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BEEF CATTLE PRODUCTION IN MINNESOTA

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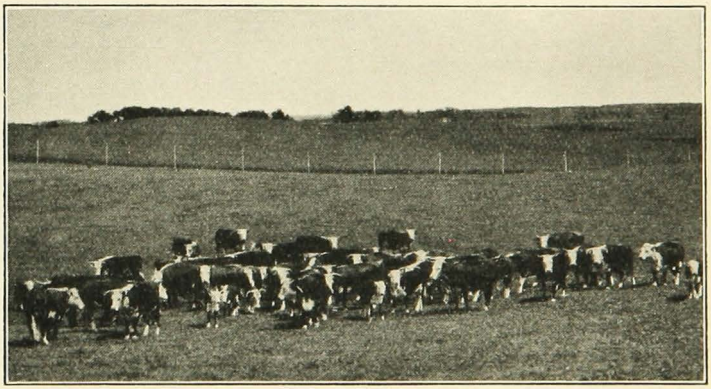

UNIVERSITY FARM, ST. PAUL

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BEEF CATTLE PRODUCTION IN MINNESOTA

C. W. CRICKMAN, G. A. SALLEE, and W. H. PETERS

INTRODUCTION

The experience of three generations of farmers has demonstrated that systems of farming with beef-cattle production as a major enterprise have provided a profitable utilization of the farmer's resources, including land, labor, and capital, on a considerable number of farms in southern Minnesota and on a less number scattered throughout other sections of the state, particularly in western Minnesota.

The purposes of this bulletin are: (1) to set forth the functions of beef cattle in the agricultural industry, (2) to trace briefly the forces influencing the development of the beef-cattle enterprise in Minnesota, (3) to outline the present status of the industry in the state, (4) to present and discuss the unit factors of cost in the production of beef cattle under the various systems of management commonly practiced in Minnesota, (5) to indicate the conditions, physical and economic, under which beef cattle have a comparative advantage in the organization of Minnesota farms, (6) to present approved practices of beef-cattle management, and (7) to bring together such information as is available on the beef-cattle supply and price situation.

METHOD OF STUDY

During the three-year period, 1929 to 1931, detailed accounting records of the farm business were obtained on each of 20 or more selected beef-cattle farms in Rock and Nobles counties in southwestern Minnesota, the part of the state where beef-cattle farming is most widely practiced. These data were collected and analyzed under the co-operative supervision of the Divisions of Agricultural Economics and Animal Husbandry, Minnesota Agricultural Experiment Station, and the Bureau of Agricultural Economics, United States Department of Agriculture.[1]

[1] The authors wish to acknowledge assistance from the chiefs and members of the staffs of the Divisions of Agricultural Economics, Minn. Agr. Expt. Sta., and Farm Management and Costs, Bureau of Agr. Econ., in organizing and developing this study, and in reviewing and criticising the manuscript. Special credit is due Robert H. Loreaux, who supervised the collection of the accounting data in the field, and C. J. Gilbert and C. G. Gaylord, county agricultural agents in Rock and Nobles counties, respectively, for their assistance throughout the study. The thanks of the authors and of the divisions making this study are extended to the following farmers in Rock and Nobles counties for their co-operation in furnishing data for this bulletin: George Anderson, Oscar Anderson, Tobias Anderson, Victor Anderson, James Baird, Charles Barnes, Morton Bassett, Arthur Birkett, James Burnham, Milford Davis, James Ellsworth, C. O. Fodness, Vernon Goembel, Gustave Greve, Henry Kanis, Charles F. Kuhl, John Larson, Lindeman Bros., Hubert Loonan, Albert Malmquist, Ralph Meyer, E. F. O'Toole, W. G. Perkins, L. E. Rasey, John Recker, Lawrence Rolph, Albert Schmidt, Harvey Schmidt, John Schweitzer, J. F. Searles, and John C. Wester.

The Division of Animal Husbandry has conducted during the past thirteen years a number of experimental trials in beef-cattle feeding at University Farm, St. Paul, and at the Northwest Experiment Station, Crookston. These and other available data have been analyzed in order to present to the farmer the information needed in making a decision as to whether beef-cattle production is a relatively profitable enterprise under conditions prevailing at his farm and in the market.

CHANGING PLACE OF CATTLE IN MINNESOTA FARMING

The functions of beef cattle have changed with the changing economic and technical status of the agricultural industry in the various parts of the cornbelt. This change has been particularly marked in Minnesota, where the acreage in corn has increased rapidly within recent years.

During the period of settlement and the gradual encroachment of cultivation upon the native grasses, cattle grazing moved ahead of the plow throughout southern Minnesota. Thus until about 1890 the production of beef cattle in Minnesota was fundamentally a matter of pasturage, with the feeding of prairie or timothy hay in winter, but with little or no grain fed except in fattening. Only a small percentage of the steers were grain fattened. Corn, in this early period, was not a leading crop. More cattle were raised within the state than could be fattened on the corn available. Some of the mature steers were sold to feeders in Iowa and Illinois, but the majority were sold directly in the markets with only such finish as could be secured with the prairie grass.

The fattening of cattle on grain in the early period was left largely in the hands of large-scale operators. They seldom started the steers on a grain ration until they were three years old or more. The cheap pasturage available for growing the steers to maturity outweighed the smaller feed cost in the fattening of younger animals. The mature steers usually were started on feed in the fall and kept on a heavy grain ration throughout the winter and oftentimes well into the following summer, the feeding period extending over an eight-to-ten months' period. Sixteen hundred pounds was not an unusual weight for such steers when ready for market.

With the rapid increase in settlement of the prairies during the late eighties and the nineties, however, the possibilities of raising cattle on cheap prairie grass and the first stage in the development of the beef-cattle industry came to an end in Minnesota. The proportion of improved farm land increased in Cottonwood County, for example, from about 60 per cent at the beginning of the decade to more than 90 per cent

at its close. The increase was equally rapid in neighboring counties. Much of the grazing land was broken and put into crops, principally wheat. In the Red River Valley large-scale wheat farmers broke the prairie ahead of any development in cattle grazing. Thus wheat farming became the chief interest for a decade or more, and cattle raising was given less attention than previously. Low prices for beef cattle during the period of the nineties, also, contributed to the decline in the number of cattle.[2] But the decline proved to be only temporary.

After 1900, significant changes in the cropping systems in southern Minnesota were under way. The acreage in wheat decreased rapidly with a corresponding increase in feed crops, particularly corn (see Fig. 1).

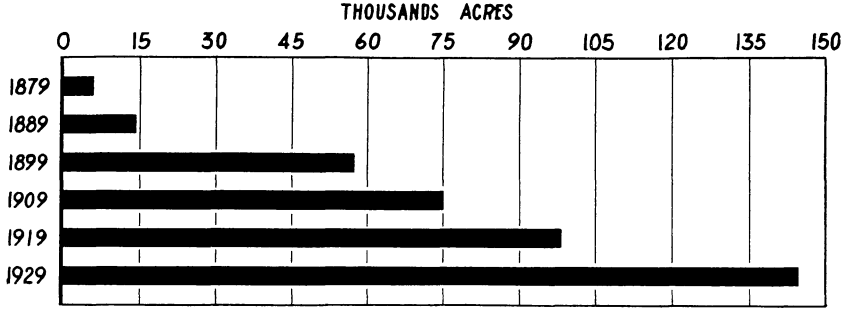

Fig. 1. Acreage in Corn in Nobles County, 1879-1929, by Decades
The development of the beef-cattle enterprise in southwestern Minnesota since about 1900 has been closely related to the rapid increase in corn production.

Corn was gaining a comparative advantage over wheat. The price of corn was rising steadily. Starting in 1896 at an average price of 22 cents per bushel for the country as a whole, it continued to mount, reaching an average of 59 cents in 1915. The development of varieties of corn better adapted to the climate of Minnesota was another significant factor in the expansion of the corn acreage. Clover and timothy had been substituted for timothy alone, and alfalfa was being introduced into the cropping system. The introduction of the silo had provided the means for storing corn fodder as a succulent feed. Through the substitution of the higher-yielding leguminous forage crops for timothy, the competition between the forages and the grain crops was more nearly equalized, thus encouraging the production of a well balanced assortment of feed crops and strengthening the mutual dependence between the crop and the cattle enterprises.

[2] Pond, George A., and Tapp, Jesse W. A Study of Farm Organization in Southwestern Minnesota. Minn. Agr. Expt. Sta. Bull. 205; also issued as U. S. Dept. of Agr. Bull. 1271, 1923.

Equally significant changes in the beef-cattle industry in Minnesota took place after 1900. With the disappearance of the abundance of native grasses and with the advancing market value of grain feeds, it was no longer possible to produce beef cattle relatively cheaply by keeping the steers on pasture during the summers and "roughing" them through the winters until they were three or four years old before fattening them. It became more economical to fatten lighter steers. Moreover, the demand in the market began to change. The export trade in highly finished, heavy, three-year-old steers declined, and well finished animals weighing 1,400 pounds and even less were no longer discriminated against, as consumers came to recognize that cuts from the lighter-weight carcass of the fat yearling or baby-beef steer or heifer could be as high in quality as cuts from the older and heavier carcasses to which they were accustomed. This change has brought about the establishment of an increasing number of small herds of cows of the beef type on medium-sized farms in the cornbelt and surrounding territory for the purpose of raising calves to be fattened on the same farm for marketing as baby beeves or fat yearlings. Accompanying the shift to lighter weight animals were far-reaching changes in breeding practices and feeding methods. Improvement in the quality of the breeding was noticeable. Economy in feeding required an early-maturing calf. The discriminating consumer of grain-finished beef prefers his beef from an evenly finished carcass. Either a high-grade or pure-bred calf gave greatest assurance of meeting these demands. Economy in feeding and higher quality in beef were obtained also by adding nitrogeneous supplements, such as cottonseed meal, linseed meal, or gluten meal, to the farm-grown concentrates in the fattening rations. Alfalfa and clover hay, also, came into more general use.

With the beef-cattle enterprise definitely established in the state as an integral part of a diversified system of farming, its principal function is the conversion of a combination of farm-grown feeds into a salable product. Pasturage and rough feeds, such as cornstalks, straw and aftermath in meadows, produced incidental to the grain and hay crops, ordinarily must be converted into animal products to put them into a marketable form. These feeds are utilized most advantageously when fed in combination with concentrates and higher quality roughages. Moreover, marketable grains and hay fed to livestock on the farm where grown are converted into a product of relatively high specific value, thus reducing transportation and other charges involved in transferring products of the soil from remote regions to centers of population.

In addition to facilitating the economical marketing of grains and roughages and providing a means for marketing pasturage and other-

wise unmarketable roughages, beef cattle tend to equalize productive employment throughout the year on the cornbelt farm. The labor requirements of cornbelt crops, produced under modern machine methods, are highly seasonal, thus leaving the farmer without a comparable amount of employment during the winter months, if crop farming is practiced alone. A beef-cattle herd or a lot of fattening steers supply productive employment supplementary to that provided by the production of the grain and forage crops.

Furthermore, the feeding of roughages and concentrates on the farm where grown restores to the soil much of the fertilizing elements removed by the crops, if the manure is handled carefully and returned to the crop land. In fact, the primary motive in fattening beef cattle on many farms in the cornbelt is to provide manure for maintaining soil fertility. On such farms the direct cash returns often do not exceed materially the feed and equipment charges involved. In such cases the value of the manure constitutes the principal contribution of the beef-cattle enterprise to the returns from the farm as a whole.

DISTRIBUTION OF BEEF-CATTLE PRODUCTION IN MINNESOTA

According to the 1930 census, Minnesota had on April 1, 1930, approximately 3,200,000 cattle. Of this total, about 30 per cent were classified as beef cattle and about 70 per cent as dairy cattle.[3] The estimated number of beef cattle, including calves, totaled approximately 925,000. Some beef cattle are raised in practically every county, but the principal producing sections of the state are the southwest, the southeast, and, to a much less degree, the west central and the Red River Valley. The number of beef cattle per 1,000 acres of farm land in each county of the state in 1930 is shown in Figure 2. Counties having an average of 27 or more head of beef cattle per 1,000 acres are shaded on the map in Figure 2, with various types of hatching, the density of the shading depending on the average number of head per 1,000 acres of farm land. The distribution of beef cattle in all other counties having less than an average of 27 head per 1,000 acres of farm land is indicated on the map by the numbers in each county. Sixty-five per cent of the beef cattle in the state in 1930 were in the 34 shaded counties. The 17 counties having an average of 47 or more head per 1,000 acres of farm land included 40 per cent of the total number. Rock, Nobles, Jackson,

[3] The number of beef cattle was estimated by excluding from the total number of cattle on farms the number of cows and heifers kept for milk on all farms, together with all other cattle on "dairy farms," as reported by the Fifteenth Census of the United States: 1930. Agriculture, Vol. III, Third Series, Type of Farm.

Martin, Fillmore, and Olmsted counties are leading counties in respect to the number of beef cattle per 1,000 acres of land in farms. The western part of the state north of the Minnesota River is primarily a

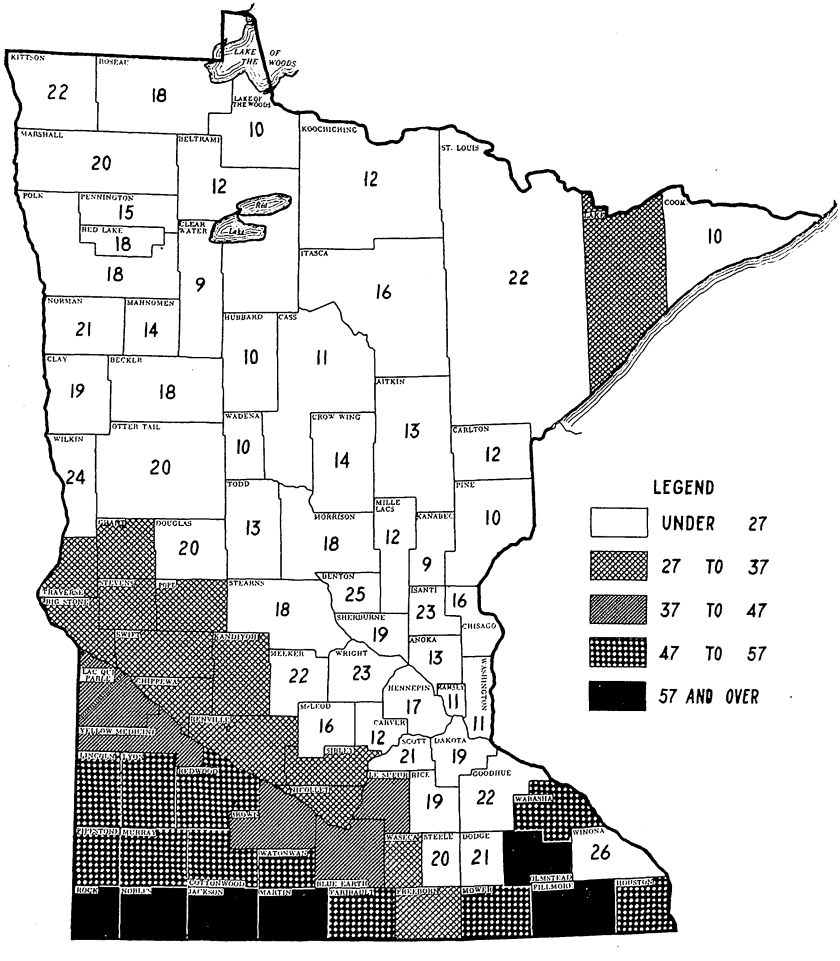

Fig. 2. Number of Beef Cattle per 1,000 Acres of Farm Land in Minnesota, April 1, 1930, by Counties

Twelve counties in southwestern Minnesota and five counties in the southeastern part of the state had 40 per cent of the total number of beef cattle in Minnesota in 1930.

cash-crop area, with relatively less attention given to livestock than in other parts of the state. If, however, the number of beef cattle in each county is expressed as a percentage of the total number of cattle in that county (see Fig. 3), thus comparing the numbers of beef cattle with

the numbers of dairy cattle, the proportion of beef cattle in the Red River Valley and west central Minnesota compares favorably with the proportion in the southwestern and southeastern parts of the state.

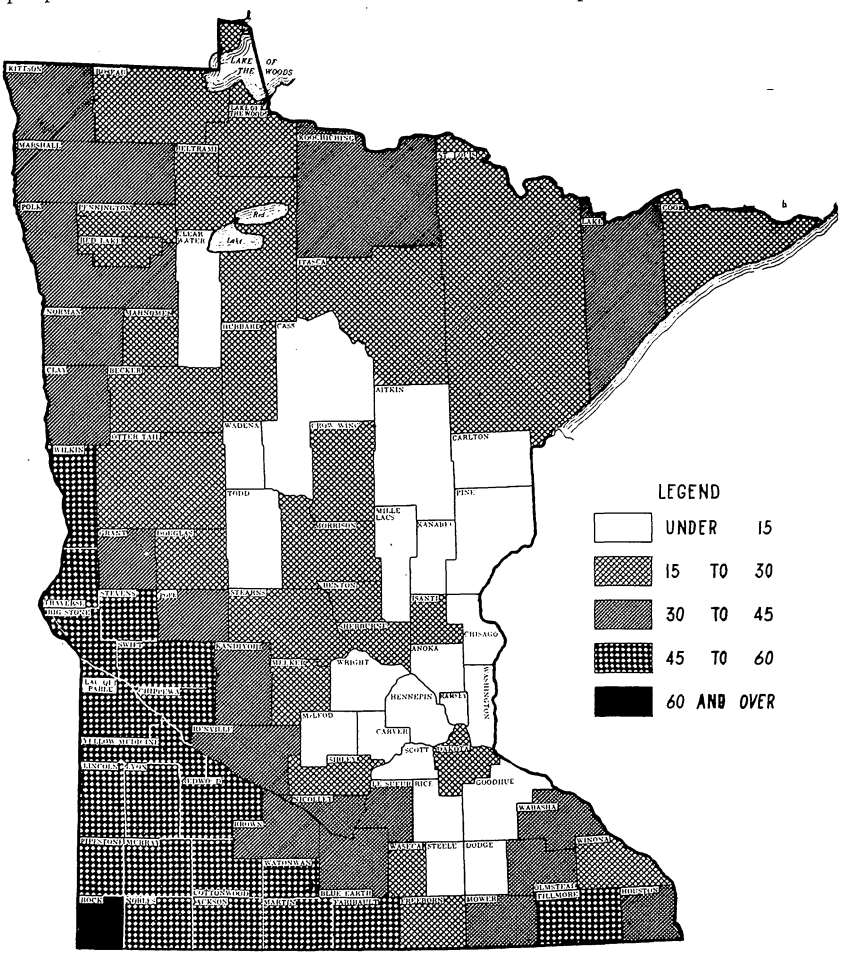

Fig. 3. Percentage of Total Number of Cattle in Minnesota That Was Beef Cattle, April 1, 1930, by Counties

West central Minnesota and the Red River Valley are primarily cash crop areas, with less attention given to cattle production than in other parts of the state. However, among the farmers having cattle there is a relatively high proportion that have beef cattle.

