changes in production plans indicated for the 24 farms are profitable.

Net cash income realized with the operation of the A plans is approximately 12 percent above the normal amount for 1936. It is over 50 percent above the normal amount for 1936 with the operation of B plans and with the 20-percent increase in price of milk. A reduction in net cash income from the normal 1936 total approaching 25 percent can be expected with the operation of the C plans and the

20-percent reduction in the price of milk. It should be apparent that the large changes in net cash income in the B and C situations are caused mainly by changes in the price of milk.

The increase of 12 percent in net cash income above the present normal amount which will be realized with the operation of the A plans indicates that the expected adjustments in production are profitable. The advantages of making the additional changes in farm organization expected in the B and C situations may be demonstrated by comparing the net cash income which will be realized in each of these situations with that which would be realized if no changes were made or if the A plans were followed. If the A-farm plans are extended in the B situation (with the 20-percent increase in milk prices), net cash income will be increased 34 percent over A. However, with the operation of the B farm plans in the B situation, net cash income will be increased *more* than 36 percent over A. If the A farm plans are extended in the C situation (with the 20-percent decrease in milk prices), net cash income will be 34 percent less than A but with the operation of the C plans, it will be reduced only 32 percent.

It may appear from these figures that the economic advantages favoring the adoption of the B and C production plans are too small to be significant. It is essential to remember, however, that although profitableness is an important consideration in the case of all farms, it is not necessarily the determining factor for all farms. The ease and convenience of putting a plan into operation may be cause for its adoption although it may not be the most profitable which might be devised. In view of this fact, the margin of advantage favoring the B and C plans appears significant. A considerable increase in net cash income is indicated for the projected A, B, and C plans from the present normal amounts.

Some general differences between the farm plans which are expected in each of these price situations may be observed by referring to table 14. The relative importance of the dairy enterprise in the various production situations is illustrated by data showing the average number of milk cows and milk production per farm and the amount of income obtained from various sources. Some increase in milk-cow numbers is expected during the next 10 years, although no change in price relationships of farm products occurs. This expansion in the size of the dairy enterprise is made possible by an increase in the quantity of feed produced. Little change in production of other farm products is probable. Total cash income as well as net cash income is expected to be increased as a result of the additional production.

An additional increase in the number of milk cows and milk production per farm can be expected if milk prices increase 20 percent. But only a small part of this increase will result from a shifting of resources from other enterprises to dairying. Cultivation of more land and purchase of more feed will make possible most of the increase in milk production.

Little change in the number of milk cows and the quantity of milk produced on these farms is probable if milk prices are reduced 20 percent. A small increase in the average size of the dairy enterprise is indicated. Production of other farm products will tend to increase slightly above the present normal quantities. Approximately the same area of land will be cultivated as at present and little change in intensity of use of resources is probable.

TABLE 14.—*Averages of individual estimates of important factors at different prices, 24 selected farms, Barron County*

| Factor | Data for price situation indicated | | | | |
|---|---|---|---|---|---|
| | 1936, actual | 1936, normal | A | B | C |
| Milk cows.....number | 14.2 | 15.4 | 16.8 | 17.5 | 15.7 |
| Milk production (sold).....pound | 86,649 | 95,147 | 103,317 | 112,503 | 95,926 |
| Milk sales.....dollar | 1,203 | 1,326 | 1,447 | 1,896 | 1,076 |
| Other income.....do | 455 | 527 | 563 | 522 | 579 |
| Total cash receipts.....do | 1,658 | 1,853 | 2,015 | 2,418 | 1,655 |
| Total cash expenses.....do | 991 | 1,094 | 1,158 | 1,257 | 1,074 |
| Net cash income.....do | 667 | 759 | 852 | 1,161 | 581 |

## NORMALIZING ADJUSTMENTS

One of the first steps in budgeting the individual farms was to adjust the actual record data for average expectancy in order to eliminate unusual circumstances peculiar to the record year. In this way the normal farm-organization and production program for 1936 was obtained for each farm. These normal farm plans provide the bench marks from which the projected farm plans and estimates of production are estimated. The A, B, and C plans in their turn, represent estimated normals for their respective production situations rather than forecasts of actual production in 1946.

As severe droughts were experienced in this area extending over a number of years before and after our record year, considerable adjustment of individual farm data was necessary. In addition to the evidence contained in the original 1936 records, the 24 selected farms were again visited in the spring of 1938 to obtain more data on normal crop yields as well as other crop- and livestock-production data. This information was the main basis for determining the normal farm plan for each farm. The combined result of this normalizing process for the 24 farms was a normal milk production for 1936 about 10 percent higher than the actual 1936 production.

It is now possible to apply an independent test to our normalizing procedure and, if necessary to make a correction. This may be done by comparing the percentage difference between actual and normal production for the whole county in 1936 with that found for the 24 selected farms. Our earlier consideration of past trends in Barron County indicates that for the entire county, normal 1936 milk production should be about 20 percent higher than actual on the basis of increased feed-production capacity. In other words the normals indicated for the 24 farms are too low and must be adjusted upward before we can apply our findings to the county. The normals may have been too low either because of inadequate information about the real normals for the individual farms, or possibly because these farms withstood drought conditions somewhat better than other farms in the county and in that respect are not sufficiently representative. It does not matter particularly for this purpose which reason was more important as the main interest is to get a normal base that represents the county. The upward correction to the normal milk-production estimate is one that has to be made for the A, B, and C estimates also. This has been done by raising the level in each instance as indicated and

then recalculating the percentages. The results of this adjustment are shown in the following tabulation:

| Price situation: | *Milk production for sale* |
|---|---|
| 1936 actual | 83.3 |
| Adjusted normal | 100.0 |
| A | 108.6 |
| B | 118.2 |
| C | 100.8 |

## Extension of the Estimates to Barron County

The extension of the findings to the whole of Barron County is the next step. As in the analysis of Dodge County, there are two main possibilities. First, the 24 selected farms could be regarded as cases, each of which represents an important response type in the area. By developing appropriate weights to apply to the percentage change from normal to the A, B, and C situations it may be possible to construct a supply schedule for the county. Several methods for doing this will be examined. The second possibility is to consider that the 24 selected farms constitute the equivalent of a random sample of the individual production responses and accept the combined findings of these 24 farms as estimates of percentage changes from normal for the county.

It is perhaps obvious that if the first possibility can be worked out on an objective basis, the sample of 24 can scarcely be regarded as approximating a random sample, especially as it was selected on the basis of certain definite criteria. The possibilities of developing weights for the 24 individual cases will therefore be considered.

Complete budgeting was carried out on only 24 farms and detailed information concerning the farm business was obtained on 50 farms. The 24 farms were selected from the 50 for detailed study on the basis of various characteristics or combinations of characteristics that were considered to be related to production responses. The manner in which these farms were selected has been described in a preceding section. It was thought that nearly all the important farm situations in the area were included in this sample group of farms. A procedure involving the use of the information pertaining to all of the 50 farms as well as data available for all farms in the county may be used.

One method of extending the results obtained from the study of the 24 farms to all farms in the area might be to determine the relationship between production responses and certain single factors such as size of farm, age of operator, and others. If a definite relationship between such factors and production response exists, the selected cases might be weighted accordingly and an estimate of production for the entire county in each of the price situations might be made. However, no significant relationship between percentage change in production estimated for the 24 farms in the A, B, and C situations and single factors such as size of farm, tenure status of operator, or other factors could be found. Apparently production responses in Barron County are dependent upon a combination of factors rather than being related to any one factor.

These negative results suggest that it is necessary to consider the importance of the various combinations of factors that exist in the area in order to arrive at reliable estimates of production response for all the farms. In other words, the relative importance of the various farm situations existing in the area needs to be considered by means of

an appraisal of the relative frequency with which these combinations occur.

The procedure used in accomplishing this objective in the Dodge County part of this study has been repeated here. The results obtained from the budget study of the 24 farms have been extended to the larger group of 50 farms for which detailed information is available. The method followed was to distribute the additional 26 farms among the 24 groups or classifications according to the ones that they best fit. The criteria considered in classifying the 26 farms include size of farm, acreage under cultivation, productivity of the soil, age of operator, tenure status, available family labor, indebtedness, proportion of income received from various sources, and others. In actual practice, the classification procedure on this basis could not be made entirely objective. Perhaps it could be best described as a judgment procedure aided by such objective measures as were available. The percentage changes in milk production from the normal 1936 quantities estimated in the A-, B-, and C-price situations for each of the 24 farms were applied to the total normal milk production for the farms falling in that classification. In this way, estimates of milk production for all 50 farms were obtained under A-, B-, and C-price conditions. These have been added to obtain estimates of total production response that can be expected for the 50 farms. The results are shown in table 15.

The differences between the estimates for the 24 and for the 50 farms are negligible. It would appear that the additional 26 farms average about the same as the selected 24 farms.

The result of the weighting procedure has been satisfactory in the sense that substantial agreement between the 24 farms and the additional 26 has been achieved. The fact that the procedure necessarily becomes somewhat subjective subtracts something from its value as an estimate for the entire county in which there are about 4,500 farms.

TABLE 15. *Estimates of milk production (for sale) at different prices for 24 selected farms and 50 record farms, Barron County*

| Price situation | Milk production for sale | |
|---|---|---|
| | 24 farms | 50 farms |
| 1936 actual | 100.0 | 100.0 |
| 1936 normal (unadjusted) | 109.8 | 109.8 |
| A | 119.2 | 119.5 |
| B | 129.8 | 130.0 |
| C | 110.7 | 111.9 |

Another method of testing the applicability of the results obtained from the study of the 24 selected farms to the 50 record farms is to compare these 2 groups with respect to important items and to determine the degree of similarity. This has been done and the results expressed as numerical averages are shown in table 16. There is little difference between these 2 groups of farms. Insofar as the information available from this comparison is concerned, the results obtained from our study of the 24 selected farms are applicable to the 50 farms.

As a further step in determining the significance of the results obtained from budgetary analysis of the selected 24 farms as well as the entire group of 50 farms, it is desirable to determine how adequately

these 2 groups of farms represent all farms in the county with respect to important items. A comparison between the sample group of 50 farms and all farms in the county with respect to some important factor is made in table 16.

The 50 sample farms are somewhat larger, on the average, than all farms in the county, have considerably more cropland, and keep more milk cows. Cash crops are less important and gross income is higher for the sample farms. In general type of farming practiced and proportion of income obtained from various sources, there is little difference. Our sample apparently fails to include enough of the smaller farms in the county to be fully representative for some purposes. There is no reason, however, to believe that this makes it unrepresentative for our present purpose of estimating the direction of probable future responses in the county.

TABLE 16.—*Averages of important factors for 24 selected farms, 50 record farms, and all farms, Barron County, 1936*

| Factor | | 24 farms | 50 farms | All farms [1] |
|---|---|---|---|---|
| Average size of farm | acres | 110 | 117 | 104 |
| Cropland | do | 65 | 68 | 41 |
| Percentage of land owner-operated | percent | 77 | 75 | 79 |
| Milk cows | number | 14 | 14 | 10 |
| Gross farm income | dollars | 1,668 | 1,667 | 1,359 |
| Source of income: | | | | |
| Milk | percent | 72.6 | 70.4 | 64.4 |
| Cattle and calves | do | 12.8 | 12.9 | 11.6 |
| Hogs | do | 3.7 | 3.8 | 3.4 |
| Poultry and eggs | do | 3.0 | 3.7 | 6.9 |
| Other livestock | do | 1 | 1.3 | .8 |
| Crops | do | 1.9 | 2.7 | 12.9 |
| Other | do | 1.6 | 1.2 | (2) |
| Total | do | 100.0 | 100.0 | 100.0 |

[1] Data on all farms in Barron County are from Wisconsin Agriculture, Wis. Dept. Agr. and Markets Bul. 188, 1938.
[2] Less than 0.05 of 1 percent.

## RELIABILITY AND GENERAL APPLICABILITY OF THE FINDINGS

The analysis undertaken in the preceding section indicates that the results obtained from the study of the selected 24 farms and the entire sample group of 50 farms may be applied to other farms in the county. No significant differences in results were obtained when the 26 additional farms were distributed among the 24 classifications and when the percentage changes in production estimated for the farm representing each classification were applied to all farms falling within it. Little correlation between response and any of the objective factors used as criteria for classification and original selection of the farms could be found. The bulk of evidence suggests that the selected group of 24 farms may be regarded as equivalent to a random sample of the county with respect to production response. Apparently response is dependent upon the influence of a combination of factors no one of which is dominant and all of which are represented in our group of 24 farms.

An analysis of the variation in response exhibited by the 24 farms such as was carried out for the Dodge County sample now is desirable in order to determine within what limits the results may be applied. It should be understood that, as in the case of Dodge County, the

computations made here are no test of the accuracy with which the individual farm estimates have been made. They merely indicate within what probable range similar results would be obtained if additional samples of 24 farms were selected for study in this county or in other areas where conditions affecting farmers' production responses are similar.

TABLE 17.—*Number of farms with specified changes from 1936 normal milk production, at different prices, 24 selected farms, Barron County*

| Change (pounds) | Data for price situation— | | |
|---|---|---|---|
| | A | B | C |
| | *Number* | *Number* | *Number* |
| −30,000 to −20,001 | | | 1 |
| −20,000 to −10,001 | | | 2 |
| −10,000 to −1 | 1 | 1 | 5 |
| 0 to 9,999 | 14 | 4 | 12 |
| 10,000 to 19,999 | 8 | 10 | 3 |
| 20,000 to 29,999 | 1 | 7 | 1 |
| 30,000 to 39,999 | | 2 | |
| Total | 24 | 24 | 24 |

The distribution of the changes in milk production from normal to A, B, and C are shown in table 17. These seem to be sufficiently near normal to permit calculation of a standard error of the mean change in each instance that may serve as a measure of the range within which estimates based on successive samples of 24 farms of the county would fall. The results of this calculation in terms of the average or mean change from the 1936 normal production per farm and the range from this mean included in its standard error are shown in table 18.

TABLE 18.—*Estimated average milk production (for sale) at different prices and change from 1936 normal, 24 selected farms, Barron County*

| Price situation | Production | Mean change from normal | Standard error of mean change |
|---|---|---|---|
| | *Pounds* | *Pounds* | *Pounds* |
| 1936 normal | 95,147 | | |
| A | 103,317 | +8,170 | ±1,393 |
| B | 112,503 | +17,356 | ±1,857 |
| C | 95,926 | +779 | ±2,013 |

This may be more easily understood by referring to table 19 in which the same information is presented in percentage terms. For example, it is estimated for the A-price situation that the normal 1946 milk production will be 108.6 percent of the normal 1936 milk production with a standard-error range from 107.1 to 110.1 percent. This means that if a considerable number of random samples of 24 farms from Barron County were budgeted, the chances are about two out of three that the estimates would fall between the limits indicated. This tells us nothing, of course, about the accuracy of the budgeting process itself. This must be judged on other grounds. The extent to which one sample may be regarded as a random sample of production response for the county must also be evaluated carefully in interpreting these statistical measures.

From the comparisons made, the consideration given to the selection of a township representing soil and topographic conditions in the county, and the general reasoning about the nature of the factors influencing production response, it would appear that the sample is representative.

TABLE 19.—*Estimated milk production (for sale) at different prices, 24 selected farms, Barron County*

| Price situation | Production | Range of probable production [1] | |
|---|---|---|---|
| | | Minimum | Maximum |
| 1936 normal | 100.0 | | |
| A | 108.6 | 107.1 | 110.1 |
| B | 118.2 | 116.2 | 120.2 |
| C | 100.8 | 98.7 | 102.9 |

[1] This is the range included by the standard error of the mean change within which estimates from additional samples of 24 farms might be expected to fall 2 times out of 3.

## SUMMARY FOR BARRON COUNTY

First consideration of the agriculture of Barron County suggested that milk production would show little response to changes in price. Alternative enterprises are less important as sources of income than in Dodge County and the possibility of transferring resources between enterprises would therefore seem less. Nevertheless the detailed analysis of individual farm budgets shows that there is some elasticity of supply even under these conditions.

The study of trends in Barron County during the preceding 10-year period shows that there has been an upward trend in normal feed-production capacity of about 20 percent. This has been brought about by a 15-percent increase in crop acreage and by a shift toward higher nutrient-yielding roughage crops, particularly alfalfa and silage corn. Clover and timothy hay and cash crops have declined in importance. Actual production has not kept pace with normal production, as the series of drought years has affected yields adversely.

The number of milk cows, after experiencing an upward trend to 1933 and then falling off, ended the period at about the initial level. Numbers of horses, sheep, and hogs on the contrary show a definite downward trend through the period 1925–37. With normal feed production it is estimated that the 1936 normal milk production would have been 20 percent higher than the actual 1936 production.

Measuring from the normal 1936 milk-production point, it is estimated that the normal 1946 Barron County production will be nearly 9 percent higher with a continuation of normal 1936 prices, about 18 percent higher with prices 20 percent higher and about the same with prices 20 percent lower. These expected trends in normal production are shown in figure 21. The broken line from 1925 to 1936 represents the trend in normal production. It was drawn after adjusting actual milk-production data for the years at the end of the period in accordance with what would normally be expected as a result of the changes that have taken place in cropping systems. Drought and adverse weather prevented actual production from fully reflecting these changes. The trend line is drawn so as to end at the 1936 normal-production point. The broken lines in the figure from 1936 to

1946 represent the trends to the probable future productions in the A-, B-, and C-price situations. The differences in the quantities of milk produced in the A, B, and C situations represent the response to differences in prices after 10 years have passed. There is some elasticity.