Because of differences, to be pointed out later, in methods of handling cattle in various parts of the state, the distribution of beef-cattle numbers, if taken alone, does not indicate accurately the relative importance of beef-cattle production in the different parts of the state. The distribution of beef-cattle production is better indicated if the numbers of beef animals per 1,000 acres of farm land in the various

counties in 1930 are weighted by the percentage of farm land in feed grains in 1929 in the respective counties, as reported by the Bureau of the Census (see Fig. 4). The availability of larger amounts of fattening grains in southwestern Minnesota as compared with the southeastern part of the state makes it economically feasible to market a higher proportion of the cattle from the southwestern part of the state with a grain finish and at heavier weights.

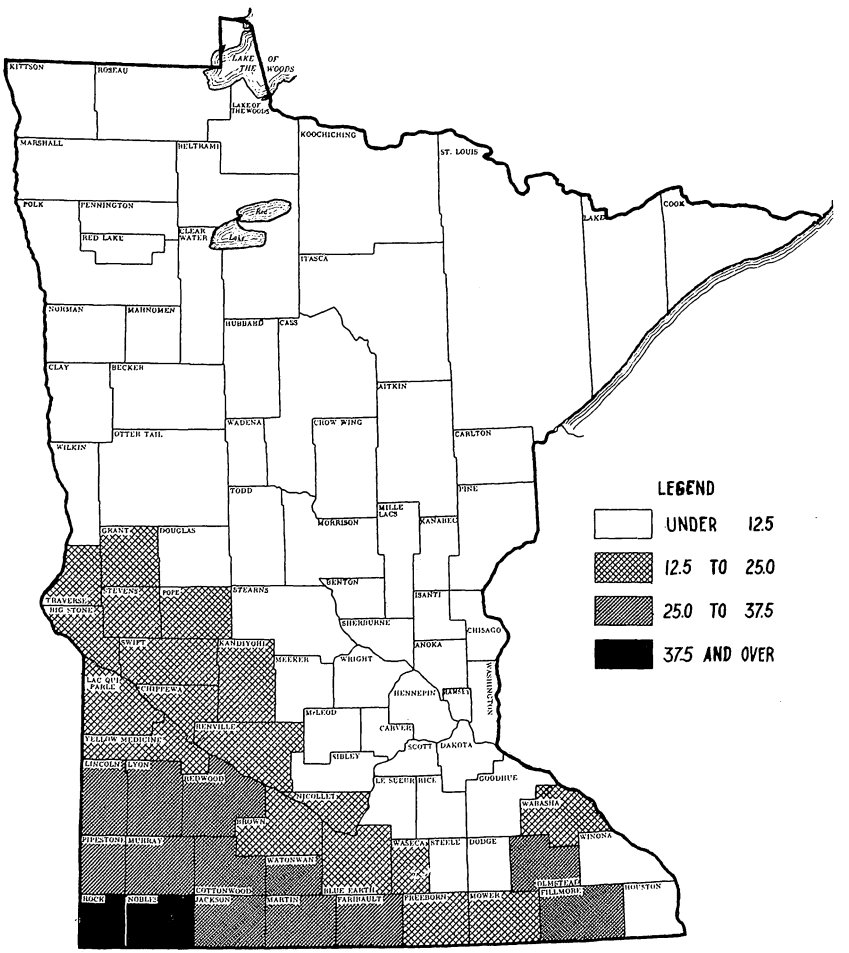

Fig. 4. Distribution of Beef-Cattle Production in Minnesota, 1930, by Counties

The relative importance of the beef-cattle enterprise is closely related to the production of fattening grains, particularly corn. The concentration of beef cattle in five counties in southeastern Minnesota shown in Figure 3 is largely the result of an attempt to use large areas of pasture and hay land to the best advantage rather than fattening grains.

SYSTEMS OF BEEF-CATTLE FARMING

Southwestern Minnesota

In southwestern Minnesota, the raising and fattening of beef cattle is one of the major agricultural enterprises. The cattle enterprise in this part of the state is closely related to the amount of corn and pasture available. In the majority of counties in southwestern Minnesota the average percentage of farm land in pasture ranged from 15 to 20 per cent in 1929 (see Fig. 5). Much of the land that was in pasture in 1929 is either too rolling or too wet to permit its use for the growing

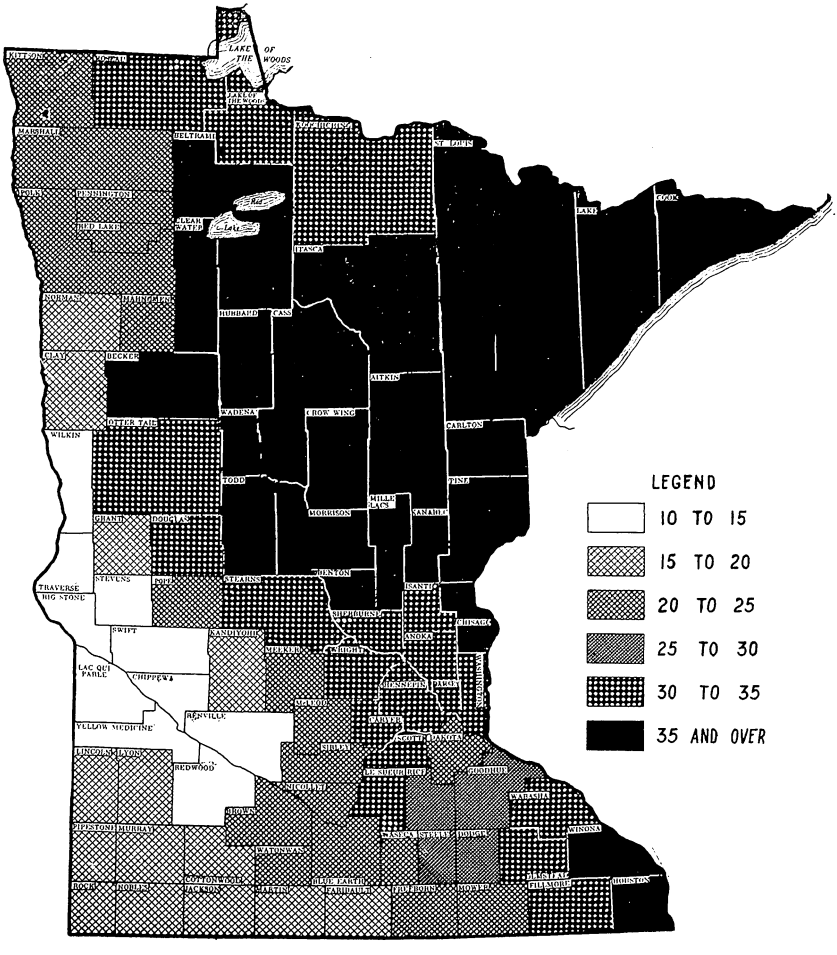

Fig. 5. Percentage of All Farm Land in Minnesota in Pasture, 1929, by Counties

In general, the proportion of the farm land that is in pasture is closely related to the percentage of the farm area that is non-tillable land.

of cultivated crops. Feed grains are the principal crops grown. An average of from about 50 to 70 per cent of all land in farms was in feed grains in this part of the state in 1929 (see Fig. 6). As an average condition, about one-half of the land that was in grain crops was in corn in 1929 (see Fig. 7). Alfalfa is the leading tame hay crop.

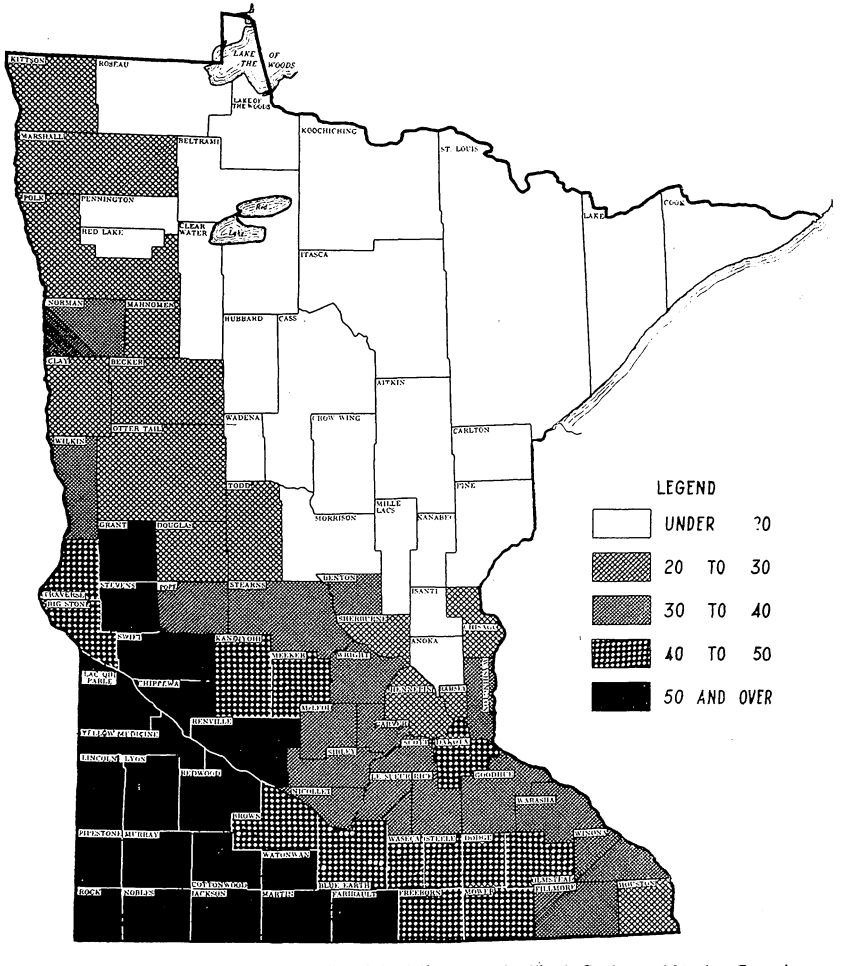

Fig. 6. Percentage of All Farm Land in Minnesota in Feed Grains, 1929, by Counties
The area of surplus feed grain production in Minnesota is confined largely to the southwestern part of the state.

To utilize these combinations of pasturage and crops, three fairly distinct systems of beef-cattle farming, in combination with hog raising, have developed. Beef-cattle farmers in southwestern Minnesota ordinarily keep herds of from 5 to 35 cows of beef or milk-and-beef breed-

ing. In some instances the cow herd is maintained primarily for the raising of calves for fattening as baby beeves. The numbers of cows on these farms range from 15 to 35. They usually are either purebreds or high-grades. The Shorthorn and Hereford breeds are represented in greatest numbers. Spring freshening predominates. The calves are

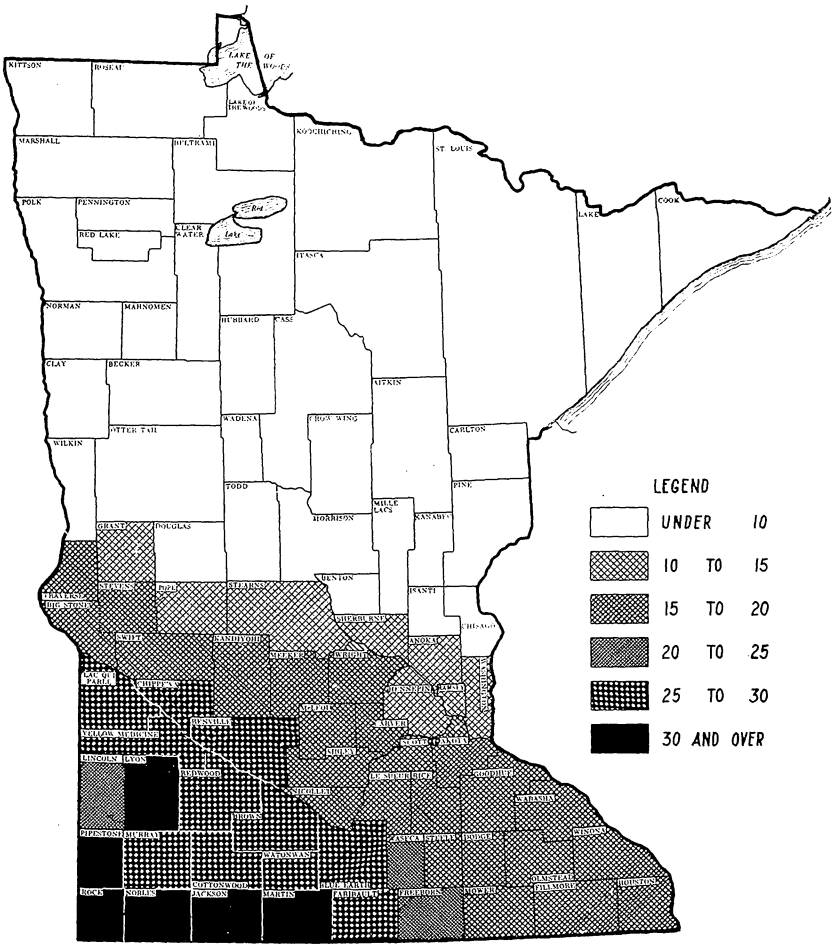

Fig. 7. Percentage of All Farm Land in Minnesota in Corn, 1929, by Counties
Within the last 25 years corn has supplanted wheat as the leading crop in southwestern Minnesota.

permitted to take the milk from their dams until they reach the weaning age, and are then fattened on a full feed of concentrates and roughages. The feeding period ranges from 200 to 225 days. On other farms the cattle enterprise is a combination of beef-cattle production and dairying.

The herds on these farms generally are of the milk-and-beef type. The numbers of cows in the herds range from 5 to 25. Freshening dates frequently are distributed throughout the year. The cows are milked and the calves are hand-fed, largely on skimmilk, until they are old enough to depend entirely on pasture or a grain and roughage ration. If fattened as baby beeves, the calves usually enter the feed lot weighing about 350 pounds. The calves born during the late summer and fall usually are roughed through the winter and carried on pasture for another season before fattening. A third group of farmers purchase additional calves or feeder steers, which are fattened during the winter and early spring months. Frequently the raising of beef cattle is a distinctly minor part of the beef-cattle enterprise on farms on which purchased cattle are fattened.

The extent to which feeder cattle have been shipped from public stockyards to Minnesota farms during recent years is indicated in Table 1. The shipments vary widely from year to year; in 1920 the number of feeder cattle shipped to farms in the state was about 35,000, whereas in 1922 the shipments had declined to about 18,000. In 1929 the number was 42,000 head; in 1931, it was only 28,000. The volume of the feeder-cattle movement from public stockyards to cornbelt feed lots, involving as it does a considerable capital risk, is closely related to the beef-cattle price outlook. This is especially true in Minnesota, where the surplus of corn on each farm is seldom as large as in parts of states centrally located in the cornbelt. If both the cattle and a significant part of the corn are purchased, the fattening enterprise is more a commercial venture than an integral part of a fairly continuous farm production program. Minnesota feeders of purchased cattle for this reason tend to be in-and-out of the business to a greater extent than feeders more centrally located in the cornbelt.

Table 1

Shipments of Inspected Feeder Cattle from Public Stockyards with Percentage Going to Minnesota, 1920-32

Year	Total shipments	Shipments to Minnesota	Percentage shipped to Minnesota
	Thousands	Thousands	Per cent
1920	3,285	35	1.1
1921	2,827	25	0.9
1922	4,039	18	0.4
1923	3,799	22	0.6
1924	3,276	31	1.0
1925	3,098	36	1.2
1926	3,087	32	1.0
1927	2,974	25	0.8
1928	3,204	29	0.9
1929	3,080	42	1.4
1930	2,951	41	1.4
1931	2,694	28	1.0
1932	2,312	21	0.9

Southeastern Minnesota

In the group of five counties constituting the beef-cattle area in southeastern Minnesota, the herds, including cows and young stock, are larger, yet the beef-cattle enterprise is less important than in southwestern Minnesota. A higher percentage of the land is in pasture (Fig. 5) and hay, and a lower percentage in feed grains (Fig. 6) in the southeastern part of the state than in the southwestern part. Baby-beef or commercial-steer feeding is practiced on only a small percentage of the farms, primarily because of the large amount of land that by reason of topography and soil must be devoted to hay and pasture, thus resulting in a relatively small production of concentrated feeds. Most of the farmers depend on a diversified agriculture for their income. Dairy products, hogs, and poultry products each constitute an important source of income. The cows are commonly of the milk-and-beef type. The usual practice is to "short-feed" or "warm-up" the yearlings or two-year-olds for market after the grazing season by feeding silage, roughage, cottonseed meal, and a light grain ration for a period of from 75 to 110 days. The feeding is done in small feed lots. The partially finished cattle are marketed from early December to late March.

The shortage of feed grains, particularly corn, has prevented Mower, Fillmore, Olmsted, Wabasha and Houston counties in southeastern Minnesota from becoming a cattle-feeding area, while the nature of much of the pasture has prevented the development of a more intensive dairy enterprise. The typical southeastern Minnesota pasture is not a dairy pasture; the carrying capacity is relatively low, the growth does not provide a good quality of pasturage throughout the pasture season, and the pastures have a tendency to "burn-out" during the latter part of the summer. Forty per cent of the pasture area in Fillmore County in 1929 was woodland pasture.

West Central and Northwestern Minnesota

Livestock production is relatively of little importance in the agriculture of the Red River Valley and west central Minnesota. There appears to be no good reason, however, why the practice of raising and fattening beef cattle should not become more general. Feeds suitable for beef-cattle production, such as barley, oats, alfalfa, and sweet-clover hay and pasture, are produced in abundance on many farms. The substitution of sweet clover pasture for the native grasses is removing the most serious handicap to cattle production.

At present most herds in this area are relatively small and of the milk-and-beef type. The average size of herd in different parts of the Valley ranges from two or three cows to 10 cows in the areas of heaviest

concentration.[4] The cows are more numerous where conditions are relatively more favorable to the production of feed crops as compared with cash crops. Generally, the cows are milked and the calves are raised by hand and marketed partially finished before they reach the age of two years. But there is a growing interest in the raising and fattening of baby beeves. In feeding trials at the Northwest Experiment Station at Crookston, comparing barley with shelled corn as the concentrate in rations for fattening baby beeves, the ration containing corn as the farm-grown concentrate produced only slightly higher average daily gains and finish than did the one containing barley, and with the relative market prices of the two grains considered, the barley-fed calves returned a larger margin of profit.[5]

UNIT FACTORS OF COST IN BEEF-CATTLE PRODUCTION

A knowledge of the unit factors of cost in producing and fattening beef cattle is essential in planning a successful organization of the farm business which includes beef cattle. Such knowledge enables a farmer to forecast the demands of the beef enterprise for his resources and the income and expense involved. In order to determine the unit factors of cost actually incurred in producing and fattening beef cattle in Minnesota, a three-year study was made of the organization and operation of farms in Rock and Nobles counties on which the raising or fattening of beef cattle was a major enterprise.[6]

The farms studied were representative of beef-cattle and hog farms found throughout southwestern Minnesota. They averaged approximately 340 acres in size, with 260 acres in crops and 65 acres in pasture. Approximately 34 per cent of the total area of the farm was in corn, 28 per cent in oats and barley, 6 per cent in tame hay, 5 per cent in flax, and 4 per cent in wild hay. In most cases, the pasture was blue grass or native pasture. On the average, approximately 40 per cent of the cash receipts were from cattle, 5 per cent from milk products, 31 per cent from hogs, and 14 per cent from crops.

One or more of the three systems of beef-cattle management de-

[4] For a more complete discussion of the livestock enterprises in the Red River Valley, see Minn. Agr. Expt. Sta. Bull. 283, An Economic Study of Livestock Possibilities in the Red River Valley of Minnesota, by George A. Sallee, George A. Pond, and C. W. Crickman.

[5] Kiser, O. M., and Peters, W. H. Sweet Clover Hay for Beef Cattle; Fattening Baby Beeves and Two-Year-Old Steers. Minn. Agr. Expt. Sta. Bull. 261, 1929.

[6] The complete cost route method was used in making the detailed study. Complete records of the production, and the labor, power, equipment and materials used in crop and livestock production, as well as of all financial transactions, were obtained on each of 20 to 24 farms each year. All records were kept under the supervision of a route man who visited each farm two or more times each month. This method is described in detail in Minn. Agr. Expt. Sta. Bull. 205, by G. A. Pond and J. W. Tapp, 1923.

scribed on pages 11 to 14—beef, milk-and-beef, and the fattening of purchased cattle—was found on each of the farms studied. Altho there was some mixture of these three systems of management on several farms, on practically every farm one system was markedly predominant.

The important differences in organization among the groups of farms operating under different systems of beef-cattle management were:

1. The farms on which the beef system of management was followed averaged 20 acres more than the farms on which the milk-and-beef system was used. This difference in total acres was almost entirely due to a like difference in the amount of pasture.

2. As a result of a larger number of animals and a higher value per head, the investment in cattle was larger on the farms on which the beef system of management was followed than on those with the milk-and-beef system. The investment in cattle during the feeding period was the largest where cattle were purchased for fattening, because a much larger number was fattened. However, the cattle that were purchased for fattening were on the farm only from six to nine months. During the rest of the year there was no investment in feeder cattle.

3. More labor was used on the farms on which the milk-and-beef system of management was practiced. Approximately the same amount of work per year was performed by the farmer himself and by hired help, regardless of the system of cattle management. Most of the additional labor required for the milk-and-beef system was provided by members of the farmer's family.

4. Fewer hogs were raised per farm on the farms with the milk-and-beef system than on the farms with the other systems of cattle management.

The unit factors of cost, including feed, labor, and miscellaneous cash costs, incurred in the production and fattening of beef cattle on these southwestern Minnesota farms are presented in the following discussion. Standards of accomplishment with average facilities and efficient management are also suggested. These standards may serve as a base for individual farmers in checking the effectiveness with which they are utilizing feed and labor in the production of beef cattle. They may also serve as basic quantities, when properly adjusted to conditions on each farm, for use in budgeting the beef-cattle enterprise in planning readjustments in the farming system. In formulating standards for feed, considerable use was made of results obtained in cattle-feeding experiments, particularly those conducted at the Minnesota Agricultural Experiment Station. In general, the methods followed and the amounts of feed and labor used in raising and fattening beef cattle in other parts of the state will closely approximate those used in southwestern Minne-

sota, except as the quantities of feed and labor used in the more northern areas may be larger because of the substitution of barley for corn and because of the longer and more severe winters.

For convenience, the discussion of the unit factors of cost and the standards is divided into three parts. The first part deals with the management of the breeding herd, the second with the raising of young cattle, and the third with the fattening of cattle for market. The discussion of the breeding herd and of the raising of young cattle in each case is divided on the basis of management into two sections. The first section deals with the herds maintained under a beef system of management, and the second section with those maintained under a milk-and-beef system.[7] Varying conditions seem to make desirable numerous combinations of cows, young stock and fattening cattle, as well as variations in methods of management. An attempt is made to present standards in such a manner that they can be used in setting up an organization involving any particular combination of cows, young stock and fattening cattle, or any method or combination of methods of management that may be desired.

Breeding Herd

Beef System.—The conditions under which a breeding herd is maintained under the beef system of management in Minnesota have been discussed. It was also indicated that under the beef system of management the calves are allowed to run with the cows, taking all the milk they produce. Because the calves raised are almost the sole source of income from the beef herd, the calves must be produced at low cost and be of such quality as to command a high price when sold on the market, if the keeping of the breeding herd is to be profitable. Well-bred, high-quality calves usually command a considerable premium on the market when sold as fat cattle, and usually mature earlier and make more rapid gains than common or scrub calves. For these reasons, considerable attention is given to securing breeding stock that will produce high-quality calves. Cows and bulls of desirable beef type have been relatively high in price. During the three-year period, 1929-31, the average value of the cows and bulls in the beef herds studied was $77 and $126, respectively. Under these conditions, farmers have hesitated to part with a bull that sired high-quality calves, or with cows that regularly produced them. To reduce the cost per calf, it has been the prac-

[7] In the following discussion, the term "beef herds" is used to indicate herds that are maintained under a predominantly beef system of management. In these herds a few cows may be milked, but the majority of them are used entirely for raising calves. Likewise the term "milk-and-beef herds" is used to indicate herds that are maintained under a predominantly milk-and-beef system of management. In these herds a few cows may be allowed to nurse their calves, but the majority of them are milked and their calves raised on skimmilk.

tice to keep satisfactory breeding animals for several years. By keeping the cows and bulls from eight to ten years, their original cost was distributed over a large number of calves, thereby reducing the cost per calf. As a result of this policy, replacements were very irregular both as to number and time. Each year there were herds in which no replacements were made and others in which a relatively large proportion of the cows were replaced. On the average, less than one cow out of 10 was replaced each year. More than 80 per cent of the replacements were made with heifers raised on the farm.

Shelters provided for breeding herds varied from lightly constructed sheds to well built barns. Investments in buildings used for breeding herds varied from $141 to $1,571 per farm and from $5 to $53 per head. The average investment over the three-year period was approximately $457 per farm and $19 per head.

Little, if any, special equipment, other than racks for feeding hay or other roughage, was provided for use by the breeding herd. When the cream separator and utensils for handling milk and cream are included, investments in equipment varied from $28 to $106 per farm, averaging $68. Expressed on a per head basis, they varied from $1.25 to $7.69, with an average of $2.80.

In the better managed herds on the farms studied, the cows calved in the spring and nursed their calves until October or November. In this way they were nursing their calves during the pasture season and were dry during the winter. As a result the cows could be carried through the winter with much less feed and labor than if they had been nursing calves. On other farms the bull was allowed to run with the cows and as a result calving dates were scattered throughout the year. Generally, from two to five cows were milked throughout the year on each of these farms to provide dairy products for home use. The cows that were milked were fed grain; the others seldom received any grain.

The range in the average annual amount of feed, labor, and miscellaneous cash costs used per head for the breeding herds managed under a predominantly beef system is shown in Table 2. The average annual expenditures per head for the three years of the study and suggested standards for a cow and a bull are also presented. The data in the columns showing the range and the average expenditures are on a per head basis for the herds as they existed, including the cows that were milked. The standard is for a cow that is not milked. (For the standard for a cow that is milked, see Table 3.)

The variation among farms in the amount of feed used, as indicated by the range shown in Table 2, is largely the result of differences in calving dates, the proportion of the cows that were milked, and the

emphasis placed upon the production of dairy products. When calves were dropped in the fall and winter, more feed was required to enable the cow to nurse the calf and still maintain her weight. Because the cows that were milked were fed grain, the amount of grain fed per head, based upon the total herd, increased as the proportion of the cows that were milked increased. A further cause of variation was the substitution of grain for hay when hay was relatively scarce, or hay for grain when grain was relatively scarce.

Table 2

Amounts of Feed, Labor, and Cash Costs per Head per Year for Breeding Herd
Beef System

Item	Range 1929-31*		Average	Standard	
	Low	High		Cow†	Bull
Number of head per farm	19	33	26	20-30	1
Percentage calf crop	73	96	87	90	..
Weight of calf at weaning time, lb.	300	475	404	400	..
Grain, lb.	166	658	456	....	750
Hay and fodder, lb.	678	3,226	2,029	3,000	3,000
Silage, lb.	...‡	6,937	2,148	....	....
Pasture, including cornstalks, days	191	248	228	225	225
Man labor, hr.	23	68	44	20	30
Horse work, hr.	2	9	5	3	2
Veterinary, medicine, salt, etc., cents	16	48	24	20	20

* In determining the range, only the farms on which records were obtained all three years were used. The figures are the three-year averages for the items.
† For a cow that is not milked.
‡ Silage was produced on only 29 per cent of the farms studied.

The variation in the amount of man labor and horse work used was partially the result of the causes mentioned and partially the result of differences in the adequacy and convenience of the buildings and equipment, the location of the supply of feed with reference to the place of feeding, and the methods of feeding. On some farms the supply of feed was located adjacent to the place of feeding, and on others it was necessary to carry or haul the feed for some distance. In a few cases, the cows were fed individually in stanchions. However, generally speaking, the cows that were not being milked were fed as a group. Those that were being milked were fed grain while in their stanchions, but ate their roughage from a common rack along with the other cows. Considerable time was saved when a feed rack that held a full load of feed was used.

The standards are suggested as approximate quantities which may reasonably be used under an efficient beef system of management and with reasonably convenient buildings and equipment. The standard is for a cow that freshens in the spring and is not milked, but nurses her calf until it is weaned at six to seven months of age. The amount of feed is based upon the assumption that the pasture will include the

equivalent of 1½ acres of average blue-grass pasture, as well as crop aftermath and cornstalk fields, and that straw will be used. The labor standard assumes a herd of 20 or more cows, handled and fed as a group. The standard for a bull assumes separation from the cows from December 1 to June 1. It further assumes that he will be provided with all the straw he will eat and that the pasture will include the equivalent of two acres of average blue-grass pasture. Silage is not included in the standard because many farms do not have silos and because a satisfactory ration can be provided without the use of silage. Whenever it is available, it may be substituted for the non-leguminous roughage at the rate of three pounds of silage to one pound of hay or fodder.

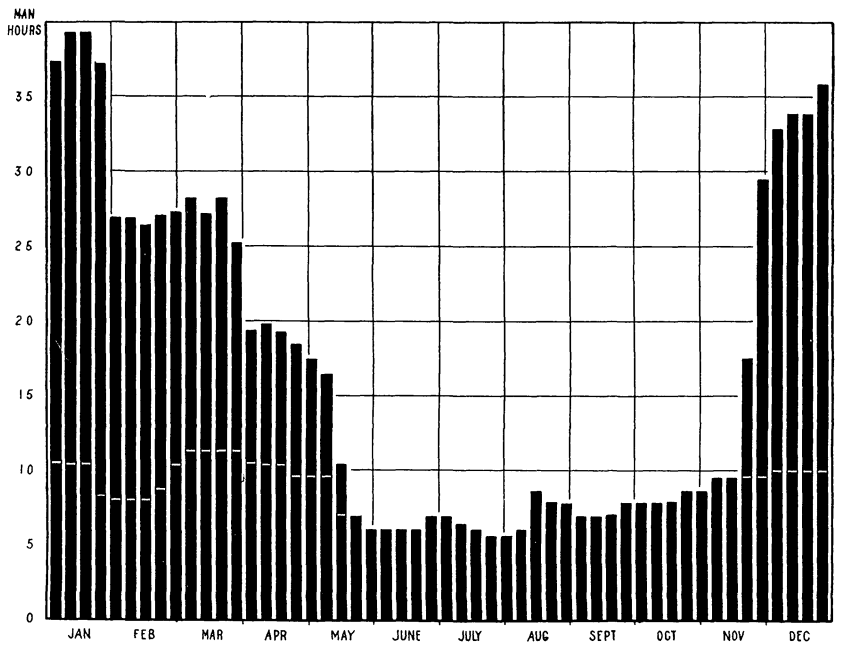

Fig. 8. Weekly Distribution of Labor Used on a Breeding Herd under a Beef System of Management

The labor distribution is for a herd of 25 cows and one bull. Four of the cows were milked. The proportion of the divided bars which is above the white line represents the labor used in caring for the nurse cows and the bull; the portion below the line and the solid bars represent that used in caring for the cows that were milked. During the busy months of the crop season, the nurse cows require little, if any, attention. The milk cows require some labor during the summer, but less than in the winter.

The weekly distribution of labor used on a breeding herd of 25 cows and one bull managed under a beef system is indicated in Figure 8. Under this system of management, a breeding herd requires very little attention from the end of the calving season until winter feeding is

begun, about December 1. As a result, the labor requirements fit well with those of a cropping organization involving a relatively large proportion of the acreage in corn.

Milk-and-Beef System.—The breeding herds on the farms where a milk-and-beef system of management was practiced contained from 13 to 19 cows of mixed breeds and breeding, the majority of which showed a preponderance of Shorthorn blood. Most of the bulls in use during the time of the study were purebred Shorthorns, but few of them were registered. The cows were milked, the cream sold, and the calves raised on skimmilk. The calves were fattened for market, generally as baby beeves or yearlings. Altho the sale of cream was an important source of income from these herds, few of the farmers fed according to butterfat production. It is doubtful if many of these cows possessed the ability to produce heavily even under the most efficient feeding and management.

Fig. 9. A Milk-and-Beef Herd of Desirable Type
The cows in a milk-and-beef herd should be, primarily, good milkers, but they should also be capable of producing beef-type feeder calves.

The average milk-and-beef breeding herd represented a smaller investment, both total and per head, than a beef breeding herd. During the three years of the study, the value of the cows and bulls averaged $64 and $114, respectively. This is $12 per head less than the value of the cows and bulls in the beef herds. Taking into consideration the difference in the size of the herds, 15 head as compared with 26 head in the beef herds, as well as the difference in value per head, the total investment was less than one-half of that in a beef herd.

On the whole, the buildings used for sheltering the milk-and-beef breeding herds were a little more expensive than those used for the beef breeding herds. This is indicated by an average investment of $493 per farm, compared with $457 for the farms on which beef herds were maintained. If the buildings used for the young stock and fattening cattle are included, the investment in buildings for the entire cattle enterprise averaged $1,133 for the beef and $1,003 for the milk-and-beef herds. The investment for the milk-and-beef breeding herds averaged approximately $33 per head.

The equipment used for the breeding herds was the same as that used for beef herds, and the investment per farm was approximately the same, averaging $69.

A milk-and-beef herd involves less risk than a beef herd, both because of the smaller investment and because of the production of both dairy products and cattle for sale. Less skill was used in the selection of the breeding stock and in the fattening of the cattle than in the beef herds. These milk-and-beef herds also involved a smaller investment, less risk, and less skill in management than a high-producing dairy herd. However, they do not offer possibilities of as large profits as may be obtained with either a beef or a dairy herd. The milk-and-beef cows generally are not capable of producing large quantities of dairy products economically, nor of raising the highest quality beef calves.

In the milk-and-beef herds, the usual dates of freshening varied from farm to farm and from year to year, but on the majority of the farms a larger number of cows freshened in the spring or early summer than in any other season. On the average, calving dates were distributed more uniformly throughout the year than in the beef herds. The number of cows milked per month was much more uniform than the number of freshenings. The calves from the cows that were to be milked were usually weaned at from one to 10 days of age.

The range in the amounts of feed, labor, and miscellaneous cash expenses per head yearly for the milk-and-beef breeding herds is presented in Table 3. The average annual expenditures for the three years studied and a suggested standard are also presented.

The amount of feed varied from farm to farm because of differences in the proportion of the cows milked, the dates of freshening, and the farmer's idea as to the amount of feed a cow should receive. Only the cows that were milked were fed grain, and as a result the average amount of grain fed per head in the herd was usually large when a large proportion of the cows were milked. Cows that were milked during the winter and spring were fed grain and hay more liberally than those that were milked during the summer and fall. Because most of the cows in the

milk-and-beef herds were milked and all that were milked received grain, the average amount of grain fed per head in the herd is considerably higher than for the beef herds.

Table 3
Amounts of Feed, Labor, and Cash Costs per Head per Year for Breeding Herd
Milk-and-Beef System

Item	Range 1929-31*		Average	Standard	
	Low	High		Cow†	Bull
Number of head per farm	13	19	15	10-20	1
Percentage calf crop	53	104	85	90	...
Butterfat produced per cow, lb.	71‡	191‡	122‡	160	...
Grain, lb.	346	2,799	1,446	1,000	730
Hay and fodder, lb.	107	3,766	2,587	3,750	3,000
Silage, lb.	...	7,154	1,055	...	...
Pasture, including cornstalks, days	191	256	236	225	225
Man labor, hr.	73	158	118	110	30
Horse work, hr.	2	10	7	4	2
Veterinary, medicine, salt, etc., cents	22	114	72	20	20

* In determining the range, only the farms on which records were obtained all three years were used. The figures are the three-year averages for the items.

† The standard is for a cow that is milked. See Table 2 for the standard for a cow that is not milked.

‡ Does not include butterfat in milk calves received, either by nursing or by hand feeding.

The amount of labor used per head varied with the proportion of the herd being milked, the number of months the cows were milked, the convenience of the buildings and facilities for feeding and caring for them, and the ability of the individual worker.

The standard for a cow is for one that is milked. It is assumed that the pasture will consist of 1½ acres of average blue-grass pasture, or its equivalent, and cornstalk pasture for one month. It is further assumed that straw will be furnished in addition to the feeds listed. The labor standard assumes a herd of 10 or more cows and reasonably convenient facilities for handling the herd. The standard for a bull is the same as for a bull in a beef breeding herd. It assumes that the bull will be stabled for six months during the year.

The distribution of labor by weeks on a milk-and-beef herd of 15 cows and one bull is presented in Figure 10. When the cows freshen in the fall and winter, a milk-and-beef herd tends to supplement crops in the use of labor. When spring and summer freshening is practiced, it competes directly with crops. If there is an abundant supply of family labor, the competition is less serious.