The interpretation of figure 21 will be aided by referring to figure 22. This shows the same information in the form of a conventional supply schedule. Here the shape of the schedule as indicated by the three points we have estimated tells us about the response to price changes. The distance from the point marked 1936 normal to A represents the response due to other factors not directly associated with price. Our

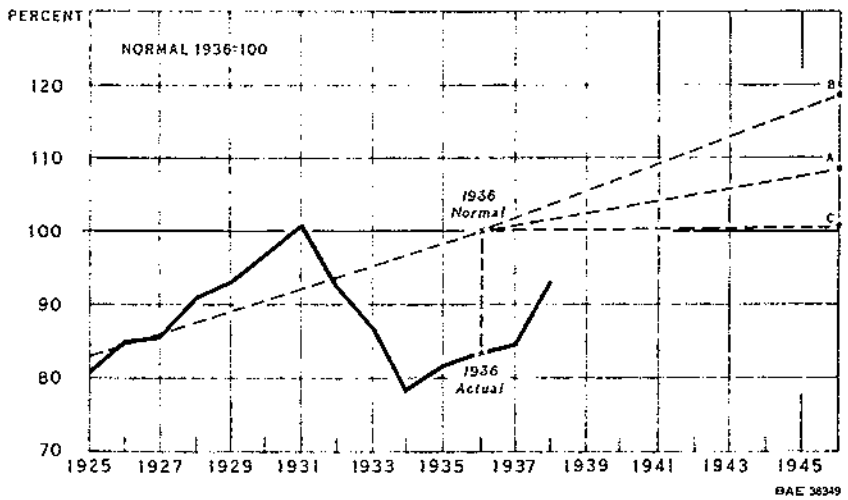


FIGURE 21.—MILK PRODUCTION AND PROBABLE FUTURE TRENDS, BARRON COUNTY (NORMAL 1936=100).

After adjusting actual 1936 production for normal weather, it is estimated that a continuation of 1936 price relationships will result in a normal 1946 production about 9 percent higher than the 1936 normal. The broken-trend line from 1925 to 1936 represents the trend in normal production and is drawn so as to end at the 1936 normal production point. Milk prices 20 percent higher will probably bring a still higher output. Milk prices 20 percent lower will result in little change from present normal production.

budget method of estimation has enabled us to take account of both types of influences as they operate over a 10-year period.

## COMPARISON OF THE RESULTS FOR BOTH COUNTIES

In the preliminary analysis, Dodge County was characterized as an area with a number of alternatives to dairying and Barron County, one with few alternatives. The two were originally selected for study with this distinction in mind. From this, qualitative reasoning led to the conclusion that the elasticity of milk supply would be less in Barron County than in Dodge.

The conclusions that have been reached as a result of the detailed budgeting analysis agree only in part with the initial premises. It is true that the supply schedule constructed for Barron County appears to be somewhat less elastic than that for Dodge, especially for decreases in milk prices. But the differences in this respect are less

than may have been anticipated and the similarities are probably more important than the differences. Both are somewhat inelastic within the price range considered. Trends under way not associated directly with price are tending to reduce the importance of the alternative products in Dodge County, so that the farming systems are becoming more like those in Barron County with respect to specialization in dairying.

Concerning the probable response in production due to influences other than price, the similarity between the two areas is even more

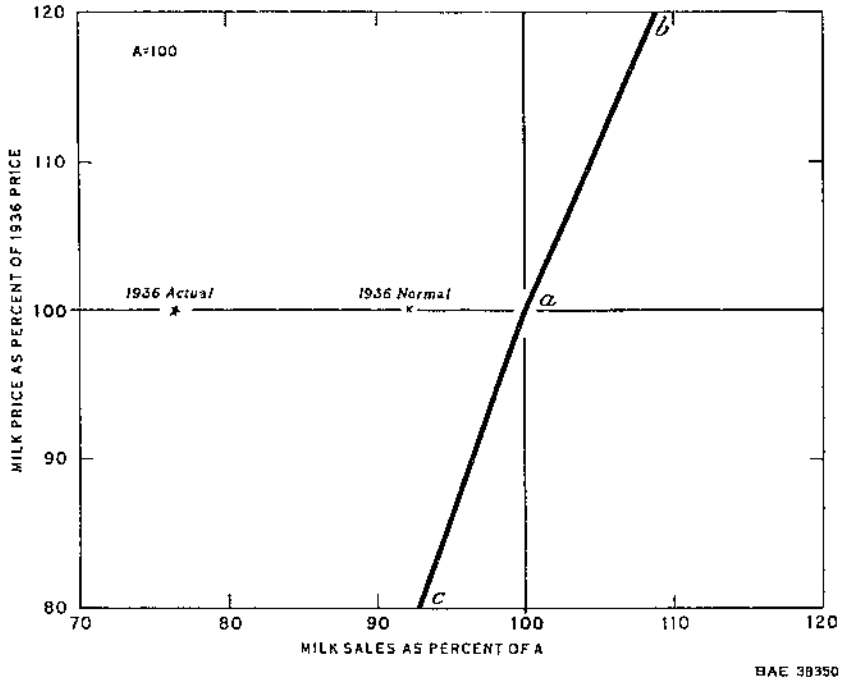


FIGURE 22.—ESTIMATED QUANTITIES OF MILK FOR SALE AT 3 PRICE LEVELS, 24 SELECTED FARMS, BARRON COUNTY (A=100).

The 10-year supply schedule for milk in Barron County is relatively inelastic to price changes. The 10-year response to nonprice factors represented by the distance between the 1936 normal point and A may be more significant.

marked. Looking backward over the period 1925–36 it is estimated that normal milk production in Dodge County has increased about 18 percent. In Barron County the increase in normal milk production is estimated at about 20 percent, an almost identical change. Looking forward from 1936 to 1946 it is estimated that the probable increase in normal milk production (if price relationships do not change much) will be about 8 percent in Dodge County and nearly 9 percent in Barron County. Parenthetically it must be pointed out that actual milk production in Barron County was depressed considerably below normal in the recent drought years and recovery had not been made by 1936. In Dodge County, on the other hand, the drought effects were not as severe and milk production had actually recovered by 1936.

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The similarity in actual and estimated production responses in these two counties suggests that similar causes must be operating. Examination of the budgetary details of our projected plans as well as the actual data on changes in the preceding period shows that this is the case. In the 1925–36 period a parallel increase in cultivated acreage of about 15 percent occurred in each area. A shift from grain to roughage crops resulting in a normally higher nutrient production per acre also occurred in each area. Alfalfa hay and silage corn increased, small grain and mixed tame hay decreased. These were the important shifts affecting feed and milk production. Other minor changes in each area differed to some extent.

In the forward-looking estimates probably the most important element was an anticipated increase in feed from additional legume seedings. Again much the same situation seemed to be expected in each county.

Contributing factors expected to influence future feed production in both areas are the educational influence of the Agricultural Conservation Program and its encouragement for increased roughage production and some slight further decrease in hogs and horses. In Dodge County the influence of hybrid seed corn may have some effect on corn yields and production either directly or indirectly through increased forage production if additional land should be shifted out of corn.

From the similarity of past trends and future estimates for these two sample areas in different parts of Wisconsin and our knowledge of production trends for the whole State, it would seem that similar future trends might be expected over much of Wisconsin. Probable exceptions might be areas where poor drainage and other adverse soil conditions limit the increase in legume acreage.

## THE MEANING OF IT ALL

The books have now been balanced. The task set at the beginning has been accomplished. For the two areas studied, past trends have been studied and explained. Probable 10-year responses in milk production for 3 significant price situations have been estimated for each area. How are these results to be used by farmers, county planners, or other agencies concerned with agricultural policy and programs?

First of all, these results will be most useful when the parallel studies now under way in selected areas in a number of other States in the dairy regions have been completed. When supply responses from enough of the significant competing areas and regions can be combined, to give an idea of what is likely to happen to milk supply in the aggregate with several different prices, and after the passage of a 10-year period of time—something can then be said about the effect of this supply on price. If similar studies of demand and consumption, even if preliminary in character, are also considered, an improved estimate of the probable long-time trend of prices of dairy products can be made.

From the point of view of any one dairyman making his own future plans, or of county planners in assisting farmers in a particular county in planning crops, interregional competition in the last analysis is reflected in the prices that can be expected.

Second, these findings should be helpful to farmers in Dodge and Barron Counties and in neighboring counties in describing the

changes that have been going on, and in pointing out their probable future direction. The results of the detailed budgets are intended to show what is most likely to happen, rather than what should happen. This furnishes a starting point for a further analysis of what could be done to increase profits. For example, in the C or low milk-price situation, it is probable that with sufficient information, adequate credit, and perhaps some special conservation payments, improvements in farm practice and organization could be developed that would be considerably more profitable than the organizations we have estimated as most probable.