Young Cattle

The term "young cattle" as used here includes all cattle except the cows and bulls in the breeding herd and the cattle in the feed lot being fattened for market. The young cattle included both cattle that were to be put on feed and heifers that were being raised for

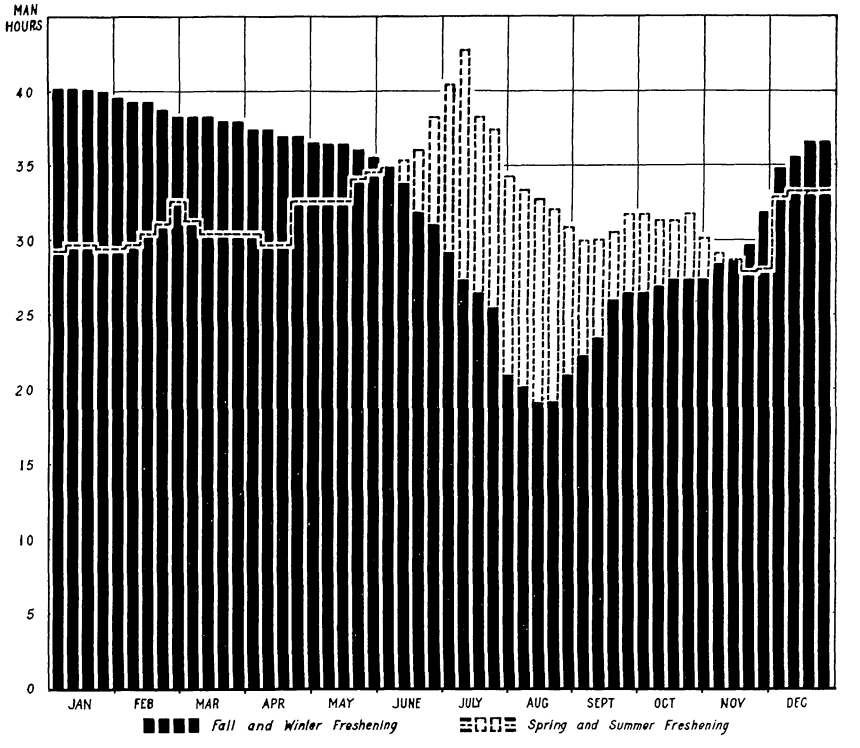

Fig. 10. Weekly Distribution of Labor Used on a Breeding Herd Under a Milk-and-Beef System of Management

Two distributions of the labor expenditure on a herd of 15 cows and one bull are shown. One is for a herd in which most of the cows freshen in the fall and winter; the other is for a herd in which the cows freshen in the spring and summer. The difference between the fall-and-winter and the spring-and-summer freshening herds in the amount of labor used during the summer months is largely the result of the difference in the number of cows milked.

breeding-herd replacements. Because calves were born throughout the year, the young cattle herds included cattle of all ages up to two years. It was impossible to separate the data on the calves and heifers raised for replacements from that on the cattle raised for fattening. For this reason, the data presented for young cattle include data for the entire young cattle herd. Generally speaking, the calves in the milk-and-beef herds that were allowed to nurse were managed in the same manner as the calves in the beef herds that nursed and that were born at the same time. Likewise, the calves in the beef herds that were hand fed were managed in the same manner as the calves in the milk-and-beef herds that were hand fed. For this reason, the discussion of young cattle in the beef herds will be confined largely to the cattle that were nursed, and the discussion of young cattle in the milk-and-beef herds to the cattle that were hand fed.

Beef System.—Fifty-four per cent of the calves in the beef herds were born in April, May, and June, with an additional 9 per cent born in July (see Fig. 11). All the calves except those from the two to six cows that were milked were allowed to run with their mothers until from six to eight months of age. The calves from the cows that were milked were fed skimmilk and usually were given enough grain and hay to offset, at least partially, the disadvantage arising from their not having been allowed to nurse. The calves that were to be fattened for market were usually put into the feed lot early in November. The calves that had been fed skimmilk were put in the same feed lot as the nursed calves and at the same time. Calves that were born in the summer or fall were carried over until the following year.

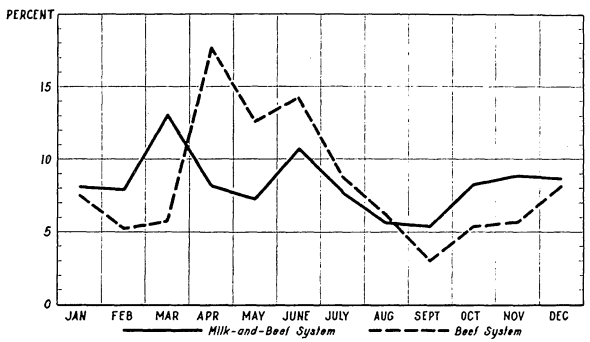

Fig. 11. Percentage Distribution of Calf Births by Months
The majority of the calves in the beef herds were born in the spring. As a result, they were old enough by late fall to be placed in the feed lot. Calf births were distributed more uniformly throughout the year in the milk-and-beef herds.

Shelters provided for young stock varied from open sheds and straw shelters to well constructed, warm barns. Investments in buildings varied from $62 to $1,472 per farm, averaging $324 for the three years. On the farms studied, the investment in special equipment used for young stock was negligible.

The range in the amounts of feed, labor, and cash cost per head for the young stock in the beef herds is indicated by the data presented in Table 4. The average annual amounts for the three-year period are also presented.

Feeding practices varied, as indicated by the data presented. Some farmers fed both grain and hay; others depended almost entirely upon pasture, crop aftermath, stalk fields, and straw to furnish feed for the young stock. The calves and heifers that received grain and hay grew more rapidly and were in better condition to freshen at two years of age than were those that did not receive grain and hay.

Table 4
Amounts of Feed, Labor, and Cash Costs per Head per Year for Young Cattle Beef System

Item	Range 1929-31*		Average
	Low	High	
Number of head per farm	12	27	20
Grain, lb.	43	534	388
Hay and fodder, lb.	25	994	369
Silage, lb.	..	3,297	523
Pasture, including cornstalks, days	164	237	196
Man labor, hr.	9	16	11
Horse work, hr.	5	4	2
Veterinary, medicine, etc., cents	1	67	39

* In determining the range, only the farms on which records were obtained all three years were used. The figures are the three-year averages for the items.

The amount of labor used varied with feeding practices and the convenience of the facilities for handling the cattle.

The standard for a heifer that is born in the spring and allowed to nurse for six months and that freshens at 24 to 27 months of age is as follows:

	First year	Second year
Grain, lb.	300	200
Legume hay, lb.	725	1,600
Pasture, excluding cornstalks, acre	0.5	1
Man labor, hr.	8	8
Horse work, hr.	1	1
Veterinary, medicine, salt, etc., cents	4	4

If freshening is delayed until the heifer is three years of age, the grain can be eliminated in the second year and 1,000 pounds of hay fed the third year. The standard assumes that straw, crop aftermath, and cornstalk pasture will be used in addition to the feed indicated. The feeding of grain and hay during the winter will help to keep the calf growing and to put the heifer in good condition for spring calving. The standard for labor assumes that the cattle will be fed as a group rather than stanchioned and fed individually.

The standard for young cattle that are raised to fatten, when an average herd is considered as a unit, is the same per head per year as the standard for a heifer for the first year. If the standard is to apply to individual calves, it should be adjusted according to the age of the calf and the length of time it will remain in the herd. The summer and fall calves that are carried over until the next year will need grain and hay during much of the winter and up to the time they can be turned on pasture. Winter calves will need very little grain or hay, if any, and spring calves none at all.

The expenditure of labor by weeks on a herd of 20 young cattle of average composition is presented in Figure 12. The amount of labor

used during the crop season is smaller than that used in the winter, but is never very large.

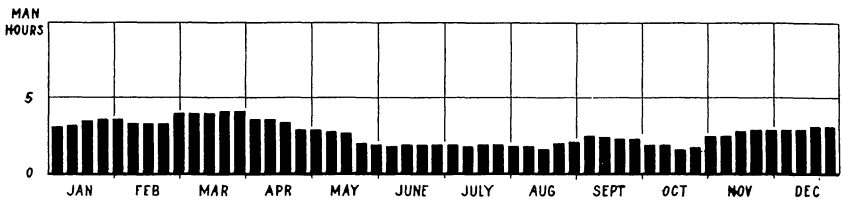

Fig. 12. Weekly Distribution of Labor Used for 20 Head of Young Beef Cattle
The young stock require the most labor in the spring when the new calf crop must be cared for, but at no time does a herd of this size require as much as five hours per week.

Milk-and-Beef System.—Calving dates were more uniformly distributed throughout the year in the milk-and-beef herds than in the beef herds (see Fig. 11). During the three-year period, 29 per cent of the calves were born in January, February, and March; 26 per cent in April, May, and June; 19 per cent in July, August, and September; and 26 per cent in October, November, and December. The largest proportion of births in any one month was 13 per cent in March, and the lowest proportion was 5.4 per cent in September. The calves were usually weaned from their mothers before they reached ten days of age, but were hand fed whole milk from one to two months. Skimmilk was then fed from four to six months. Because of the small number of calves born each year, the herds of young cattle found on these farms often contained yearling or older steers and heifers which were being accumulated until enough to make a carload could be fattened at one time. Approximately 49 per cent of the young stock that were raised and fattened for market were put in the feed lot as yearlings weighing from 550 to 650 pounds, with 600 pounds the most common weight; 28 per cent were started on feed as calves weighing from 300 to 400 pounds, with 350 pounds the usual weight.[8] The majority of the farmers following this system of management started the cattle on feed in December, approximately one month later than the calves from the beef breeding herds.

Shelters used for the young stock, on the whole, were a little more substantially constructed than those used for young stock in the beef herds. Investments varied from $11 to $1,258 per farm, with an average of $349. The investment in equipment used for the young stock was negligible.

The variations in the amount of feed, labor, and cash costs per head per year for young stock in the milk-and-beef herds and the average

[8] When put in the feed lot, the calves from the beef breeding herds weighed from 50 to 100 pounds per head more than these calves.

annual amounts used during the three-year period are presented in Table 5. As previously indicated, the herds included both hand-fed and nursed calves previous to the time they were put in the feed lot, steers and heifers being accumulated for later fattening, and also calves and heifers being raised for breeding-herd replacements.

Table 5
Amounts of Feed, Labor, and Cash Costs per Head per Year for Young Cattle Milk-and-Beef System

Item	Range 1929-31*		Average
	Low	High	
Number of head per farm	12	39	23
Grain, lb.	287	1,066	867
Hay and fodder, lb.	247	990	844
Silage, lb.	...	2,427	374
Pasture, including cornstalks, days	159	241	194
Man labor, hr.	10	24	15
Horse work, hr.	1	4	3
Veterinary, medicine, etc., cents	17	43	32

* In determining the range, only the farms on which records were obtained all three years were used. The figures are the three-year averages for the items.

The range in the amount of feed, as shown in Table 5, indicates a wide variation in feeding practices. Some farmers fed very little grain, and others fed relatively large quantities. The same was true of the feeding of hay. Part of the variation among farms is the result of differences in the proportion of cattle of the different ages, and in the length of time skimmilk and whole milk were fed. The amount of whole milk fed is not indicated because of the lack of any measure of the amount secured by the calves that nursed. In the absence of a measure of the quantity of whole milk consumed, the amount of skimmilk also is omitted. The young stock in the milk-and-beef herds were generally fed more grain and hay than those in the beef herds.

The standard for a skimmilk-fed heifer[9] that is raised to replace a cow in the breeding herd is as follows:

	First year	Second year
Whole milk, lb.	140	....
Skimmilk, lb.	2,200	....
Grain, lb.	375	200
Legume hay, lb.	725	1,600
Pasture, excluding cornstalks, acres	0.5	1.2
Man labor, hr.	12	8
Horse work, hr.	1.5	1.5
Veterinary, medicine, salt, etc., cents	7	7

The standard is for a heifer that freshens at two years of age. If freshening is delayed until the heifer is three years of age, the grain can

[9] For a standard for a heifer that is nursed see page 27.

be omitted in the second year. Approximately 1,000 pounds of hay and 1.5 acres of pasture should be provided for a two-year-old heifer.

The labor standard assumes reasonably convenient facilities and that the cattle will be fed as a group rather than stanchioned and fed individually.

The standard for other skimmilk-fed young cattle[10] in the milk-and-beef herds, considering the herd as a unit, is the same per head per year as for heifers for the first year. In using the standard for individual animals within the herd, it will be necessary to adjust the standard according to the age of the individual animal, length of the time it is fed, and the season of the year during which it is fed. Calves that are nine months old require more pasture or grain and hay than calves that are only one month old. Summer calves usually remain in the young cattle herd for 15 to 16 months before being put in the feed lot, but spring calves remain in the herd only six to nine months. Further, winter feeding requires hay and grain, but pasture usually is sufficient during the summer.

The distribution of labor by weeks on 20 young cattle in a milk-and-beef herd of average composition is shown in Figure 13. The amount of labor used on young cattle during the crop season is relatively small.

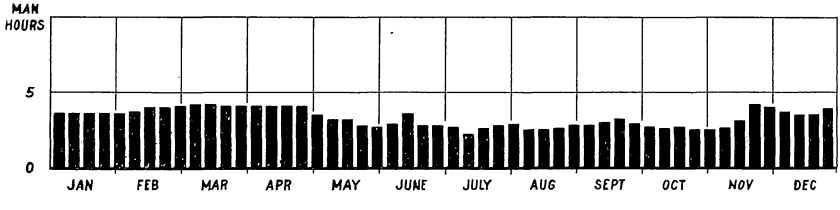

Fig. 13. Weekly Distribution of Labor Used in Caring for 20 Young Cattle Under a Milk-and-Beef System of Management
A herd of young milk-and-beef cattle requires very little labor.

Fattening Cattle

There was a wide variation among farms in the class and grade of cattle fattened for market and in the methods of feeding. Generally speaking, the calves from the beef herds were of high quality and when finished as baby beeves they often topped the market. The calves from the milk-and-beef herds were of less desirable beef type and quality. The cattle that were purchased to fatten varied from thin cows and low-grade calves and yearlings to choice calves, yearlings, and two-year-old steers. The calves from the beef herds were usually put in the feed lot in November, weighing from 400 to 450 pounds. Those from the milk-and-beef herds generally were started on feed about December 1 as

[10] For the standard for a calf that is nursed see page 27.

yearlings weighing from 600 to 650 pounds, or as calves weighing around 350 pounds. The length of the feeding period varied with the class of cattle fed and with market conditions. Because of the drastic decline in the price of fat cattle in 1930 and 1931, some lots of cattle were continued on feed for a considerable time after they would have been sold had conditions been otherwise. In exceptional cases, calves were fed as long as ten months.

With the exception of one farm, all of the fattening was done in dry lots. Most of the feeding was done during the fall, winter, and spring. Purchased cattle were usually fed during the same months as the cattle that were raised.

Shelters provided for fattening cattle varied from straw stacks to well constructed, warm barns. Investments in shelter ranged up to $1,300 per farm, depending partly upon the number of cattle provided for and partly upon the construction. The investment per 100 pounds gain in weight ranged up to $26, and averaged $3.40. Investments in the cattle themselves varied with the number of head and with the type and grade.

Fig. 14. A Group of Choice Feeder Calves

Well bred beef calves, such as are shown in the picture, are essential to the production of market-topping baby beeves.

The equipment used for fattening cattle consisted of portable feed bunks and of racks for feeding roughage. In several cases, the feeding facilities were a part of the building used as a shelter and were therefore included in the investment in shelter. The investment in portable bunks and racks was $118 on one particularly well equipped farm, but usually varied from $5 to $25.

The range in the average amounts of feed, labor, and cash costs per 100 pounds gain in weight for the cattle[11] fattened on the farms studied

[11] Because of the mixture of classes and grades of cattle fed together, it was impossible to secure significant averages for each class and grade.

is shown in Table 6. The average for the two years, 1930 and 1931, is also presented. The data cover the entire period from the time the cattle were started on feed until they were sold. The variation among farms is partially the result of differences in the cattle, which have already been discussed, and partially the result of differences in feeding practices. Some farmers fed a protein supplement and thereby obtained more rapid and economical gains than those that did not feed a supplement. In some cases, the cattle were full-fed grain and in others they were not. In one instance, the cattle were fed on sweet clover pasture. Sometimes oats formed a considerable proportion of the grain, and on other farms oats was used only for starting the cattle on feed.

Table 6
Amounts of Feed, Labor, and Cash Costs Used for Fattening Cattle

Item	Range 1930-31*		Average
	Low	High	
Pounds produced per farm per year	5,685	68,475	11,890
Per 100 pounds gain in weight:			
Corn, lb.	415	960	856
Small grain, lb.	13	445	149
Protein supplement, lb.	...	38	23
Hay and fodder, lb.	105	745	289
Silage, lb.	...	335	128
Man labor, hr.	2.3	4.8	3.5
Horse work, hr.	0.8	3.4	1.5
Veterinary, medicine, salt, etc., cents	2	21	6

* No data are presented for 1929 because data on weights were incomplete. In determining the range, only the farms on which records were obtained in all three years were used. The figures are the two-year averages for the items.

The amount of labor used varied with the methods of feeding and the convenience of the feed lot and equipment. Much more labor was used when the feed was carried out in baskets or tubs than when it was scooped from the crib directly into the feed bunks or was hauled in wagon loads. The amount of labor used also varied with the rapidity of the gains. The cattle that gained slowly were fed more days and usually received more total feed per 100 pounds gain in weight than those that gained rapidly. The labor was reduced on some farms by the use of self-feeders for the grain.

Because of the wide variety in the classes and grades of cattle that are fed, and in the length of the feeding period and the rations used, it is not practicable to attempt to set up standards for feeding all classes of cattle under all conditions. For this reason, only three standards are presented (see Table 7). The standards are for fattening "good" to "choice" calves, yearlings, and two-year-old steers in a dry lot during the fall, winter, and spring. The length of the feeding period is the time usually taken to finish properly the particular class of cattle.

Table 7
Standards for Fattening Calves and Yearling and Two-Year-Old Steers

Item	Calves	Yearlings	Two-year-olds
Length of feeding period, days	200-225	140-180	100-125
Gain per day, lb.	2.2	2.4	2.6
Per 100 pounds gain in weight:			
Feed—Grain, lb.	525	600	700
Protein supplement, lb.	60	75	90
Legume hay, lb.	200	250	325
Man labor, hr.	2.3	2.3	2.3
Horse work, hr.	0.7	0.7	0.7
Veterinary, medicine, salt, etc., cents	2	2	2

The ration of grain, protein supplement, and legume hay is a simple one that has proved highly satisfactory. The grain is assumed to be corn, with the exception of a small amount of oats which is used in starting the cattle on feed. Barley may be substituted for corn at the rate of 10 pounds of barley for 8 or 9 pounds of corn. Wheat also may be substituted pound for pound for corn with similar results. However, unless wheat is lower in price per pound than shelled corn, the wheat ration will not be as economical. Both wheat and barley should be ground for best results. If hogs follow the cattle, it makes little difference whether the corn is fed as shelled, ground, or broken ear corn, as the hogs salvage any that is wasted. In adjusting the standard to an ear-corn basis, the amount of grain should be increased 25 per cent to allow for the cobs.

In Minnesota the protein supplement most generally used is linseed meal. Cottonseed meal, soybean meal, or corn gluten meal may be used instead of linseed meal with very satisfactory results. Fairly economical gains can be obtained on a ration of corn and alfalfa hay without the use of a protein supplement. However, the use of a protein supplement is recommended because it saves other feed, increases the rate of gain, and results in a better finish. As a result of the "bloom" on cattle that have been fed a protein supplement, they usually bring a premium on the market. When the roughage is primarily non-leguminous, the feeding of a supplement becomes decidedly advantageous.

Silage is not included in the standard because many farms do not have silos and because a satisfactory ration can be provided without the use of silage. When silage is available, it may be substituted for a portion of the hay on the basis of three pounds of silage for one pound of hay. Because silage is bulky, the feeding of too large quantities results in a decrease in the amount of grain consumed and a consequent decrease in the rapidity of gains. The feeding of a protein supplement is necessary to balance a ration containing silage.

The nature of the adjustment in the standard which is necessary to make it apply to any individual lot of cattle will depend upon the breed-

ing, age, grade, and class of the cattle fattened, the length of the feeding period, the degree of finish desired, the kind of feeds available and their preparation, the season of the year during which the feeding operation is to be carried on, and the ability of the feeder. These various factors are discussed further, beginning on page 51.

The weekly distribution of labor used during the feeding period on 20 fattening cattle is shown in Figure 15. The cattle were put on feed in November and were sold the first week in June. Very few cattle normally are fed during the summer months. Under such conditions the fattening of cattle interferes only slightly with work on the crops.

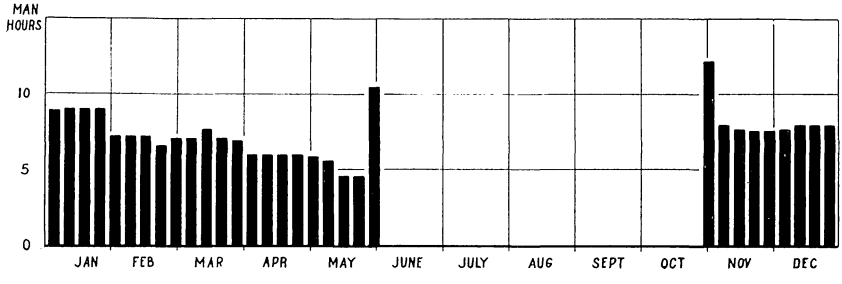

Fig. 15. Weekly Distribution of Labor Used for 20 Fattening Cattle (10,000 pounds gain in weight)

The labor peak the first week of November is due to sorting the cattle and getting them settled in the feeding lot. The peak the last week in May is the result of marketing. The fattening of a lot of cattle offers productive employment through the winter months, when there is little work on crops to be done.

RELATIONSHIP AMONG CLASSES OF LIVESTOCK AND SYSTEMS OF BEEF CATTLE MANAGEMENT IN THE USE OF THE PRODUCTION FACTORS

In the preceding section, data on the standard quantities of the different kinds of feed used in the maintenance and production of units of beef cattle and milk-and-beef cattle are presented. The amounts of labor, horse work, investment, and cash outlay per unit also are shown, together with the time distribution of the use of labor. If those data are supplemented by similar data available for competing and supplementary classes of livestock, and the collected data are summarized into a convenient form, they provide a basis for analyzing the relationships among different systems of beef-cattle management and between beef cattle and other classes of livestock in their use of the production factors, that is, the farmer's land, labor, power, and equipment.

Proportional Demands for Use of Labor, Capital, and Feed

A knowledge of the relative amounts of man labor and feed used per animal by different classes of livestock for a given production is

useful in a consideration of the kinds and number that should be kept to give the best utilization of the feed crops grown and the labor available on a particular farm. Similarly, a knowledge of the relative amounts of capital invested in the production of different classes of livestock is helpful in balancing the livestock system with the capital invested or the capital and credit available for investment. The capital investment in buildings may not be a factor of immediate importance to the farmer who already has buildings adequate for sheltering whatever numbers of livestock he chooses to keep, but it must be considered by him when making replacements and by others who have not yet equipped their farms for extensive livestock farming.

For the purpose of comparing the quantities and the proportional combinations of the production factors expended on beef cattle under different systems of management and on different classes of livestock, animals of the beef cattle and competing classes have been grouped in Table 8 into herd or drove units, which for convenience will hereafter be called herd units. Hours of man labor, dollars of invested capital, pounds of concentrates and roughages, and acres of blue-grass pasture used for the indicated production are summarized for each herd unit. Table 9 indicates the percentage distribution, by kinds of feeds, of the total pounds of concentrates and roughages fed on selected farms.

In determining the number of animals that are included in each herd unit, the limits to which the enterprise could be expanded without overtaxing the supply of any one production element were kept in mind. The number of finished cattle which constitute a lot of convenient size for marketing also was considered. For example, a baby-beef unit of 33 cows, 1 bull, 25 baby beeves, and 8 heifers for replacement provides use for approximately 76 acres of blue-grass pasture, which was the average amount available on the baby-beef farms studied in Rock and Nobles counties. Moreover, a lot of 25 baby beeves constitutes a carload. A milk-and-beef cattle unit including 20 cows utilizes approximately the same quantities of grain and roughage if the calves not needed for replacements in the cow herd are grain-finished before marketing. As the calving dates of a milk-and-beef herd usually are about equally divided between the spring and fall season, the feeders would be partly calves and partly yearlings. With a purchased-steer feeding unit, which ordinarily is supplementary to hogs in the use of concentrates, the limiting factor is the quantity of farm-grown concentrates available. The unit selected would supplement a hog unit in the utilization of the surplus corn on farms producing about 100 acres of corn. It is also of convenient size for marketing. The dairy cattle unit is a two-man enterprise that can be maintained on the feed crops grown on dairy

Table 8

Comparison of Herd Units of Specified Classes of Livestock in the Use of Labor, Capital, and Feed*

Unit	Production per animal	Man labor per unit	Capital investment per unit‡	Feed per Unit†					
				Farm-grown concentrates	Commercial protein supplement	Dry roughage	Skim-milk	Whole milk	Blue-grass pasture
Baby-beef cattle unit:§		Hours	Dollars	Pounds	Pounds	Pounds	Pounds	Pounds	Acres
33 beef cows	400 lb. gain (calf)	1,020	2,508	4,000	.....	99,000	.....	....	66.0
25 baby beeves	500 lb. gain	288	....	65,625	7,500	25,000	.....	Nursed	...
4 yearling heifers	350 lb. gain	32	229	1,200	.....	5,600	.....	....	4.0
4 heifer calves	500 lb. gain	32	81	800	.....	2,900	8,800	560	2.0
1 beef bull	.....	30	126	750	.....	3,000	.....	....	...
Building and equipment		...	1,202	.....	.....	.....	.....	....	...
Total		1,402	4,146	73,375	7,500	135,500	8,800	560	74.0
Milk-and-beef cattle unit:‖									
20 milk-and-beef cows	160 lb. butterfat	2,200	1,280	20,000	.....	75,000	.....	....	30.0
15 feeder calves and yearlings	450 lb. gain	155	....	37,680	4,500	15,000	.....	....	...
15 beef calves	475 lb. gain	180	575	5,625	.....	10,875	33,000	2,100	15.0
3 yearling heifers	350 lb. gain	36	138	600	.....	4,800	.....	....	3.6
3 heifer calves	500 lb. gain	24	60	1,125	.....	2,175	6,600	420	1.5
1 beef bull	.....	30	114	750	.....	3,000	.....	....	2.0
Buildings and equipment		...	1,072	.....	.....	.....	.....	....	...
Total		2,625	3,239	65,280	4,500	110,850	39,600	2,520	52.1
Purchased-feeder unit:									
40 yearlings	400 lb. gain	368	2,210	96,000	12,000	40,000	.....	....	...
40 two-year-olds	340 lb. gain	313	2,970	95,200	12,240	44,200	.....	....	...
Buildings and equipment		...	560	.....	.....	.....	.....	....	...
Total (yearlings)		368	2,770	96,000	12,000	40,000	.....	....	...
Total (two-year-olds)		313	3,530	95,200	12,240	44,200	.....	....	...
Dairy cattle unit:¶									
20 dairy cows	250 lb. butterfat	3,000	1,740	38,000	.....	110,000	.....	....	30.0
5 dairy heifers	350 lb. gain	175	270	2,000	.....	15,000	.....	....	5.0
5 dairy calves	450 lb. gain	175	120	1,875	.....	3,625	11,000	1,000	4.0
12 veal calves	160 lb. gain	288	....	.....	.....	.....	.....	8,400	...
1 dairy bull	.....	65	150	1,400	.....	6,500	.....	....	...
Buildings and equipment		...	2,200	.....	.....	.....	.....	....	...
Total		3,703	4,480	43,275	.....	135,125	11,000	9,400	39.0

Table 8—Continued

Comparison of Herd Units of Specified Classes of Livestock in the Use of Labor, Capital, and Feed*

Unit	Production per animal	Man labor per unit	Capital investment per unit‡	Feed per Unit†					
				Farm-grown concentrates	Commercial protein supplement	Dry roughage	Skim-milk	Whole milk	Blue-grass pasture
		Hours	Dollars	Pounds	Pounds	Pounds	Pounds	Pounds	Acres
Sheep unit:									
225 ewes	60 lb. gain (lamb)	405	2,250	16,875	.....	91,125	.....	....	67.5
225 feeder lambs	25 lb. gain	225	....	20,250	2,250	16,875	.....	....	...
6 rams	.....	30	120	450	.....	2,700	.....	....	2.0
Buildings and equipment		...	500	.....	.....	.....	.....	....	...
Total		660	2,870	37,575	2,250	110,700	.....	....	69.5
Hog unit:**									
20 sows and litters	1,450 lb. gain	436	530	116,000	(5,800)††	.....	42,500	....	9.0
Buildings and equipment		...	478	.....	.....	.....	.....	....	...
Total		436	1,008	116,000	(5,800)	.....	42,500	....	9.0

* The data for beef cattle are summarized from Tables 2, 3, and 7; those for hogs and sheep from unpublished results of the Rock and Nobles counties study; and those for dairy cattle are adapted from Minn. Agr. Expt. Sta. Tech. Bull. 44, page 22.

† For a period of one year for breeding stock, and for the gain in weight indicated for fattening animals. The gains for fattening cattle approach the upper limit of the usual range in order to indicate the maximum quantities of feed needed.

‡ Unit livestock values are 1929-1932 average March 1 inventory values of beef cattle, hogs, and sheep breeding stock and purchase value of feeding cattle bought on farms in Rock and Nobles counties; and March 1 inventory values of dairy stock on selected farms in southeastern Minnesota. Investment in shelter and equipment is average per farm value of structures and equipment used by the different classes of livestock in the two groups of counties, respectively.

§ Assumes one heifer a year per approximately 8 cows for replacements and 12 per cent death loss. Four cows would be milked.

‖ Assumes one heifer a year per approximately 7 cows for replacements and 10 per cent death loss; that cows freshen both spring and fall, thus providing a lot of feeder calves, a part of which would be yearlings. All of the cows would be milked.

¶ Assumes that calves, other than heifer calves needed for replacements (1 heifer a year per 4 cows) and those lost through death, would be vealed.

** Assumes sows would be fattened after spring litters are weaned.

†† Commercial protein supplement used if skimmilk is not available.

farms ranging from 160 acres to 200 acres in size. The amounts of pasture and roughage available are the limiting factors to a sheep enterprise, and hog production tends to have its limitations in the number of litters that can be given attention at farrowing time.

Table 9

Percentage Distribution, by Kinds of Feed, of Total Pounds of Feeds Fed to Specified Classes of Livestock on Selected Minnesota Farms*

Kind of feed	Class of livestock						
	Beef cattle			Dairy cattle			
	Cows and bulls	Young cattle	Fattening cattle	Cows	Young cattle and bulls	Sheep	Hogs
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Concentrates:							
Corn	31	37	83	11	10	56	76
Small grain	69	63	13	74	86	44	22
Commercial feeds:							
24% and less protein	..	..	1	10	3	..	..
25% and more protein	..	..	3	5	1	..	2
Total	100	100	100	100	100	100	100
Roughages:							
Alfalfa hay	28	24	34	22	20	9	...
Other tame hay	10	13	16	19	23	4	...
Wild hay	12	13	21	3	6	19	...
Corn fodder and stover	32	32	10	11	7	59	...
Silage†	18	18	19	45	44	9	...
Total	100	100	100	100	100	100	...

* Data for beef cattle, sheep, and hogs are an average of 70 farm-year records in Rock and Nobles counties during the period 1929-31; those for dairy cattle are an average of 80 farm-year records in Steele County for the same period.

† Dry basis, or one-third of actual weight.

The comparisons in Table 8 bring out the wide variation in the proportions in which the production factors are used by the different classes of livestock and by beef cattle under different systems of management. Hogs are by far the heaviest users of farm grains per unit of labor expended. They are also the heaviest consumers of available skimmilk. But they do not use any roughage and very little pasture. Purchased feeder cattle also are heavy users of concentrates per unit of labor expended. Under the system of management employed in southwestern Minnesota, they usually do not use any summer pasture. They provide use for a medium quantity of roughage. A baby-beef cattle unit provides the maximum utilization of a combination of concentrates, roughage, and pasture per unit of labor expended. A milk-and-beef cattle unit provides use for approximately the same quantities of concentrates and roughage as a baby-beef unit, but in using these quantities of concentrates and roughages it uses fewer acres of pasture. The principal difference, however, between the two systems of beef-cattle management is in the labor demands of the two units. If all of the cows are milked,

the milk-and-beef unit uses approximately twice as much labor as the baby-beef unit. A dairy-cattle unit is a much heavier user of roughage, proportionately to grain; but dairy cattle provide a market for a much smaller quantity of total feed, including pasture, per unit of labor expended than do either beef cattle or sheep. Sheep are the heaviest consumers of roughage and pasture per unit of labor expended of all classes. If the lambs are grain-fattened, sheep use a medium quantity of farm-grown grains.

The comparisons in Table 8 on the capital investment associated with the different herd units are based on 1929-1932 farm prices and on the quality of livestock and condition of structures and equipment inventoried on groups of farms that kept accounting records. These investments are higher than the present (1933) values of the animals included in the different units. The prices of the different classes of livestock tend, however, to maintain a fairly uniform long-time relationship, as indicated in Figure 22 on page 63. Assuming the price relationships to be fairly uniform, the 1929-1932 values indicate fairly accurately the investment relationships among the herd units. Any maladjustment in livestock price relationships will correspondingly affect the investments involved in the different herd units.

The investment in a beef cattle herd is greater than the livestock investment in any of the other herd units. The investment in livestock, by herd units, as presented in Table 8 was: baby-beef breeding herd, $2,944; milk-and-beef herd, $2,167; purchased-feeder unit, $2,210; dairy herd, $2,280; sheep unit, $2,370; hog unit, $530. The total investment associated with a beef cattle herd, however, was slightly less than that associated with a dairy herd of the size selected. Dairy cattle require warmer and better equipped buildings than do beef cattle. If necessary, beef cattle can be sheltered satisfactorily in straw sheds or other inexpensive structures.

Distribution of Demands for Labor

The herd units of the various classes of livestock and of beef cattle under different systems of management not only make unequal demands for man labor, but they vary widely in respect to the seasons of the year when they require most attention (see Fig. 16). It is important, in the interest of economy, from the standpoint of the farm business as a whole, that the farm family labor supply have as nearly full-time productive employment throughout the working year as is possible. Hence it is essential that classes of livestock be selected that tend to supplement rather than compete too seriously with crops in the use of labor.

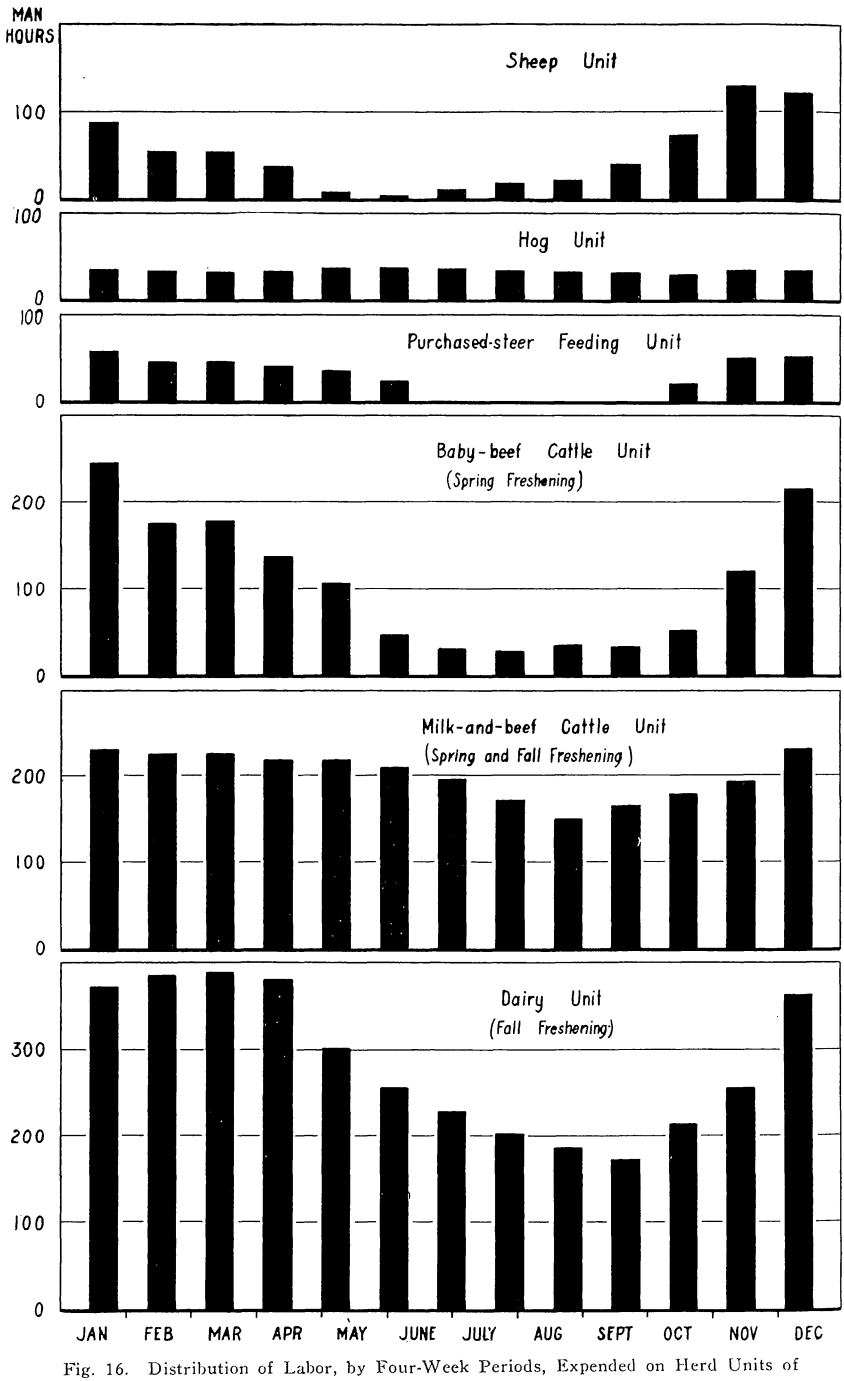

Fig. 16. Distribution of Labor, by Four-Week Periods, Expended on Herd Units of Specified Classes of Livestock

Different classes of livestock vary widely in respect to the seasons of the year when they require most attention.