Analysis of this type, while beyond the scope of this study, is well worth pursuing and can readily be developed from the background furnished here.

It is not necessary, of course, to wait for complete perfection of all studies that are in progress before drawing useful conclusions about the general nature of supply response in dairying. One other study of this character in the Cabot-Marshfield Area, Vermont, has already been completed and published (*1*). The Cabot-Marshfield Area is a highly specialized dairy area on the outer margin of the Boston milkshed. The production responses found in this area are compared with those for Dodge and Barron Counties in table 20.

An upward trend in milk production is observed in both States with A or B prices. It appears to be somewhat greater in Wisconsin than in Vermont. With lower prices it appears that production will decline most in the Vermont area. Nevertheless, it is necessary to observe that in two widely separated areas, one in the Great Lakes States and one in New England, underlying forces seem to be operating in the direction of increased production unless prices should drop considerably. Full discussion of the significance of this is reserved for a later publication now planned to bring together the results of a number of area studies.

TABLE 20.—*Past trends and estimated future responses, at different prices, in normal milk production for selected areas* [1]

| Area | 1926 normal | 1936 normal | A | B | C |
|---|---|---|---|---|---|
| Cabot-Marshfield, Vt. | 94.0 | 100.0 | 108.8 | 116.7 | 99.5 |
| Dodge County, Wis. | 79.3 | 100.0 | 107.8 | 119.9 | 93.0 |
| Barron County, Wis. | 84.8 | 100.0 | 108.6 | 118.2 | 100.8 |

[1] The B and C milk prices used in Wisconsin were 20 percent higher and lower, respectively, than A prices. Those used in Vermont were varied by only 15 percent. This is because the Vermont farm prices are on a higher level and are more largely influenced by class I prices for fluid milk. This is a rough correction for the fact that a given absolute change in the milk-price structure results in a larger percentage price change in Wisconsin than in Vermont.

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# TABLES

TABLE 21.—*Total milk production by years, Wisconsin, 1924–38*

| Year | Milk production | Year | Milk production | Year | Milk production |
|---|---|---|---|---|---|
| | *Million pounds* | | *Million pounds* | | *Million pounds* |
| 1924 | 9,775 | 1929 | 11,056 | 1934 | 10,659 |
| 1925 | 10,052 | 1930 | 11,207 | 1935 | 10,921 |
| 1926 | 10,361 | 1931 | 11,305 | 1936 | 11,598 |
| 1927 | 10,255 | 1932 | 10,992 | 1937 | 11,378 |
| 1928 | 10,241 | 1933 | 10,851 | 1938 | 11,862 |

Wisconsin Crop and Livestock Reporting Service.

TABLE 22.—*Livestock units in Dodge County, 1926–38*

| Year | Livestock unit equivalents of [1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Milk cows [2] | All other cattle | Horses and mules | Hogs | Sheep | Chickens | Total | |
| | | | | | | | Total units | Index (1927–37=100) |
| | *Number* | *Number* | *Number* | *Number* | *Number* | *Number* | *Number* | |
| 1926 | 68,200 | 12,056 | 16,500 | 11,760 | 590 | 5,050 | 114,156 | 95.2 |
| 1927 | 68,500 | 11,704 | 16,170 | 13,160 | 690 | 5,290 | 115,534 | 96.3 |
| 1928 | 67,200 | 12,100 | 16,060 | 12,280 | 630 | 5,260 | 113,530 | 94.7 |
| 1929 | 63,100 | 11,968 | 15,870 | 10,500 | 630 | 5,382 | 107,510 | 89.7 |
| 1930 | 68,200 | 13,420 | 16,400 | 13,920 | 1,050 | 5,593 | 118,583 | 98.9 |
| 1931 | 71,000 | 13,860 | 16,020 | 15,040 | 1,060 | 5,753 | 122,733 | 102.3 |
| 1932 | 70,800 | 14,828 | 15,550 | 15,060 | 1,060 | 5,578 | 122,876 | 102.5 |
| 1933 | 72,300 | 14,300 | 15,250 | 14,160 | 870 | 5,070 | 121,950 | 101.7 |
| 1934 | 75,500 | 14,740 | 15,120 | 14,100 | 980 | 5,412 | 125,852 | 105.0 |
| 1935 | 74,300 | 13,156 | 15,900 | 9,080 | 1,150 | 5,462 | 119,648 | 99.8 |
| 1936 | 77,100 | 13,288 | 16,200 | 11,800 | 1,180 | 5,626 | 125,194 | 104.4 |
| 1937 | 77,000 | 14,300 | 16,200 | 11,200 | 1,110 | 5,851 | 125,661 | 104.8 |
| 1938 | 76,200 | 14,168 | 16,000 | 11,320 | 1,100 | 5,383 | 124,171 | 103.5 |

[1] Livestock-unit equivalents for each class of livestock are as follows: Milk cows, 1; horses, 1; all other cattle, 0.44; hogs, 0.2; sheep, 0.1; poultry, 0.01.
[2] Cows and heifers 2 years old and over kept for milk.

Computed from data from the Wisconsin Crop and Livestock Reporting Service (table 30).

TABLE 23.—*Total milk production, Dodge County, 1925–38*

| Year | Milk production | | | Year | Milk production | | |
|---|---|---|---|---|---|---|---|
| | Total | Relative | | | Total | Relative | |
| | | (1927–37=100) | (1936=100) | | | (1927–37=100) | (1936=100) |
| | *1,000 pounds* | | | | *1,000 pounds* | | |
| 1925 | 386,000 | 92.0 | 81.2 | 1933 | 383,000 | 91.4 | 80.7 |
| 1926 | 377,000 | 89.9 | 79.3 | 1934 | 410,460 | 97.8 | 86.3 |
| 1927 | 379,000 | 90.3 | 79.7 | 1935 | 416,440 | 99.3 | 87.6 |
| 1928 | 373,000 | 88.9 | 78.4 | 1936 | 417,020 | 99.4 | 87.7 |
| 1929 | 445,810 | 106.3 | 93.8 | 1937 | 475,520 | 113.4 | 100.0 |
| 1930 | 429,010 | 102.3 | 90.2 | 1938 | 456,940 | 108.9 | 96.1 |
| 1931 | 427,700 | 102.0 | 89.9 | 1939 | [1] 467,840 | 111.5 | 98.4 |

[1] Preliminary.

Wisconsin Crop and Livestock Reporting Service.

TABLE 24.—*Total digestible nutrients produced by various crops in Dodge County, 1925-37*

| Year | Total digestible nutrients in— | | | | | | | | | Total feed | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All corn | Barley | Oats | All wheat | Rye | Wild hay | Alfalfa | Clover and timothy | Other hay | Total digestible nutrients | Index (1927–37=100) |
| | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | |
| 1925 | 144, 523 | 19, 936 | 90, 040 | 3, 021 | 485 | 14, 896 | 24, 250 | 59, 966 | 2, 300 | 360, 329 | 92. 5 |
| 1926 | 106, 012 | 25, 021 | 102, 786 | 5, 408 | 742 | 10, 263 | 23, 020 | 68, 680 | 4, 260 | 346, 212 | 88. 9 |
| 1927 | 94, 297 | 32, 567 | 101, 200 | 5, 408 | 805 | 9, 095 | 27, 040 | 97, 900 | 3, 790 | 372, 722 | 95. 7 |
| 1928 | 129, 007 | 39, 527 | 99, 375 | 4, 475 | 337 | 14, 446 | 19, 150 | 71, 320 | 6, 290 | 383, 927 | 98. 5 |
| 1929 | 126, 157 | 34, 373 | 82, 835 | 3, 716 | 615 | 14, 650 | 38, 715 | 119, 360 | 8, 935 | 429, 356 | 110. 2 |
| 1930 | 133, 697 | 40, 295 | 98, 768 | 4, 501 | 832 | 19, 740 | 42, 990 | 88, 330 | 12, 160 | 441, 316 | 113. 3 |
| 1931 | 117, 868 | 33, 578 | 61, 857 | 2, 744 | 617 | 20, 741 | 32, 810 | 51, 960 | 9, 940 | 332, 115 | 85. 2 |
| 1932 | 156, 884 | 51, 551 | 88, 300 | 4, 558 | 1, 512 | 22, 687 | 19, 720 | 41, 760 | 10, 150 | 397, 122 | 101. 9 |
| 1933 | 167, 576 | 40, 741 | 68, 078 | 3, 997 | 1, 051 | 20, 762 | 44, 956 | 34, 650 | 14, 190 | 395, 426 | 101. 5 |
| 1934 | 133, 661 | 45, 854 | 68, 522 | 4, 065 | 1, 410 | 17, 970 | 33, 950 | 20, 445 | 12, 900 | 338, 849 | 87. 0 |
| 1935 | 141, 960 | 54, 082 | 71, 600 | 3, 698 | 2, 586 | 20, 496 | 90, 020 | 49, 068 | 13, 012 | 446, 522 | 114. 6 |
| 1936 | 85, 434 | 49, 037 | 73, 221 | 2, 796 | 660 | 21, 098 | 74, 450 | 43, 848 | 5, 186 | 356, 660 | 91. 5 |
| 1937 | 156, 196 | 62, 583 | 78, 185 | 1, 008 | 1, 118 | 21, 008 | 20, 130 | 29, 190 | 21, 082 | 391, 490 | 100. 5 |

[1] 1936 data.