Farmers on large farms, with relatively large proportions of their land in corn and small grains, are greatly rushed with crop work during the planting, cultivating, and harvesting seasons. But they do not have a comparable amount of productive employment during the winter months. The distribution of the labor demands of either beef cattle or sheep are better suited to meet this situation than are those of dairy cattle. If the beef cows nurse their calves, the breeding herd requires very little attention during the pasture season (see Fig. 16). Fattening cattle are not put into the feed lot until about November 1, and usually they are marketed ahead of the rush of the summer work. Dairy cows, on the other hand, require a fairly constant amount of labor throughout the year. There is scarcely any seasonal variation in the use of labor on hogs, and the total amount used in any season is relatively small.

COMBINATIONS OF FARM RESOURCES FAVORABLE TO THE SELECTION OF A BEEF-CATTLE ENTERPRISE

In accounting for the present distribution of beef-cattle production in Minnesota, the physical conditions in certain parts of the state which are favorable to a beef-cattle enterprise were contrasted with the physical conditions of other parts, which are more favorable either to dairying or to other types of livestock farming. And in the preceding section the functions of beef cattle, as measured by their demands upon the feed, labor, and capital resources of the farmer, were compared with those of other classes of livestock. It is proposed next to discuss the adaptation of beef cattle to forming a part of the production system of a particular farm. Two farms have been selected to illustrate the discussion. One is typical of many farms in southwestern Minnesota and of scattered farms throughout the state that are now producing baby beef. The other farm, located in the southeastern part of the state, is not so well suited to a beef-cattle enterprise. It has been developed as a fairly successful dairy farm. A comparison of the resources on these two farms, together with a comparison of the adaptability of the functions of different classes of livestock to the utilization of the resources of each farm, will indicate the typical combinations of resources on individual farms that are favorable to the selection of a beef-cattle enterprise. The inventories of the feed and livestock on each of the two selected farms are presented in Tables 10 and 11, respectively. The disposal of the feed crops on each farm is shown in Table 12. The regular labor supply on each farm consisted of two men.

Among the classified resources of these and other farms, the following are thought to be most important in influencing the choice of a system of farming that includes a beef-cattle enterprise, as contrasted

with a system that includes dairy cattle or sheep, or that provides for the direct sale of the feed crops: (1) size of farm, (2) proportion of feed crops that are concentrates and roughages, together with the protein content of both concentrates and roughages, (3) amount and quality of pasture, (4) the regular labor supply available for attending livestock, (5) the amount of capital or credit available for investment in livestock and in livestock equipment, and (6) the operator's aptitude for handling various kinds of livestock. These same factors influence the selection of the system of beef-cattle management.

Table 10
Distribution of Acreage and Production of Crops on Two Selected Farms

Use of land	Beef-cattle farm			Dairy farm		
	Area	Yield per acre	Total production	Area	Yield per acre	Total production
	Acres	Bu. or tons	Bu. or tons	Acres	Bu. or tons	Bu. or tons
Corn for grain	107	40	4,280	48	40	1,920
Corn for fodder	12	4.6	55	..	..	..
Corn for silage	..	..	..	21.5	6.5	140
Barley	22	40	880	..	..	..
Oats	47	56	2,632	..	..	..
Barley and oats	..	..	..	48	45	2,160
Alfalfa hay	14*	2	28	14	3	42
Clover and timothy hay	32*	1.2	38.4	10.5	1.2	13
Alfalfa hog pasture	9	..	..	4	..	..
Permanent blue-grass pasture	69	..	..	55	..	..
Roads and farmstead	15	..	..	6	..	..
Total	327	..	..	207	..	..

* The hay land was all pastured with young calves; the second crop of clover was harvested for seed.

Table 11
Number of Head and Production of Productive Livestock on Two Selected Farms

Kind of livestock	Beef-cattle farm		Dairy farm	
	No. of head	Production	No. of head	Production
Beef cows	28	26 calves	..	.....
Dairy cows	..	.....	21	6,300 lb. butterfat
Bull	1	.....	1	.....
Baby beeves	23	13,335 lb. gain in feedlot	..	.....
Other cattle	6	.....	16	.....
Brood sows	27	56,185 lb. marketable hogs	18	34,000 lb. marketable hogs
Chickens	265	.....	200	.....
Colts	2	.....	2	.....
Work horses	10	.....	8	.....

Size of Farm

An essential feature of a beef-cattle farm is that it be sufficiently large to provide for the production of relatively large amounts of pasturage and roughage. To maintain the breeding herd economically, roughage and pasturage must be depended upon almost entirely. Ordinarily, it is only on the larger farms that the necessity for leaving wet

Table 12

Quantities of Feed Consumed per Year Compared with Feed Crops Produced on Two Selected Farms

Feed	Units of feed consumed by							Used for seed	Produced on farm	Bought	Carried over
	Cows	Fattening cattle	Other cattle	Hogs	Chickens	Horses	Total				
Beef-cattle farm											
Corn, bu.	....	1,200	....	3,813	118	....	5,131	17	4,280	868	....
Oats, bu.	148	197	193	495	150	1,012	2,195	141	2,632	....	296
Barley, bu.	....	....	....	573	41	....	614	40	880	....	226
Commercial protein supplement, lb.	....	....	....	5,394	3,900	....	9,294	...	....	9,294	...
Alfalfa hay, tons	8.8	12.3	5.3	....	....	1.6	28	...	28	....	...
Clover and timothy hay, tons	....	5.5	....	....	....	16.5	22	...	38.4	....	16.4
Corn fodder, tons	33.7	....	1.8	....	....	15.5	55	...	55	....	...
Dairy farm											
Corn, bu.	40	....	....	1,667	....	200	1,907	13	1,920	....	...
Small grain, bu.	892	....	120	692	150	200	2,064	96	2,160	....	...
Commercial protein supplement, lb.	2,625	....	160	....	....	....	2,625	...	....	2,625	...
Alfalfa hay, tons	25.2	....	13.6	....	....	3.2	42	...	42	....	...
Clover and timothy hay, tons	....	....	....	....	....	13	13	...	13	....	...
Silage, tons	100	....	40	....	....	....	140	...	140	....	...
Skimmilk, lb.	....	....	32,000	102,000	....	....	134,000	...	134,000	....	...

or rough land out of cultivation or for supplying the rotation with a soil-conditioning grass or legume crop results in acreages of these crops that are sufficient to meet the needs of a beef-cattle herd adequate in size to balance the crops in utilizing labor. Moreover, if the young cattle are fattened on grain before going to market, a relatively large farm is needed to provide the necessary quantities of farm-grown concentrates, unless a part of the concentrates are purchased, as is sometimes done. Cattle are ordinarily second to hogs as claimants for the supply of fattening grains.

With the 1922-1931 average yields in Rock and Nobles counties (corn, 30 bushels; barley, 30 bushels; oats, 36 bushels) and the proportional relationship among the acreages of the grain crops indicated in Table 10 for the beef-cattle farm, approximately 120 acres of grain crops would be needed to furnish the farm-grown concentrates for a combination of 25 baby beeves and 20 litters of hogs (see Table 8). Approximately 35 acres would be needed for growing farm grains for work stock and chickens, making a total of 155 acres of corn and small grain. Allowing 50 acres for growing roughages, 80 acres for permanent pasture, and 10 acres for farmstead and waste land, a total of 140 acres would be needed for these purposes. It appears therefore that a beef-cattle farm on which a carload of baby beeves and 20 litters of hogs are raised and fattened should be approximately 300 acres or more in size. This accomplishment would be feasible on a somewhat smaller farm if the entire farm were tillable and sweet-clover pasture were substituted for blue-grass pasture. Sweet-clover pasture ordinarily can be depended upon to carry three to four times as many animals per acre as can be carried on blue-grass pasture. By keeping a somewhat smaller breeding herd, a baby-beef enterprise can be adjusted to farms 240 acres or more in size. If a milk-and-beef herd is maintained, the farm may be somewhat smaller than a farm on which a baby-beef herd is maintained, as relatively less pasture in proportion to other feed crops is needed for a milk-and-beef herd. With a system of beef-cattle farming in which feeders are purchased and fed in a dry lot, the number of cattle can be adjusted to the size of the farm. In order to provide sufficient farm-grown concentrates for 40 yearling or two-year-old feeders, in addition to 20 litters of hogs, the farm should be 280 acres in size or larger, depending upon the normal yields of corn. Many farms in southwestern Minnesota as small as 160 acres in size yield sufficient concentrates for a small lot of fattening cattle, if the production of hogs is reduced proportionately.

Proportional Combination of Grain and Roughage

In discussing the size of farm favorable to a beef-cattle enterprise, a relatively high proportion of the land was assumed to be devoted to concentrates as contrasted with roughages. The proportion assumed was approximately the same as indicated in Table 9 for the beef-cattle farm. On this farm 80 per cent of the crop area was in grains. This compares with 67 per cent in the organization of the dairy farm presented in Table 10. The proportion of the farm area in pasture was 21 per cent on the beef-cattle farm, as compared with 24 per cent on the dairy farm. The proportion of the farm area used for pasture on dairy farms is frequently much higher than 24 per cent, as indicated in Figure 5. A larger quantity of concentrates relative to the supply of roughages is needed for beef-cattle production than for dairying (see Table 8). In the maintenance of a dairy herd and the production of dairy products, the ratio of pounds of farm-grown concentrates to pounds of dry roughage is approximately one to three (1 to 3.2), whereas with a system of beef-cattle production, in which a herd of beef cows is maintained for raising baby beeves for fattening, the ratio is one to something less than two (1 to 1.8). With purchased feeder cattle the ratio is considerably more than two to one (2.4 to 1 with yearlings).

Equally important, if not more so, in determining the adaptation of beef cattle on a particular farm, is the proportion of the feed grains that are essentially fattening grains, particularly corn. In the illustrations presented in Table 10, 61 per cent of the harvested grain acreage on the beef-cattle farm was in corn, as compared with 50 per cent on the dairy farm. This difference in proportion of the grain acreage in corn in combination with the difference in total acreage of grain on the two farms, resulting from differences in size of farms and percentages of total area in grain crops, is of great significance in determining the choice among roughage-consuming classes of livestock. For example, on these two farms the hog enterprise consisting of 18 litters used practically the entire production of corn on the dairy farm, whereas with a hog enterprise of equal size on the beef-cattle farm there would have been approximately 2,500 bushels of corn available for a beef-cattle enterprise. In dairy production little, if any, corn is needed for providing a well balanced and economical ration, whereas in beef production corn or some other fattening grain is essential. The ration of farm-grown concentrates for a dairy herd on representative dairy farms in southern Minnesota consisted of 13 per cent corn and 87 per cent small grains, whereas the ration of farm-grown concentrates for a baby-beef herd, including the fattening calves, on farms in Rock and Nobles counties,

consisted of 80 per cent corn and 20 per cent small grain (see Tables 8 and 9). Under conditions in which the feeder cattle were purchased and a breeding herd was not maintained on the farm, the farm-grown concentrate ration for beef cattle consisted of 86 per cent corn and 14 per cent small grain. A similar comparison between a beef-cattle and a dairy herd in the class of roughages consumed indicates that 41 per cent of the roughages used by a baby-beef herd was wild hay, corn fodder, or stover, while only 14 per cent of the dairy herd ration consisted of these low-grade roughages. In addition, the beef herds undoubtedly obtained a larger proportion of their subsistence from unrecorded feeds, such as straw and cornstalks, than did the dairy herds.

Pasture

Farms so situated that their topographic or drainage features make it necessary to use annually 20 per cent or more of the farm area for pasture do not provide a satisfactory basis for the development of what is commonly called a cash-grain system of farming. The presence on a farm of (1) land that is in a large degree suitable only for pasture, or (2) a crop rotation that includes a soil-improvement pasture crop, generally makes it desirable to keep either cattle or sheep to utilize the pasture. Cattle as a major enterprise ordinarily have a comparative advantage over sheep on the cornbelt farm, unless the pasture is exceptionally low in quality. Sheep raising on a large scale in the cornbelt is handicapped with too many risks to compete on an equal basis with cattle. As between beef cattle and dairy cattle, the acreage of pasture on a particular farm is not so significant in favoring one or the other as is the quality of the pasture and the number of crop acres associated with the pasture and their adaptability to the various feed crops. Pastures that have a tendency to "burn-out" in the latter part of the summer can be used to a better advantage with beef cattle than with dairy cattle. The influence of the number of crop acres in the farm and of a high proportion of the crop acreage in fattening grains in favoring the selection of beef cattle has already been discussed.

The acreage of pasture is a factor of importance in influencing the system of beef-cattle management. A milk-and-beef herd uses less pasture proportionately to concentrates than a baby-beef herd (see Table 8). If the feeders are purchased, little, if any, pasture is used for the beef-cattle enterprise unless, as is customarily done in Minnesota, feeders are purchased for feeding together with farm-raised calves, thus combining two systems of beef-cattle management.

Labor Supply

On the relatively large farms (240 acres or more) adapted to growing feed-grain crops on a relatively high percentage of the farm acreage, the rush of work during the seeding, cultivating, and harvesting seasons is so great that the farmer with the customary labor supply is limited in the amount of attention that he and his helpers can give to livestock during those seasons. He does recognize, however, a need for a productive use for his labor supply during the winter that will be supple-

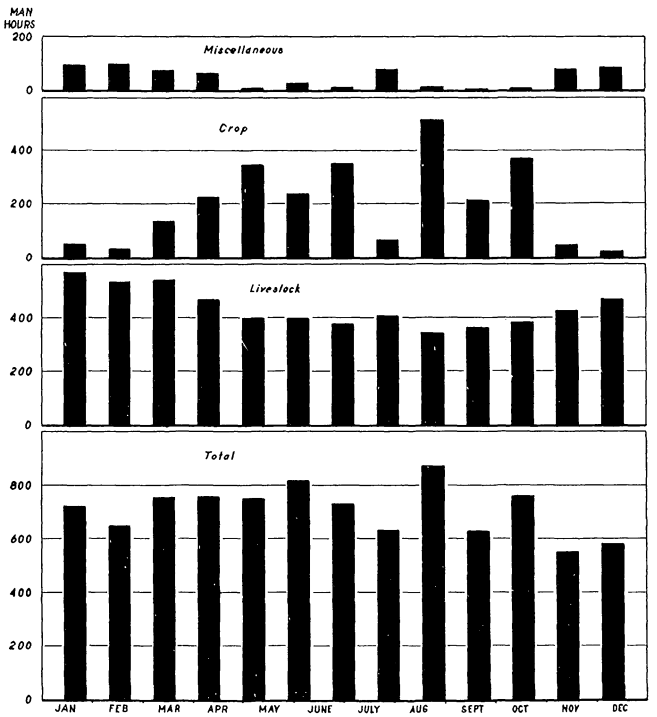

Fig. 17. Distribution of Labor, by Four-Week Periods, on the Beef-Cattle Farm Described in Tables 10, 11, and 12

The labor requirements of cornbelt crops, produced extensively under modern machine methods, are highly seasonal, thus leaving the farmer without a comparable amount of productive employment during the winter months if crop farming is practiced alone. A beef herd or a lot of fattening steers supply productive employment supplementary to that provided by the growing of grain and forage crops.

mentary to that provided by crops during the summer. The nature of the seasonal distribution of labor on a combination of beef cattle and hogs is such that the combination supplements crops by providing relatively little use for labor during the cropping season, but a much larger use during the winter season (see Figures 16 and 17). The problem of

balancing crops with livestock on large farms adapted to extensive feed-grain production is primarily that of feed utilization, as contrasted with labor utilization on farms with a smaller crop acreage. On farms that are not uniformly well adapted to feed grains, and which as a result generally are smaller than farms on which feed grains are grown extensively, the labor demands of the crops are such that more attention can be given to livestock (see Fig. 18). Dairy cattle provide productive employment for a relatively large amount of labor per unit of feed and equipment used, and the labor is fairly evenly distributed throughout the year (see Fig. 16). For that reason, dairy cattle have an advantage over beef cattle in the productive use of labor on farms that have a cropping organization somewhat similar to the smaller farm presented in Table 10.

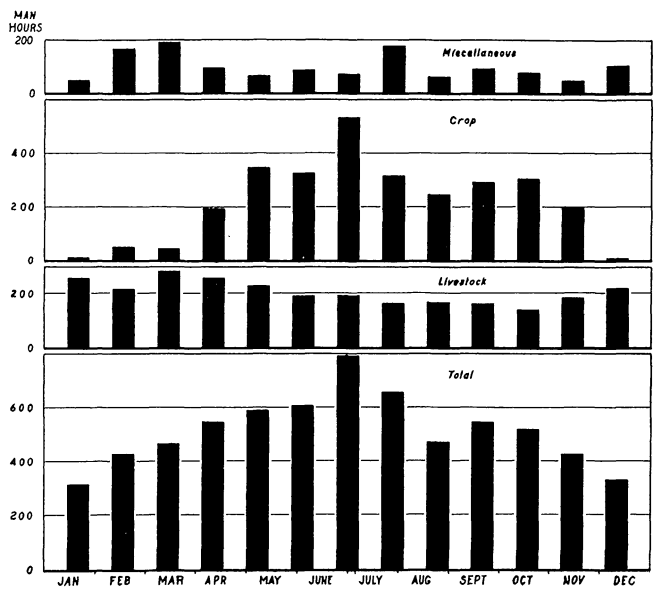

Fig. 18. Distribution of Labor, by Four-Week Periods, on the Dairy Farm Described in Tables 10, 11, and 12

On farms having a relatively large proportion of their area that is not well adapted to feed grains and which as a result generally are smaller than farms on which feed grains are grown extensively, the labor demands of the crops are such that considerable time of the labor supply is available for caring for livestock. Dairy cattle provide productive employment for a relatively large amount of labor per unit of feed used, and the labor is fairly evenly distributed throughout the year.

The milk-and-beef system of beef-cattle management represents an attempt to combine the merits of beef-cattle production for utilizing large quantities of feeds and pasture with those of dairying for labor utilization. On the farm that has insufficient pasture for carrying a

breeding herd large enough to provide the number of baby-beef calves that would be required to use the surplus of fattening grains, and that has a relatively large supply of family labor, a milk-and-beef herd frequently can be used to utilize the harvested feed crops and the extra labor supply, and still keep the size of the herd within the limits of the acreage of pasture available. If, on the other hand, the supply of both pasture and labor is small relative to the quantity of feed grains and roughages, a small breeding herd provides use for the pasture, and the feeders raised can be supplemented with purchased feeders.

Available Capital or Credit

As indicated in Table 8, the difference in total investment between a baby-beef herd unit and a dairy herd unit was not great. The distribution of the investment is favorable to beef cattle in that a smaller amount of capital is invested in building and equipment. Milk-and-beef herds include fewer animals than a baby-beef herd, and thus involve a smaller investment. With purchased feeders, the investment in buildings and equipment is relatively very small if the fattening of purchased feeders is practiced independently of cattle raising. Sheep, also, involve a small investment in buildings and equipment (see Table 8), but a more expensive type of fence is required for sheep than for cattle. The investment in fences is not included in the comparative figures in Table 8.

The percentage of tenancy frequently is relatively high on farms well adapted to the production of grain crops. In 1930 the percentage of tenancy in southwestern Minnesota ranged from 35 per cent in Brown County to 62 per cent in Rock County, as compared with 31 per cent for the state as a whole. Farm operators on rented farms often are handicapped for livestock production by the lack of adequate buildings. Under such conditions, beef-cattle production can be more readily adjusted to the use of inexpensive sheds and straw-pile shelters than can dairy production.

BASIS FOR DETERMINING THE COMPARATIVE ADVANTAGE OF BEEF CATTLE ON A PARTICULAR FARM

The characteristics of an area and of individual farms favorable to the selection of a beef-cattle enterprise have been outlined and discussed. A consideration of the relationships between the functions of beef cattle and the characteristics of a particular farm may serve as a guide to the operator in forming an opinion on whether he should include beef cattle in his system of farming. But a reliable answer to the question of whether the production of beef cattle, either as a supplementary enter-

prise or as a major line of production, will enable him to obtain a more profitable utilization of his productive resources than he could obtain with any other enterprise combination, not including beef cattle, requires a systematic evaluation of opinions gained in a preliminary survey of the situation.

As inferred in the preceding discussion, the answer involves a comparison of the results of possible adjustments of the production program to the internal conditions of the particular farm and to prospective market conditions. The land, labor, power, equipment, and other resources of an individual farm determine in a fairly definite manner the effectiveness, viewed from a physical or quantitative standpoint, with which different enterprises or combinations of enterprises may be conducted. Market conditions determine the relative prices at which the products of different enterprises may be exchanged for goods and services, as well as the comparative rates that must be paid for the elements of cash outlay connected with alternative enterprises.

The approach to a determination of the comparative advantage of beef cattle in the organization of a particular farm is a comparison of the farmer's resources, such as those described on pages 41 to 49, with the quantities of each commonly used under good management in the maintenance and production of units of the different classes of livestock. In the comparison of the amounts of labor used, the seasonal distribution also should be considered. For this comparison, the data in Tables 2 to 8 and Figures 7 to 16 will serve as a useful guide in the absence of more specialized data relating to each farm. These data are based on standard farm practice in management and in feeding on selected southwestern Minnesota farms during the period 1929-1931 and indicate general relationships. They are not to be thought of as "constants," however. It is a common experience that the quantities and the proportional combination of the various factors of livestock production that may be assumed to be standard vary from farm to farm and from year to year on farms in the aggregate. This variation is the effect, in part, of differences in the quality of the production resources, including the farmer's managerial ability, on different farms. It is the effect, also, of the possibility of substituting, within limits, from year to year, one production element for another as a means of economizing the productive factor which is either temporarily scarce among the farmer's resources or high in price in the market. Insofar as records of the business and the experience of the operator of a particular farm make it possible, it is highly desirable that the standards be adjusted to the conditions on the individual farm and to prospective market prices.

These preliminary comparisons will suggest possible combinations of

enterprises, or systems of farming, some of which may include beef cattle and some of which may not. The tentative combinations should be systematically compared by preparing a budget for each. The probable returns from the system of farming including beef cattle, as contrasted with those from other systems not including beef cattle, will indicate the comparative advantage or disadvantage of beef cattle under the conditions assumed for the particular farm and in the market.

The prices used in budgeting costs and financial returns should be based on the best information available regarding the probable trend of prices over the period for which the program is planned. In this connection, the statistical data in the concluding section of this bulletin on the present trends in production, market supply, and demand, together with the discussion of the present beef-cattle market situation should be helpful.

The application of the budget method to the problem of comparative advantage in the choice and proportional combination of enterprises is more fully discussed and illustrated in Minnesota Agricultural Experiment Station Bulletins 205, 284, 295, and Technical Bulletin 44. It is recommended that the reader consult one or more of these bulletins if he is not already familiar with the budget method of analysis. Farmer's Bulletin 1564, Farm Budgeting, issued by the United States Department of Agriculture, explains in detail the preparation of a farm budget.

SOME POINTS ON MANAGEMENT OF BEEF CATTLE

In carrying out any type of livestock-production enterprise, a number of problems arise that cannot readily be subjected to statistical analysis. This is because animals are living beings, each animal a separate unit subject to development proportionate to its inherent characteristics and the suitability of the environment in which it must live. These problems are generally summed up or classified under the heading, "Care and Management." The care given the animals and the management used in carrying out the livestock enterprise are influenced by the attitude of the farmer toward the particular enterprise in which he is engaged. If he likes the type of enterprise he has chosen and enjoys working with the type of animals he is raising or handling, he is likely to be much more successful than if he has a dislike for that type of animal. As has been pointed out earlier in this bulletin, successful care and feeding of cattle require that suitable equipment and suitable feeds be available, but even proper equipment and proper feeds will not bring success unless the feeder has some knowledge of the requirements for successful development of the type of animal with which he is working and a sincere human interest in the well-being of his animals. This fact was clearly

demonstrated by observation of the progress made on the several farms in the accounting study. This requirement is one that must be possessed by the individual operator. If he does not possess it naturally, seldom will he acquire it, and the best advice that can be given him is that he discontinue the livestock enterprise in which he is engaged and try something else that he thinks he will like better and understand better.

There were some practices in management brought out both by observation and by the statistical data that can readily be applied to advantage by all beef producers.

Importance of Well Bred Animals

A well bred animal, in the sense in which the term is here used, implies one that conforms closely to the requirements of the purpose for which it is intended and does so because of having inherited those characteristics from its ancestry. It has often been demonstrated that the well bred animal has a higher value at market time than does the poorly bred one. It has also been demonstrated that the cost for feed and care need not be higher for the well bred animal than for the poorly bred one. To say that a well bred animal of high market value can be produced just as cheaply as a poorly bred one of low market value is, however, not strictly correct because the cost of the breeding stock is also involved. This must necessarily be somewhat higher for the well bred animal than for the poorly bred one, but it need not be much higher.

One can develop successfully and profitably either a herd of milk-and-beef type cattle or a herd of beef cattle by starting with cows or heifers that show reasonable conformity to the desired type, even tho of mixed breeding. Such cows and heifers often can be purchased locally or at the market for about their immediate value for beef. In following out a constructive breeding policy, it is then essential to secure a purebred bull of a breed recognized as either a milk-and-beef type breed or a beef breed, as may be desired. It is essential that grading-up be practiced generation after generation by selecting sires from the same breed each time a purchase is made. It is essential that bulls of high merit be used. But it is also essential that conservatism be used in the price paid, because care must be taken to keep the cost of the calf at birth down to a reasonably low figure. The price that can be paid for a sire depends upon the number of cows to be bred.

The constructive, successful, and profitable breeding of beef cattle can be accomplished only when a large enough number of females, at least 20 to 30, can be mated to one sire so that the sire may be used to somewhere near his capacity for service. Under conditions prevailing in the beef industry in the past, the price that can be paid for a desirable

sire for use in producing beef calves for market would range from $125 to $175.

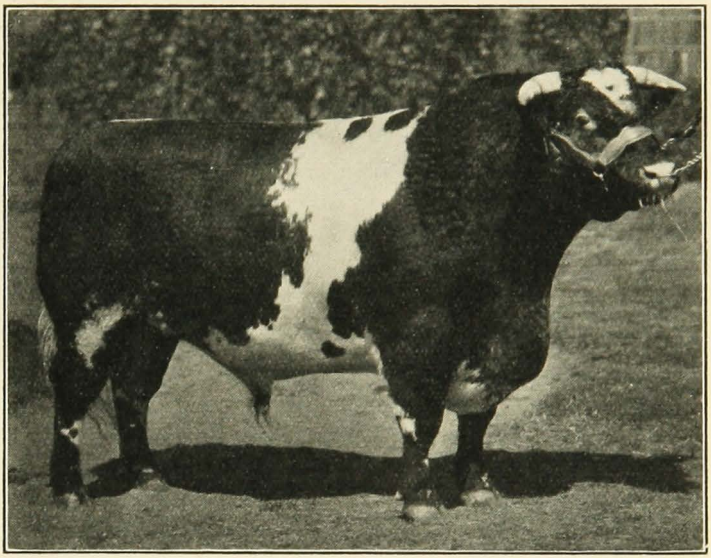

Fig. 19. A Herd Sire of Desirable Type

Good growth, thickness and smoothness of flesh, fullness of the rear quarter, and strong, yet clean-cut appearance of head and legs, are characteristics which make this bull a very desirable herd sire.

Whether a purebred or a grade herd of beef or milk-and-beef type cattle is being maintained, it is important that the cow herd be inspected carefully at least once each year and culled if necessary. Cows that are getting old and cows that have been poor producers of milk or have produced no calf or an inferior calf should be sold and replaced with the best heifers from the best cows. Where the herd of cows numbers from 25 to 30 head, it generally will be necessary to retain about five heifers each year if the herd is to be improved and the desired number of females maintained.

Importance of a High Percentage Calf Crop

An item affecting profits, brought out clearly in the study, is the number of calves raised per year in proportion to the number of cows. Where a herd of twenty or more cows is maintained, seldom will a 100 per cent calf crop be secured. The usual experience is that one or two cows will not produce a calf and that one or two calves will be lost at birth or soon thereafter. Under farm conditions of care and feed, one may reasonably expect about a 90 per cent calf crop, while under ranch

conditions a 70 per cent calf crop is considered normal and an 80 per cent calf crop can be considered good. When only one-half to two-thirds of the cows produce calves during the year, the percentage of calf crop becomes the most important item affecting profit or loss. Under proper conditions of care, the only hazard to an extremely low calf crop is contagious abortion in the herd.

Every precaution should be taken to prevent this disease, and if it makes its appearance, it is essential that it be stamped out by testing all cows and disposing of those that react to the test.

Feed for the Breeding Herd

An item of cost that showed wide variation among the farms studied was the cost of maintaining the cow herd. On some of the farms the operators were so generous in the provision of feed to the cow herd that profits were greatly reduced because of the high feed bill; on others cows were maintained on such a low plane of nutrition as to impair their health and reduce calf crops below normal.

It can readily be seen from this study that it is easy to feed a herd of beef cows too liberally for economical maintenance, and that it is also possible to feed them too poorly. A highly profitable beef-production enterprise cannot be planned without planning the cropping system for the farm along with it. Cheap and satisfactory feeding of the cow herd generally requires one acre of permanent grass pasture for a cow and her calf for spring and fall use, with one-half acre of sweet clover pasture for mid-summer use, or else two acres of permanent pasture if it is to be grazed throughout the season. For wintering, from one-half to one ton of good quality hay, such as alfalfa, clover, sweet clover, or upland prairie hay, and from one to 1½ tons per cow of low-grade roughage, such as corn fodder, sorghum fodder, sudan grass, millet or lowland hay, will be required. The one to 1½ tons of low-grade roughage may be replaced by 2 to 3 tons of corn silage. Cows producing milk in winter will require grain, in addition, according to the amount of milk they are producing. Such grain should be fed at the rate of about one pound of grain to each 4 pounds of milk produced. If proper pasture and suitable feeds for winter are not provided, one of two things will happen—either the feed bill will be too high or the cows will be fed too poorly for highest profits.

Shelter

The type of shelter required will vary with the type of enterprise. For the milk-and-beef type of cow herd it is necessary that a reasonably well built barn be provided. A barn with a good-sized loft for the storage of hay and straw is to be preferred. Tie stalls with stanchions

for the cows and box-stall space for the calves are desirable. Cows producing milk in the winter should be kept comfortable and should be well fed, and small calves being raised on skimmilk during the winter months should be kept warm and comfortable. The tie stalls should be provided for holding the cows for milking, if for no other purpose. For success, and if sanitary milk is to be produced, the cows and young calves in the milk-and-beef type herd should be housed, cared for, and fed according to the dairy cattle housing, feeding, and management plan. A cheap shed will be satisfactory for housing the fattening calves from the milk-and-beef type herd while on feed.

The size of the barn and of the feeding shed will be governed by the size of the herd maintained. To provide floor space for the housing of a herd of 30 cows, their calves during the first winter, a herd sire, and the necessary working space for feeding and handling the milk, a barn 32 feet by 70 feet, outside measurements, is the minimum that can be recommended. Allowing for from 26 to 28 calves to be fattened, a shed 20 feet by 50 feet will be required if the feeding is done in racks and bunks out-of-doors, or a shed 30 feet by 50 feet if mangers are provided so that the feeding can be done inside.

Providing shelter for the beef-type herd is a much simpler problem because the cows can run together throughout the winter and can be fed in racks and bunks out-of-doors. For a herd of 30 beef cows, a shed 30 feet by 80 feet should be provided. This will allow for partitioning off three box stalls in one end of the shed, each 10 feet wide and 14 feet deep. The herd sire can be housed in one stall, leaving the other two for handling one or two cows in each at calving time and for a few days thereafter in the spring, and for use in handling animals that may need special attention now and then. With a shed of this size for 30 cows, it would be necessary that the feeding be done out-of-doors.

It is taken for granted that successful management of the ordinary beef cow herd in Minnesota requires that the cows calve during the spring months—March to June. The calves will then run with their dams through the summer months and require no shelter. The same type of shed as is recommended for the calves from the milk-and-beef type herd through the winter fattening period will be satisfactory for the calves from the beef-type herd through the fattening period. If purchased feeder-cattle are to be fattened, it is necessary to make the feeding shed only large enough to house the desired number. Because the labor of feeding is considerably reduced by feeding out-of-doors and because fattening cattle will gain almost as rapidly and on very little more feed when fed out-of-doors than when fed in the shed, the great majority of cattle fatteners prefer the outdoor feeding plan.

Water Supply

The water supply is always a problem on any livestock farm. To solve it sometimes requires a considerable expenditure. A large supply tank is most satisfactory. It should be located on ground high enough so that water can be piped from it to automatic waterers regulated by float valves. These waterers, carrying a small supply of water, will be refilled as the water is consumed. They may be kept from freezing by kerosene lamps. The drinking tank is best located out-of-doors but in a place protected from the wind. The supply tank may be filled as needed by a windmill, gasoline engine, or electric-motor-operated pump.

Buying Feeder Cattle

On farms on which a supply of suitable feed is available for fattening more cattle than are raised, and on farms with a cropping system that does not include pasture, buying of thin animals for fattening becomes an important problem.

How to Buy.—Thin feeder cattle can be purchased in any one of several ways. The buyer may go to the ranch and purchase them directly from the producer. Comparatively few feeder cattle are purchased in this way, however, because the seller has the advantage of having his cattle at home where he can ask any price he chooses and the buyer may take them or leave them as he likes. The buyer, therefore, may have to do considerable traveling and incur too much expense in getting the cattle he wants.

Throughout the range areas commission men list cattle that are to be for sale by ranchers, and anyone wanting feeder cattle may order from them. The number obtained by this plan has been on the increase, but this method and the first mentioned, combined, have not provided a market for any large percentage of the feeder cattle of the country. As a consequence the great majority of thin feeder cattle are shipped to the large central markets to be sold, and farmers go there or send orders to purchase what they want. That such a large percentage of the feeder cattle of the country find their way to the fattening yards by this route is good evidence that it is considered by most people the most satisfactory way of both buying and selling thin feeder cattle. The development, in recent years, of producer-owned co-operative selling agencies offers an opportunity for the cattle fattener to use the services of such organizations in buying cattle on the markets or direct from the producer.

Kind of Feeders to Buy.—A question that is often uppermost in the mind of the cattle fattener is, "What kind of cattle should I buy?" Many kinds of thin feeder cattle are to be found throughout the country and on the large markets. There are thin cattle in all stages of im-

provement by breeding from veritable scrubs to high-grade and even purebred cattle of the beef breeds. There are steers and heifers of all ages, and bulls and cows—all in various degrees of thrift, growth for age, and amount of fat carried. Generally there is money to be made in fattening any of these if they are bought right. In fact, getting value received for the money invested at the time of purchase of the thin cattle is of greater importance than the particular type or grade that is purchased. There are differences in the way cattle of the different kinds should be fed to secure the largest profit. For instance, older cattle fatten in a shorter time than do younger ones. Older cattle can utilize a higher percentage of roughage than can young cattle. Older cattle make a larger daily gain than do young cattle. Older cattle require a larger amount of digestible nutrients per 100 pounds of gain than do young cattle. Heifers fatten more quickly than steers, but steers show a slightly larger daily gain than heifers. It is generally a good policy to adhere to the standard types of fairly well graded, two-year-old steers, yearlings, or calves of the beef breeds that will grade from "good" to "choice" thin feeder animals.

Time to Buy Feeders.—Since a high percentage of the cattle of the country that are sold in thin condition are produced on the ranges, and since nearly all range cattle are marketed during the months of August, September, October, and November, as shown in Figure 20, about the only time of the year that cattle suited for fattening are available in large numbers is from August to November. Generally, therefore, cattle that are to be purchased for fattening may best be purchased

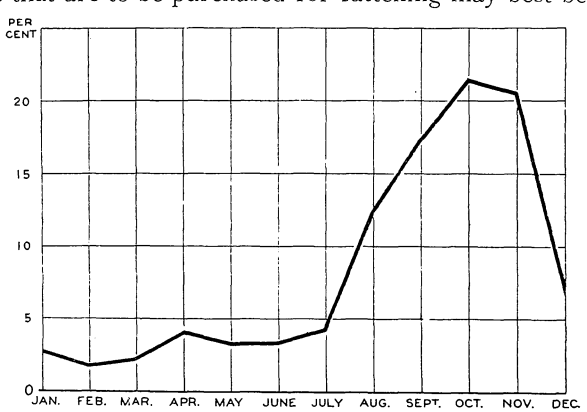

Fig. 20. Range Cattle Marketed Each Month

Most range cattle go to market in August, September, October, and November. As a high percentage of the cattle of the country that are sold in thin condition are produced on the ranges, purchases of cattle for fattening should be made during these months, even tho the feeder prefers to carry the thin cattle for a time on a maintenance ration before starting to fatten them.

during that period even though the feeder may prefer to carry the thin cattle for a time on a maintenance or growing ration before starting to fatten them. His object in carrying such cattle for a time before starting to fatten them would be to delay the date of marketing in the hope of securing a higher price by having fat cattle to sell when fat cattle are scarce. As shown in Figure 21, prices for fat cattle are generally higher between July and January than they are between January and July. The peak is usually reached in October or November. Why, then, do not more feeders market fat cattle during these two months? The answer to this question is not difficult for the experienced cattle feeder. The reason is that many factors other than the price paid for the feeders and the price received for the fat cattle affect profits. It is generally more expensive to fatten cattle through the hot summer months than it is in the fall, winter, and early spring. A larger profit often will be secured by feeding in the months most favorable for gains, even tho the cattle may sell at a lower price, than by carrying fattening cattle through the hot summer months which are unfavorable to gains.