Computed from data from the Wisconsin Crop and Livestock Reporting Service. (See table 28.)

TABLE 25.—*Prices and index numbers of prices received by Wisconsin farmers for principal farm products, 1925-37*

| Year | Prices received for— | | | | | Index numbers of prices received (1927–37=100) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Milk per hundredweight | Milk cows per head | Hogs per hundredweight | Lambs per hundredweight | Eggs per dozen | Milk | Milk cows | Hogs | Lambs | Eggs |
| | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Cents* | | | | | |
| 1925 | 1. 92 | 66. 25 | 10. 87 | 12. 36 | 33. 2 | 128. 9 | 97. 2 | 143. 5 | 143. 3 | 146. 9 |
| 1926 | 1. 92 | 80. 50 | 11. 70 | 12. 09 | 31. 3 | 128. 9 | 118. 1 | 159. 8 | 146. 0 | 138. 5 |
| 1927 | 2. 11 | 89. 85 | 9. 52 | 11. 85 | 28. 6 | 141. 6 | 131. 8 | 130. 1 | 143. 1 | 126. 5 |
| 1928 | 2. 12 | 102. 40 | 8. 74 | 12. 37 | 30. 3 | 142. 3 | 150. 2 | 119. 4 | 149. 4 | 134. 1 |
| 1929 | 2. 01 | 107. 25 | 9. 50 | 12. 23 | 31. 5 | 134. 9 | 157. 3 | 129. 8 | 147. 7 | 139. 4 |
| 1930 | 1. 62 | 84. 40 | 8. 82 | 8. 56 | 24. 1 | 108. 7 | 123. 8 | 120. 5 | 103. 4 | 106. 6 |
| 1931 | 1. 15 | 56. 85 | 5. 76 | 6. 22 | 17. 8 | 77. 2 | 83. 4 | 78. 7 | 75. 1 | 78. 8 |
| 1932 | .89 | 38. 75 | 3. 38 | 4. 67 | 15. 9 | 59. 7 | 56. 8 | 46. 2 | 56. 4 | 70. 4 |
| 1933 | .98 | 35. 50 | 3. 44 | 4. 97 | 14. 4 | 65. 8 | 52. 1 | 47. 0 | 60. 0 | 63. 7 |
| 1934 | 1. 09 | 35. 90 | 4. 12 | 6. 11 | 17. 6 | 73. 2 | 52. 6 | 56. 3 | 73. 8 | 77. 9 |
| 1935 | 1. 32 | 58. 40 | 5. 57 | 7. 20 | 23. 9 | 88. 6 | 85. 6 | 117. 1 | 87. 0 | 105. 8 |
| 1936 | 1. 51 | 68. 25 | 9. 12 | 8. 10 | 22. 8 | 101. 3 | 100. 1 | 124. 6 | 97. 8 | 100. 9 |
| 1937 | 1. 59 | 72. 58 | 9. 52 | 8. 80 | 21. 2 | 106. 7 | 106. 4 | 130. 1 | 106. 3 | 93. 8 |

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TABLE 26.—*Index numbers of Wisconsin feed prices, 1925–37*

| Year | Millfeeds | | Protein feeds | |
|---|---|---|---|---|
| | (1910–14=100) | (1927–37=100)[1] | (1910–14=100) | (1927–37=100)[1] |
| 1925 | 124 | 121 | 142 | 116 |
| 1926 | 111 | 108 | 145 | 119 |
| 1927 | 131 | 127 | 149 | 122 |
| 1928 | 144 | 140 | 165 | 135 |
| 1929 | 126 | 123 | 168 | 138 |
| 1930 | 105 | 102 | 142 | 116 |
| 1931 | 68 | 66 | 95 | 78 |
| 1932 | 54 | 52 | 73 | 60 |
| 1933 | 67 | 65 | 88 | 72 |
| 1934 | 100 | 97 | 112 | 92 |
| 1935 | 102 | 99 | 107 | 88 |
| 1936 | 108 | 105 | 117 | 96 |
| 1937 | 126 | 123 | 125 | 102 |

[1] Index numbers on 1927–37 base computed from 1910–14 series.

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TABLE 27.—*Acreages of crops harvested, by major classes, Dodge County, 1925–38*

| Year | All corn | Small grain | All hay | Cash crops [1] | Total |
|---|---|---|---|---|---|
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| 1925 | 74,930 | 118,650 | 81,930 | 17,755 | 293,265 |
| 1926 | 75,250 | 127,940 | 76,540 | 17,360 | 297,090 |
| 1927 | 72,390 | 127,905 | 80,960 | 13,520 | 294,775 |
| 1928 | 71,650 | 128,490 | 88,310 | 16,230 | 304,680 |
| 1929 | 70,400 | 128,060 | 93,030 | 17,500 | 308,990 |
| 1930 | 71,650 | 125,840 | 98,620 | 20,100 | 315,610 |
| 1931 | 73,740 | 125,040 | 98,240 | 17,000 | 314,620 |
| 1932 | 83,380 | 135,150 | 94,270 | 13,500 | 326,300 |
| 1933 | 83,120 | 133,790 | 83,990 | 13,790 | 314,690 |
| 1934 | 87,750 | 137,750 | 94,180 | 17,890 | 337,570 |
| 1935 | 81,250 | 138,780 | 92,020 | 19,080 | 331,130 |
| 1936 | 76,280 | 135,510 | 103,310 | 14,240 | 329,340 |
| 1937 | 94,230 | 142,460 | 84,020 | 16,120 | 343,830 |
| 1938 | 87,630 | 144,810 | (2) | 16,270 | (2) |

[1] Canning peas and potatoes. [2] Data not available.

Wisconsin Crop and Livestock Reporting Service (compiled from table 28).

TABLE 28.—*Acreages of principal crops harvested, Dodge County, 1925–38*

| Year | All corn | Oats | Barley | Other small grain | All tame hay [1] | Alfalfa | Clover and timothy | Wild hay | Canning peas | Potatoes | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| 1925 | 74,930 | 98,770 | 15,230 | 4,650 | 62,160 | 10,130 | 48,500 | 19,770 | 14,575 | 3,180 | 293,265 |
| 1926 | 75,250 | 101,790 | 20,100 | 6,050 | 61,610 | 10,010 | 45,630 | 14,030 | 13,640 | 3,720 | 297,090 |
| 1927 | 72,390 | 95,570 | 26,180 | 6,105 | 67,890 | 10,340 | 53,780 | 13,070 | 9,580 | 3,940 | 294,775 |
| 1928 | 71,650 | 95,820 | 28,260 | 4,410 | 65,380 | 8,570 | 52,160 | 22,930 | 12,100 | 4,130 | 304,680 |
| 1929 | 70,400 | 94,820 | 25,690 | 4,490 | 75,390 | 13,350 | 55,900 | 17,440 | 13,930 | 3,630 | 308,990 |
| 1930 | 71,650 | 91,860 | 29,090 | 4,890 | 73,960 | 16,880 | 50,900 | 24,660 | 15,990 | 4,110 | 315,610 |
| 1931 | 73,740 | 89,080 | 32,030 | 4,530 | 68,610 | 18,320 | 43,300 | 29,030 | 12,270 | 4,730 | 314,620 |
| 1932 | 83,380 | 89,590 | 39,340 | 6,220 | 56,410 | 10,690 | 37,960 | 37,860 | 8,910 | 4,590 | 326,300 |
| 1933 | 83,120 | 82,140 | 45,340 | 6,310 | 54,330 | 20,200 | 24,340 | 29,660 | 9,450 | 4,340 | 314,690 |
| 1934 | 87,750 | 87,400 | 43,740 | 6,610 | 62,090 | 24,250 | 25,560 | 32,090 | 12,730 | 5,160 | 337,570 |
| 1935 | 81,250 | 81,900 | 49,810 | 7,010 | 67,620 | 32,150 | 27,260 | 24,400 | 14,010 | 5,070 | 331,130 |
| 1936 | 76,280 | 81,720 | 49,400 | 4,390 | 73,170 | 37,240 | 31,320 | 30,140 | 9,310 | 4,930 | 329,340 |
| 1937 | 94,230 | 87,260 | 57,640 | 4,560 | 54,020 | 14,380 | 20,850 | [2] 30,000 | 11,280 | 4,840 | 343,830 |
| 1938 | 87,630 | 86,920 | 53,350 | 4,540 | (3) | (3) | (3) | (3) | 12,030 | 4,240 | (3) |

[1] Includes alfalfa, clover, timothy, and other tame hay.
[2] Estimated.
[3] Data not available.

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TABLE 29.—*Estimated normal feed-producing capacity, with 1917–36 average yields, in 1925 and 1937, Dodge County*

| Crop | 1917–36 average yield per acre | Total digestible nutrients per acre | Acreage | | Total digestible nutrients | |
|---|---|---|---|---|---|---|
| | | | 1925 | 1937 | 1925 | 1937 |
| | *Bushels* | *Pounds* | *Acres* | *Acres* | *1,000 pounds* | *1,000 pounds* |
| Barley | 30.4 | 1,138 | 15,230 | 57,640 | 17,335 | 65,604 |
| Oats | 41.8 | 936 | 98,770 | 87,260 | 92,480 | 81,703 |
| All wheat | 19.7 | 946 | 3,740 | 3,020 | 3,537 | 2,856 |
| Rye | 17.2 | 784 | 630 | 1,540 | 494 | 1,208 |
| Corn | 37.1 | 1,425 | 74,930 | 94,230 | 106,748 | 134,244 |
| | *Tons* | | | | | |
| Wild hay | 1.1 | 770 | 19,770 | [1] 30,000 | 15,223 | 23,100 |
| Alfalfa | [2] 2.2 | 2,200 | 10,130 | 14,380 | 22,286 | 31,636 |
| Other hay [3] | [4] 1.5 | 1,500 | 52,030 | 39,040 | 78,045 | 59,460 |
| Total | | | | | 336,148 | 399,811 |

[1] Estimated.
[2] 13-year average, 1924–36.
[3] All tame hay minus alfalfa.
[4] 11-year average, 1926–36, for clover and timothy was used.

TABLE 30.—*Numbers of livestock in Dodge County, 1925–38*

| Year | Milk cows [1] | All other cattle | Horses and mules | Hogs | Sheep | Chickens |
|---|---|---|---|---|---|---|
| | *Number* | *Number* | *Number* | *Number* | *Number* | *Number* |
| 1925 | 69, 100 | 27, 500 | 17, 700 | 54, 900 | 6, 700 | (2) |
| 1926 | 68, 200 | 27, 400 | 16, 500 | 58, 800 | 5, 900 | 505, 000 |
| 1927 | 68, 500 | 26, 600 | 16, 170 | 65, 900 | 6, 900 | 529, 000 |
| 1928 | 67, 200 | 27, 500 | 16, 060 | 61, 100 | 6, 300 | 526, 000 |
| 1929 | 63, 100 | 27, 200 | 15, 870 | 52, 800 | 6, 300 | 538, 200 |
| 1930 | 68, 200 | 30, 500 | 16, 400 | 59, 600 | 10, 500 | 559, 300 |
| 1931 | 71, 000 | 31, 500 | 16, 020 | 75, 200 | 10, 600 | 575, 300 |
| 1932 | 70, 800 | 33, 700 | 15, 550 | 75, 300 | 10, 600 | 557, 800 |
| 1933 | 72, 300 | 32, 500 | 15, 250 | 70, 800 | 8, 700 | 507, 000 |
| 1934 | 75, 500 | 33, 500 | 15, 120 | 70, 500 | 9, 800 | 541, 200 |
| 1935 | 74, 300 | 29, 900 | 15, 900 | 48, 400 | 11, 500 | 546, 200 |
| 1936 | 77, 100 | 30, 200 | 16, 200 | 59, 000 | 11, 800 | 562, 600 |
| 1937 | 77, 000 | 32, 500 | 16, 200 | 56, 000 | 11, 100 | 535, 100 |
| 1938 | 76, 200 | 32, 200 | 16, 000 | 56, 600 | 11, 000 | 538, 300 |

[1] Cows and heifers 2 years old and over kept for milk.
[2] Data not available.

Wisconsin Crop and Livestock Reporting Service.

TABLE 31.—*Milk production for 41 selected farms and prices received by a typical dairyman, Dodge County, 1927–37*

| Year | Milk production | | Price of butterfat in milk [1] | |
|---|---|---|---|---|
| | Total | Relatives (1927–37=100) | Per pound | Relatives (1927–37=100) |
| | *Pounds* | | *Cents* | |
| 1927 | 4, 806, 741 | 97. 5 | 58 | 146. 6 |
| 1928 | 4, 625, 346 | 93. 8 | 58 | 146. 6 |
| 1929 | 4, 961, 252 | 100. 6 | 53 | 134. 0 |
| 1930 | 5, 177, 481 | 105. 0 | 42 | 106. 2 |
| 1931 | 5, 004, 373 | 101. 5 | 31 | 78. 4 |
| 1932 | 4, 862, 208 | 98. 6 | 23 | 58. 2 |
| 1933 | 4, 691, 068 | 95. 1 | 27 | 68. 3 |
| 1934 | 4, 875, 818 | 98. 9 | 29 | 73. 3 |
| 1935 | 5, 029, 094 | 102. 0 | 36 | 91. 0 |
| 1936 | 5, 302, 817 | 107. 5 | 38 | 96. 1 |
| 1937 | [2] 4, 907, 860 | 99. 5 | 40 | 101. 1 |

[1] Prices paid by Rock River Creamery.
[2] Data adjusted to complete the year.

TABLE 32.—*Method of classifying case farms for detailed study* [1]

| Item | Significant land variation | Size of farm | Family labor supply | Age of operator | Tenure | Indebtedness |
|---|---|---|---|---|---|---|
| Total farms (24) | Good land (12) | Small (6) | No family labor (3) | Under 35 (1) | Renter (1) | On equipment. |
| | | | | 35 to 50 (2) | Owner (2) | Little debt. |
| | | | | | | Heavy debt. |
| | | | Family labor (3) | 35 to 50 (2) | Renter (1) | On equipment. |
| | | | | | Owner (1) | Heavy debt. |
| | | | | Over 50 (1) | Owner (1) | Little debt. |
| | | Large (6) | No family labor (3) | Under 35 (1) | Renter (1) | On equipment. |
| | | | | 35 to 50 (2) | Owner (2) | Little debt. |
| | | | | | | Heavy debt. |
| | | | Family labor (3) | 35 to 50 (2) | Renter (1) | On equipment. |
| | | | | | Owner (1) | Heavy debt. |
| | | | | Over 50 (1) | Owner (1) | Little debt. |
| | | | | | Renter (1) | On equipment. |
| | Poor land (12) | Small (6) | No family labor (3) | Under 35 (1) | Owner (2) | Little debt. |
| | | | | 35 to 50 (2) | | Heavy debt. |
| | | | Family labor (3) | 35 to 50 (2) | Renter (1) | On equipment. |
| | | | | | Owner (1) | Heavy debt. |
| | | | | Over 50 (1) | Owner (1) | Little debt. |
| | | Large (6) | No family labor (3) | Under 35 (1) | Renter (1) | On equipment. |
| | | | | 35 to 50 (2) | Owner (2) | Little debt. |
| | | | | | | Heavy debt. |
| | | | Family labor (3) | 35 to 50 (2) | Renter (1) | On equipment. |
| | | | | | Owner (1) | Heavy debt. |
| | | | | Over 50 (1) | Owner (1) | Little debt. |
| Total, 24 farms | Good land (12) | Small farms (12) | No family labor (12) | Operator under 35 (4) | Renters (8) | Renters with debt on equipment (8). |
| | Poor land (12) | Large farms (12) | Family labor (12) | Operator 35-50 (16) | Owners (16) | Owners with little debt (6). |
| | | | | Operators over 50 (4) | | Owners with much debt (10). |

[1] Figures in parentheses following each category indicate number of farms selected.

TABLE 33.—*Total milk production (for sale) in 1936 and estimated production at different prices, 24 farms, Dodge County*

| Price situation | Milk production (for sale) | | |
|---|---|---|---|
| | Total | Relatives | |
| | | (1936 actual=100) | (A=100) |
| | *Pounds* | | |
| 1936 actual | 3,120,993 | 100.0 | 92.7 |
| 1936 normal | 3,127,734 | 100.2 | 92.9 |
| A | 3,365,838 | 107.8 | 100.0 |
| B | 3,741,300 | 119.9 | 111.2 |
| C | 2,902,692 | 93.0 | 86.2 |

TABLE 34.—*Livestock units in Barron County, 1926–38*

| Year | Livestock unit equivalents [1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Milk cows [2] | All other cattle | Horses and mules | Hogs | Sheep | Chickens | Total | |
| | | | | | | | Total units | Index (1927-37=100) |
| | *Number* | *Number* | *Number* | *Number* | *Number* | *Number* | *Number* | |
| 1926 | 45,600 | 10,604 | 12,300 | 3,200 | 1,000 | 2,240 | 75,044 | 99.1 |
| 1927 | 44,300 | 10,164 | 13,050 | 3,420 | 1,230 | 2,440 | 74,634 | 98.6 |
| 1928 | 43,400 | 10,164 | 12,890 | 3,300 | 1,150 | 2,440 | 73,344 | 96.9 |
| 1929 | 48,000 | 10,808 | 13,510 | 2,980 | 1,110 | 2,300 | 78,708 | 104.0 |
| 1930 | 48,900 | 11,368 | 12,900 | 1,950 | 1,020 | 2,442 | 77,850 | 102.8 |
| 1931 | 50,400 | 12,408 | 12,170 | 1,900 | 1,080 | 2,459 | 80,417 | 106.2 |
| 1932 | 52,500 | 12,510 | 11,830 | 1,980 | 1,060 | 2,235 | 82,145 | 108.5 |
| 1933 | 51,500 | 11,616 | 11,610 | 1,660 | 930 | 2,257 | 79,573 | 105.1 |
| 1934 | 52,200 | 11,060 | 11,190 | 1,440 | 890 | 2,207 | 79,587 | 105. |
| 1935 | 44,600 | 8,844 | 10,500 | 960 | 850 | 1,927 | 67,681 | 89.4 |
| 1936 | 44,600 | 9,416 | 10,700 | 1,240 | 830 | 2,062 | 68,848 | 90.9 |
| 1937 | 45,100 | 9,944 | 10,700 | 1,220 | 810 | 2,021 | 70,035 | 92.6 |
| 1938 | [3] 47,700 | 10,120 | 10,600 | 1,220 | 830 | 1,779 | 72,249 | 95.4 |

[1] Livestock-unit equivalents for each class of livestock are as follows: Milk cows, 1; horses, 1; all other cattle, 0.44; hogs, 0.2; sheep, 0.1; poultry, 0.01.
[2] Cows and heifers 2 years old and over kept for milk.
[3] Preliminary.

Computed from data from the Wisconsin Crop and Livestock Reporting Service (table 40).

TABLE 35. *Total milk production, Barron County, 1925–38*

| Year | Milk production | | | Year | Milk production | | |
|---|---|---|---|---|---|---|---|
| | Total | Relatives | | | Total | Relatives | |
| | | (1927–37=100) | (Adjusted 1936=100) [1] | | | (1927–37=100) | (Adjusted 1936=100) [1] |
| | *1,000 pounds* | | | | *1,000 pounds* | | |
| 1925 | 244,000 | 91.3 | 80.8 | 1932 | 278,880 | 104.3 | 92.3 |
| 1926 | 256,000 | 95.7 | 84.8 | 1933 | 262,950 | 98.4 | 87.1 |
| 1927 | 258,000 | 96.5 | 85.4 | 1934 | 236,640 | 88.5 | 78.3 |
| 1928 | 275,000 | 102.8 | 91.0 | 1935 | 246,920 | 92.0 | 81.4 |
| 1929 | 280,890 | 105.0 | 93.0 | 1936 | 251,720 | 94.1 | 83.3 |
| 1930 | 291,760 | 109.1 | 96.6 | 1937 | 255,360 | 95.5 | 84.5 |
| 1931 | 304,150 | 113.7 | 100.7 | 1938 | [2] 280,000 | 104.9 | 92.9 |

[1] These percentages were based on an adjusted 1936 production figure, 302,064 pounds, which is 120 percent of the actual 1936 production figure of 251,720 pounds.
[2] Preliminary.

Wisconsin Crop and Livestock Reporting Service, Bul. 202, May 1939 [Mimeographed].

TABLE 36. *Total digestible nutrients produced by various crops in Barron County, 1925–37*

| Year | Total digestible nutrients in | | | | | | | | | Total feed | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All corn | Barley | Oats | All wheat | Rye | Wild hay | Alfalfa | Clover and timothy | Other hay | Total digestible nutrients | Index (1927–37=100) |
| | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | *1,000 pounds* | |
| 1925 | 31,591 | 11,880 | 51,285 | 379 | 614 | 2,191 | 970 | 96,968 | 3,040 | 201,898 | 112.0 |
| 1926 | 30,321 | 12,871 | 42,835 | 207 | 697 | 1,148 | 3,980 | 83,100 | 1,930 | 177,197 | 98.3 |
| 1927 | 30,315 | 14,591 | 37,320 | 339 | 403 | 1,421 | 6,880 | 121,430 | 2,950 | 215,658 | 119.7 |
| 1928 | 36,058 | 18,298 | 41,562 | 360 | 359 | 870 | 8,930 | 95,730 | 2,370 | 204,677 | 113.6 |
| 1929 | 33,619 | 18,409 | 41,607 | 361 | 508 | 1,610 | 11,339 | 107,590 | 4,351 | 219,754 | 122.0 |
| 1930 | 35,217 | 20,444 | 48,362 | 336 | 547 | 1,988 | 8,900 | 88,510 | 5,610 | 210,214 | 116.7 |
| 1931 | 28,315 | 11,875 | 33,705 | 255 | 323 | 2,064 | 7,430 | 71,040 | 6,760 | 162,728 | 90.3 |
| 1932 | 13,357 | 9,360 | 35,873 | 420 | 486 | 1,505 | 6,700 | 46,460 | 10,740 | 124,901 | 86.0 |
| 1933 | 42,352 | 5,870 | 21,498 | 425 | 770 | 1,547 | 8,600 | 45,570 | 17,460 | 147,098 | 81.6 |
| 1934 | 45,723 | 5,287 | 21,881 | 523 | 238 | 752 | 1,981 | 7,044 | 33,640 | 120,069 | 66.6 |
| 1935 | 38,893 | 8,632 | 48,140 | 1,605 | 5,120 | 916 | 20,836 | 47,895 | 26,756 | 198,757 | 110.3 |
| 1936 | 17,832 | 3,212 | 19,683 | 805 | 1,303 | 1,302 | 18,046 | 66,576 | 19,287 | 146,556 | 82.4 |
| 1937 | 42,348 | 3,247 | 31,013 | 2,423 | 6,382 | [1] 1,392 | 25,035 | 71,357 | 16,452 | 199,649 | 110.8 |

[1] 1936 data.

Computed from data from the Wisconsin Crop and Livestock Reporting Service. (See table 38.)

TABLE 37. *Acreages of crops harvested, by major classes, Barron County, 1925–38*

| Year | All corn | Small grain | All hay | Cash crops [1] | Total |
|---|---|---|---|---|---|
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| 1925 | 27,380 | 61,515 | 75,850 | 13,435 | 178,480 |
| 1926 | 27,360 | 62,820 | 76,240 | 13,830 | 180,250 |
| 1927 | 26,330 | 61,450 | 76,210 | 14,000 | 178,080 |
| 1928 | 25,310 | 64,250 | 73,150 | 17,780 | 180,490 |
| 1929 | 25,900 | 65,440 | 84,510 | 13,950 | 189,800 |
| 1930 | 27,130 | 66,260 | 77,940 | 16,250 | 187,580 |
| 1931 | 28,503 | 63,710 | 77,870 | 17,303 | 187,440 |
| 1932 | 32,260 | 65,720 | 75,880 | 14,490 | 188,350 |
| 1933 | 36,300 | 65,680 | 78,840 | 12,470 | 193,350 |
| 1934 | 51,030 | 53,350 | 67,130 | 13,830 | 185,370 |
| 1935 | 41,340 | 86,820 | 57,630 | 14,240 | 200,030 |
| 1936 | 33,170 | 72,080 | 95,600 | 11,040 | 215,490 |
| 1937 | 35,010 | 70,360 | 86,560 | 12,360 | 204,250 |
| 1938 | 35,360 | 65,200 | (2) | 8,880 | (2) |

[1] Canning peas and potatoes.
[2] Data not available.

Wisconsin Crop and Livestock Reporting Service (compiled from table 38).

TABLE 38. *Acreages of principal crops harvested, Barron County, 1925–38*

| Year | All corn | Oats | Barley | Other small grain | All tame hay [1] | Alfalfa | Clover and timothy | Wild hay | Canning peas | Potatoes | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* | *Acres* |
| 1925 | 27,380 | 48,060 | 9,550 | 3,905 | 73,140 | 440 | 70,540 | 2,710 | 6,195 | 8,240 | 178,480 |
| 1926 | 27,360 | 49,490 | 10,340 | 2,990 | 74,070 | 1,880 | 70,040 | 2,170 | 4,760 | 9,050 | 180,250 |
| 1927 | 26,330 | 47,000 | 12,050 | 2,400 | 74,120 | 2,680 | 69,880 | 1,790 | 3,810 | 11,180 | 178,080 |
| 1928 | 25,310 | 47,200 | 14,850 | 2,200 | 72,020 | 4,330 | 65,890 | 1,130 | 4,570 | 13,210 | 180,490 |
| 1929 | 25,900 | 48,880 | 14,900 | 1,600 | 82,350 | 4,930 | 74,100 | 2,130 | 4,780 | 9,170 | 189,800 |
| 1930 | 27,130 | 50,210 | 14,370 | 1,680 | 74,960 | 4,450 | 65,800 | 2,980 | 5,250 | 10,980 | 187,580 |
| 1931 | 28,500 | 48,510 | 13,790 | 1,380 | 75,190 | 4,370 | 65,400 | 2,080 | 3,620 | 13,710 | 187,440 |
| 1932 | 32,260 | 51,660 | 12,500 | 1,500 | 73,600 | 4,540 | 58,070 | 2,280 | 3,300 | 11,190 | 188,350 |
| 1933 | 36,360 | 52,080 | 11,210 | 2,300 | 76,630 | 5,500 | 50,630 | 2,210 | 4,280 | 8,190 | 193,350 |
| 1934 | 51,030 | 44,430 | 7,060 | 1,890 | 65,340 | 2,830 | 17,610 | 1,790 | 5,110 | 8,720 | 185,370 |
| 1935 | 41,340 | 67,160 | 10,480 | 9,180 | 50,440 | 8,690 | 28,140 | 1,190 | 5,950 | 8,290 | 200,030 |
| 1936 | 33,170 | 58,580 | 9,620 | 4,480 | 96,390 | 12,690 | 55,730 | 2,210 | 5,110 | 5,930 | 215,490 |
| 1937 | 35,010 | 53,250 | 4,130 | 12,920 | 81,350 | 10,690 | 64,890 | [2] 2,210 | 6,250 | 6,130 | 204,250 |
| 1938 | 35,360 | 50,400 | 4,670 | 10,190 | (3) | (3) | (3) | (3) | 4,450 | 4,430 | (3) |

[1] Includes alfalfa, clover, timothy, and other tame hay.
[2] 1936 data.
[3] Data not available.

Wisconsin Crop and Livestock Reporting Service.

TABLE 39.—*Estimated normal feed-producing capacity, with 1917–36 average yields, in 1925 and 1937, Barron County*

| Crop | 1917–36 average yield per acre | Total digestible nutrients per acre | Acreage | | Total digestible nutrients | |
|---|---|---|---|---|---|---|
| | | | 1925 | 1937 | 1925 | 1937 |
| | *Bushels* | *Pounds* | *Acres* | *Acres* | *1,000 pounds* | *1,000 pounds* |
| Barley | 27.2 | 1,018 | 9,550 | 4,130 | 9,725 | 4,206 |
| Oats | 34.3 | 768 | 48,960 | 53,250 | 37,617 | 40,913 |
| All wheat | 16.6 | 707 | 305 | 3,160 | 291 | 2,518 |
| Rye | 15.9 | 725 | 830 | 9,380 | 602 | 6,801 |
| Corn | 25.6 | 983 | 27,380 | 35,010 | 26,915 | 34,416 |
| | *Tons* | | | | | |
| Wild hay | 1.1 | 770 | 2,710 | [1] 2,210 | 2,087 | 1,702 |
| Alfalfa | [2] 1.8 | 1,800 | 440 | 16,690 | 792 | 30,042 |
| Other hay [3] | [4] 1.3 | 1,300 | 72,700 | 67,660 | 94,510 | 87,958 |
| Total | | | | | 172,539 | 208,556 |

[1] 1936 acreage.
[2] 13-year average, 1924–36.
[3] All tame hay minus alfalfa.
[4] 11-year average, 1926–36, for clover and timothy was used.

TABLE 40.—*Numbers of livestock in Barron County, 1925–38*

| Year | Milk cows [1] | All other cattle | Horses and mules | Hogs | Sheep | Chickens |
|---|---|---|---|---|---|---|
| | *Number* | *Number* | *Number* | *Number* | *Number* | *Number* |
| 1925 | 45,500 | 23,500 | 13,000 | 16,600 | 7,100 | (2) |
| 1926 | 45,600 | 24,100 | 12,300 | 16,300 | 10,000 | 228,000 |
| 1927 | 44,300 | 24,100 | 12,080 | 17,100 | 12,300 | 244,000 |
| 1928 | 43,400 | 23,100 | 12,890 | 16,500 | 11,500 | 244,000 |
| 1929 | 48,000 | 24,700 | 13,510 | 14,900 | 11,100 | 230,000 |
| 1930 | 48,900 | 25,700 | 12,500 | 8,400 | 10,200 | 244,200 |
| 1931 | 50,400 | 28,200 | 12,170 | 9,500 | 10,800 | 245,900 |
| 1932 | 52,500 | 28,500 | 11,830 | 9,900 | 10,600 | 223,500 |
| 1933 | 51,500 | 26,400 | 11,610 | 8,300 | 9,300 | 225,700 |
| 1934 | 52,200 | 26,500 | 11,100 | 7,200 | 8,900 | 220,700 |
| 1935 | 44,600 | 20,100 | 10,500 | 4,800 | 8,500 | 192,700 |
| 1936 | 44,600 | 21,400 | 10,700 | 6,200 | 8,300 | 206,200 |
| 1937 | 45,400 | 22,600 | 10,700 | 6,100 | 8,100 | 202,100 |
| 1938 | [3] 47,700 | 23,000 | 10,600 | 6,100 | 8,300 | 177,900 |

[1] Cows and heifers 2 years old and over kept for milk.
[2] Data not available.
[3] Preliminary.

Wisconsin Crop and Livestock Reporting Service.

TABLE 41.—*Butterfat production for 41 selected farms and prices paid by 1 creamery in Barron County, 1926–37*

| Year | Butterfat production | | Price of butterfat in cream [1] | |
|---|---|---|---|---|
| | Total | Relatives (1927–37=100) | Per pound | Relatives (1927–37=100) |
| | *Pounds* | | *Cents* | |
| 1926 | 115,484 | 90.0 | 48.8 | 134.1 |
| 1927 | 121,611 | 94.8 | 52.1 | 143.2 |
| 1928 | 133,918 | 104.4 | 51.6 | 141.9 |
| 1929 | 135,683 | 105.8 | 48.9 | 134.5 |
| 1930 | 140,139 | 109.2 | 40.9 | 112.5 |
| 1931 | 135,540 | 105.7 | 29.3 | 80.7 |
| 1932 | 124,890 | 97.4 | 21.5 | 59.0 |
| 1933 | 122,598 | 95.6 | 23.6 | 64.9 |
| 1934 | 113,713 | 88.6 | 26.9 | 74.0 |
| 1935 | 118,533 | 92.4 | 32.5 | 89.4 |
| 1936 | 132,783 | 103.5 | 36.8 | 101.3 |
| 1937 | [2] 131,749 | 102.7 | [3] 35.9 | 98.8 |

[1] Prior to Jan. 1, 1930 the charge for hauling was deducted before the monthly price was established. Prices paid by Barron Cooperative Creamery.
[2] Data adjusted to complete the year.
[3] Price to 1 patron.

TABLE 42.—*Total milk production (for sale) in 1936 and estimated production at different prices, 24 farms, Barron County*

| Price situation | Milk production for sale | | | Milk production corrected for normal feed conditions [1] | | |
|---|---|---|---|---|---|---|
| | Total | Relatives | | Total | Relatives | |
| | | (1936 actual =100) | (1936 normal =100) | | (Adjusted normal= 100) | (A=100) |
| | *Pounds* | | | *Pounds* | | |
| 1936 actual | 2,079,584 | 100.0 | 91.1 | 2,079,584 | 83.3 | 76.7 |
| 1936 normal | 2,283,517 | 109.8 | 100.0 | 2,495,501 | 100.0 | 92.1 |
| A | 2,470,598 | 119.2 | 108.6 | 2,710,114 | 108.6 | 100.0 |
| B | 2,700,078 | 129.8 | 118.2 | 2,949,682 | 118.2 | 108.8 |
| C | 2,302,215 | 110.7 | 100.8 | 2,515,405 | 100.8 | 92.8 |

[1] The corrected milk-production data were obtained by estimating feed production available with long-time normal yields for the area. The normal feed-producing capacity in this area was about 20 percent greater than that actually realized in 1935 and 1936. The normal milk production as estimated from the 24 farm records was only 9.8 percent above actual production. Hence an additional correction was applied to make the final adjusted normal milk production 20 percent above actual 1936 production. The same correction was applied to the A, B, and C estimates.

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