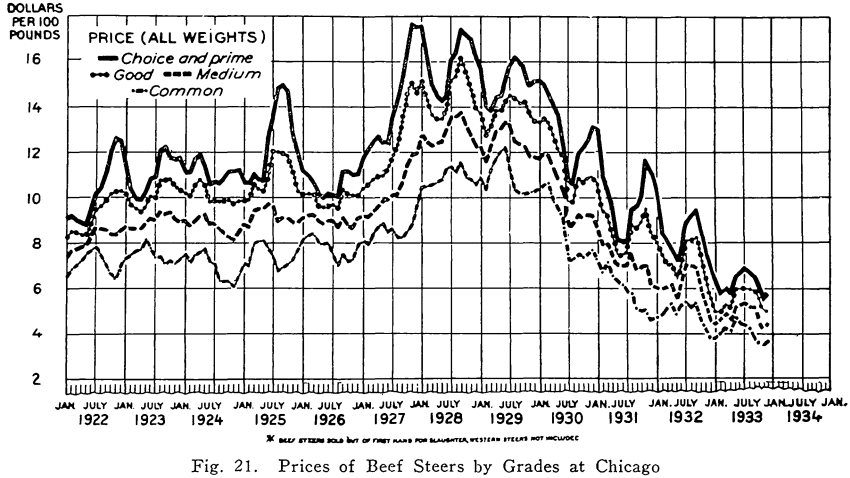

Fig. 21. Prices of Beef Steers by Grades at Chicago

The peak of fat cattle prices usually is reached during the months of October and November.

On the other hand, each succeeding year more feeders seem to be solving the problem of successfully and profitably fattening cattle by feeding grain while the cattle are on pasture through the summer months. The principal secret of success in summer fattening seems to be in holding back the cattle through the winter months, starting them on grain in April, and gradually working up to a full feed about July 1 and continuing them on a full feed of grain until ready for market. Handled in this way, two-year-olds should be ready for market in August, yearlings in September and October, and calves in November and December.

Rations for Fattening Cattle[12]

Many methods and many different feed combinations are used in fattening cattle with varying degrees of success and profit. A study of all cattle-fattening experiments conducted by the Minnesota Experiment Station to date shows that the most important factor affecting profits is the general trend of cattle prices during the period the cattle are on feed, and the suitability of the ration used is the second factor in importance. A high percentage of all cattle fattened in the United States are fattened in the cornbelt area. Since the variety of feed crops grown in this area is limited largely to corn, the small grains, and the legume and non-leguminous hay crops, it is natural that much the same feeding plan is used by the majority of successful cattle fatteners. Several so-called standard rations have been developed. They have proved profitable in experiments at the Minnesota Experiment Station in the following order: (1) corn as grain, a legume hay, corn silage and a protein supplement; (2) corn, a legume hay, and a protein supplement; (3) corn and a legume hay; and (4) corn, a legume hay and corn silage. The relative desirability of these different rations for use by individual cattle fatteners will depend on the feeds available on the particular farm, the relative prices of different feeds at the farm, the kind of cattle fed, and the relative prices for fat cattle of different degrees of finish.

The corn may be fed as ear corn, broken ear corn, corn-and-cob meal, shelled corn, or ground shelled corn. If pigs are provided to follow the cattle and the pigs are properly handled, it matters little in what form the corn is fed. It has been noted that corn-and-cob meal is an excellent from in which to feed corn to fattening cattle. Cattle fed corn-and-cob meal remain on feed with very little disturbance of the digestive system during the fattening period. Feeding corn as corn-and-cob meal simplifies the problem of feeding the right amount of corn to produce most economical gains, as the presence of the cob with the corn allows for feeding the cattle all they will eat and still limits the amount of corn consumed to about the quantity per day that will give most economical gains. Where corn is full fed, the cattle can be fed as much legume hay as they care to eat. The amount of silage should be limited to from 12 to 15 pounds per head daily for fattening calves, from 18 to 20 pounds for yearling cattle, and from 25 to 30 pounds for two-year-old cattle. When any one of the common protein supplements, such as linseed meal, cottonseed meal, corn gluten meal or soybean oilmeal, is fed, it is most profitable to feed from one to two pounds per head daily, regardless of the age or size of the cattle.

[12] For a more complete discussion on rations for fattening cattle, see Minn. Agr. Expt. Sta. Bull. 300, The Selection and Purchase of Feeders and Rations for Fattening Beef Cattle, by W. H. Peters. 1933.

Feeding all feeds regularly twice each day is the most generally approved practice relative to the frequency of feeding. Fed in this way, thin cattle can be started on the fattening ration with 2 pounds of corn per head daily for calves and with 4 pounds of corn per head daily for yearlings and two-year-olds, increasing the amount at the rate of one-half pound per head every second day for calves, and one pound every second day for yearlings and two-year-olds until a full feed has been reached. It is preferable to delay feeding the protein supplement until the cattle have reached a full feed of grain. Meanwhile, the cattle can be fed all the hay and silage they will eat. Handled in this way, a feeding period of from 100 to 125 days will be required to fully fatten two-year-old steers, from 140 to 180 days for yearlings, and from 200 to 225 days for calves.

In the above feeding plan, ground barley or ground wheat may be substituted for corn with results approaching closely those secured with corn. All or part of the legume hay may be replaced by such a roughage as prairie hay, timothy, or corn fodder. If this substitution is made, it is doubly important that a protein supplement be fed. Salt should, of course, always be before fattening cattle. It is also a safe and economical precaution to provide a simple mineral carrying calcium and phosphorus. Many other feeds may be used but generally with smaller profits than those secured when the well-known standard rations listed previously are used.

When corn and a legume hay constitute the ration fed, approximately 50 bushels of corn and 1,500 pounds of hay will be required to produce a satisfactory finish whether the animal be a two-year-old, a yearling, or a calf. When corn, a legume hay and a protein supplement are used, approximately 40 bushels of corn, 300 pounds of protein supplement and 1,000 pounds of hay will be required, while if silage is added, 35 bushels of corn, 300 pounds of protein supplement, one ton of silage and 800 pounds of hay will be required. This amount of feed ordinarily will provide for a gain of approximately 450 pounds on calves, 375 pounds on yearlings, and 320 pounds on two-year-old steers.

Pigs Following Fattening Cattle

In localities where corn is used as the grain for fattening cattle, it generally has been found that profits can be increased a little by placing some growing pigs with the cattle. The pigs will salvage any corn not eaten by the cattle, as well as the corn that passes through the cattle undigested. It is most important that pigs follow the cattle when whole ear corn, broken ear corn, or shelled corn is fed, but it will still pay to have pigs with the cattle if ground ear corn or ground shelled corn is

fed. Pigs will make practically no gain following cattle fed ground small grains. Thrifty feeder pigs weighing from 80 to 120 pounds are most suitable to follow fattening cattle. When whole corn is fed, one pig to each two-year-old steer, two pigs to each three yearling cattle, and one pig to each two fattening calves will be about the right number. When combined in these proportions the pigs will require some additional feed besides that salvaged from the cattle, and best profits from the pigs will be secured when they are fed enough additional feed so that they will gain about one pound each per day. This will generally be about one-fifth of a pound of a good protein supplement per pig daily and from one to two pounds of grain. In fattening calves, pig profits will be increased if two groups of pigs are fattened, the first group marketed when they weigh from 200 to 225 pounds and the second when the cattle are fat. Handled in this way, pigs should gain from 40 to 50 pounds from the feed salvaged per steer during a normal fattening period.

Selling Fat Cattle

Generally, once a group of fattening cattle has been brought up to a full feed of grain, the most profitable plan of procedure will be to continue them on the full feed of grain until they are fully fat and then to sell them. Attempts to delay fattening or to hold cattle that are already fat enough to suit the packer, in the hope that the price will go up, usually result in loss rather than increased profit. Any plan that may be followed to delay the time of marketing will usually result in increased costs that will equal or exceed any increase in selling price secured as a result of the delay.

It is a little difficult to describe how to tell when cattle are fat enough to suit the packer-buyer. A few trips to a central market made for the purpose of studying this question is about the only way to become informed. By careful observation of the appearance of cattle pronounced as satisfactorily fat by the buyer, the producer will quickly gain an impression as to how cattle look when fully fat.

Inexperienced feeders have been known to send cattle to market thinking they were fat enough to kill when they would sell again as feeders to go back to the country for further fattening. Seldom will it be possible to make thin cattle satisfactorily fat in feeding periods any shorter than 200 days for calves, 140 days for yearlings, and 100 days for two-year-olds.

Importance of Margin

Profits from the fattening of purchased cattle will depend partly on the success of the feeder in keeping the cost of gains below the selling price of the cattle. Another important factor affecting profits is the

margin in selling price over cost price on the original weight. For instance, if a 400-pound feeder calf costs 5 cents per pound, gains 500 pounds at a feed cost of 6 cents per pound, and sells at 7 cents per pound, the profit would be divided as follows:

Selling value of 500 lb. gain at 7 cents per lb.	$35.00
Cost of 500 lb. gain at 6 cents per lb.	30.00
Profit on gain made	$ 5.00
Selling value of 400 lb. original weight at 7 cents per lb.	$28.00
Cost of 400 lb. original weight at 5 cents per lb.	20.00
Profit on margin in selling price over cost price of 400 lb. original weight	$ 8.00

In this instance the profit made by the margin is greater than the profit made on the gains. The margin was 2 cents per pound. Occasionally a margin of more than 2 cents per pound will be secured and the profit on the margin will be still greater. Sometimes a smaller margin or even a minus margin will be experienced and this proves disastrous to profits from cattle fattening because the cost of gains is generally close to the selling price and often exceeds the selling price. Thus the only source of profit is the margin. If the cost of gains exceeds the selling price, and, in addition, there is no margin, there is no way for the fattener of purchased cattle to escape a loss. Margin, therefore, carries considerable responsibility in obtaining a profit from the cattle-fattening enterprise, and it is highly important to use the utmost care in purchasing feeder cattle.

Naturally, the trend of cattle prices during the feeding period also has an influence on margin and the fact that cattle prices may decline through the fattening period, reducing or entirely eliminating the margin, is the largest element of risk in the cattle-fattening enterprise.

THE BEEF CATTLE MARKET SITUATION

From 1921 to 1926 cattle prices were low, relative to the prices of hogs and sheep, but with the reduction in numbers of cattle slaughtered in 1927 cattle prices moved sharply upward into line with other livestock prices (see Fig. 22). During 1928 and 1929 cattle prices were at high levels, reflecting further decreases in slaughter and an unusually strong consumer demand for beef. Following 1929, demand weakened as a result of the sharp drop in consumer income; and, altho cattle slaughter continued to decrease through 1932, the trend of cattle prices has been downward since that year, and at the end of 1933 the general average was at the lowest level in more than 25 years.

The average price of cattle slaughtered under federal inspection from January to September in 1933 was $4.27 per 100 pounds, compared with $5.16 for the corresponding months in 1932 and $6.48 in 1931.

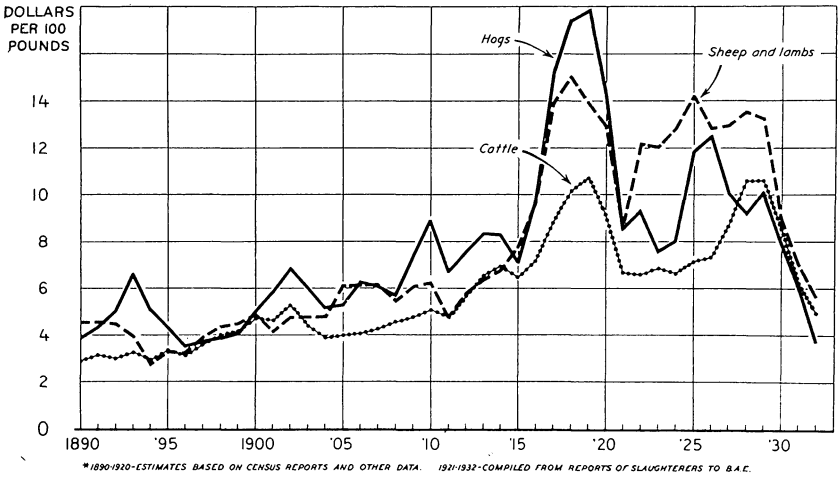

Fig. 22. Average Price Paid for Livestock by Wholesale Slaughterers, 1890-1932
From 1921 to 1926 cattle prices were low relative to the prices of hogs and sheep, but with the reduction in cattle slaughtered in 1927 cattle prices moved sharply upward into line with other livestock prices.

The price of beef cattle, relative to the price of other livestock and livestock products, is influenced upward or downward by fluctuations in supply. The relationship between receipts of cattle and the price of good beef steers at Chicago from 1890 to 1932 is indicated in Figure 23. In the lower part of the chart the trend in the price of steers has been adjusted for changes in the general price level. On this basis the effect on price of a scarcity of cattle in the period 1910-1916 and 1926-1930 is markedly reflected in the relatively high prices which prevailed during those periods. On the other hand, the influence of heavy receipts from 1920 to 1926 is reflected in the relatively low prices of that period.

Cattle numbers tend to move in fairly regular cycles, ranging in duration from 14 to 16 years. The periods of increasing and decreasing numbers in the last two cycles were from 1896 to 1912 and from 1912 to 1928. Since 1928 an upward trend of another cycle has been under way. Beef production has moved in corresponding cycles, but with a lag of approximately two years in the turning points. The relative changes in cattle numbers and beef production from 1900 to 1933 are shown graphically in Figure 24.

The upswing of the cycle beginning in 1896 was eight years in length and that of the one beginning in 1912, six years. The upswing of the present cycle, which had its beginning in 1928, has been under way for six years. The duration of the present upward trend and the future rate of increase in numbers depends (1) upon conditions within the industry which will determine the potential capacity and the incentives for future expansion, and (2) upon conditions outside the industry which will affect the demand for beef.

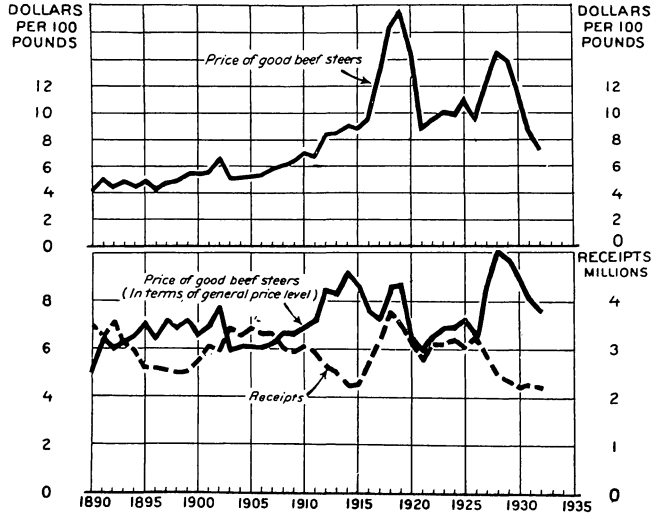

Fig. 23. Relation between Price and Supply of Cattle at Chicago, 1890-1932
The most important factors influencing the prices of steers usually are the supply coming on the market and the general price level. The lower portion of the chart indicates that, with the influence of the general price level eliminated, small receipts usually sell at relatively high prices, and large receipts usually sell at relatively low prices.

The present upswing in cattle numbers differs in many respects from previous periods of an upward trend. The striking feature of the increase is that it has been confined largely to cows and calves; the number of steers has shown little increase. Table 13 shows the number of all cattle, separated into classes, on farms and ranches on January 1, 1928, 1932, 1933, and 1934. The increase in cows has resulted in increased calf numbers, and, in the absence of a corresponding increase in calf slaughter, the number of calves on January 1 has increased each year from 1928 to 1934. Of these increased numbers of calves on January 1 of each successive year, the steers have been slaughtered largely within the following 18 months as yearlings or two-year-olds, and there has been no accumulation of aged steers, such as has occurred in other periods of increasing cattle numbers. There has been an increasing number of heifer calves of beef type slaughtered as yearlings, but the

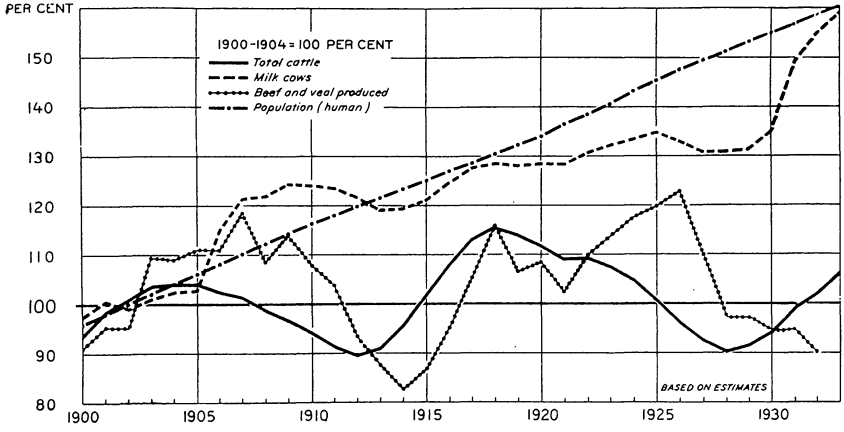

Fig. 24. Cattle and Milk Cows on Farms January 1 Compared with Production of Beef and Veal, and Population, 1900-1933

The slaughter of beef cattle and calves tends to increase temporarily in periods when the total number of cattle is decreasing, on account of the slaughtering of stock cattle, and to decrease in periods when the number of cattle is increasing, because of the tendency to withhold cattle from slaughter in order to build up herds. The proportion of the total number of cattle reported as milk cows has increased, particularly since about 1918. The failure of the number of cattle to increase throughout as rapidly as population is accounted for in part by declining exports, but largely by declining per capita consumption of beef in this country. About the beginning of the century the net exports of beef and veal from the United States amounted to several hundred million pounds. During recent years, however, imports have exceeded exports somewhat.

Table 13
Number of Cattle on Farms in the United States, by Classes, January 1, 1928, 1932, 1933 and 1934*

Date	Total	Cows and heifers 2 years and over for milk	Heifers 1-2 years for milk cows	Heifer calves for milk	Cows and heifers 2 years and over not for milk	Heifers 1-2 years not for milk	Calves other than heifer calves for milk cows	Steers over 1 year	Bulls over 1 year
	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands
1928.....	56,701	22,129	4,158	4,606	8,765	2,523	7,785	5,362	1,373
1932.....	62,656	24,475	4,685	4,953	9,771	2,853	9,192	5,206	1,521
1933.....	65,552	25,277	4,704	5,137	10,352	3,075	10,066	5,403	1,558
1934.....	67,352	26,062	4,743	5,265	10,688	3,240	10,284	5,467	1,597

* Data from Reports of the Division of Crop and Livestock Estimates, United States Department of Agriculture.

greater part of the increased numbers estimated on January 1 of each year has gone ultimately to increase the numbers of milk and beef cows.

The steady increase in cattle numbers since 1928 was not reflected in increased supplies in the markets or in increases in inspected slaughter until early in 1933 (see Fig. 25). Normally, an upturn in market supplies was expected in 1930. The upswing in inspected slaughter of cattle and calves was delayed for two years as a result of the declining

cattle prices accompanying the depression. The slaughter of cows and heifers reached a peak in the 12-month period ending June 30, 1926. Thereafter slaughter of those two classes of cattle declined sharply until April, 1933. The slaughter in 1932 was the smallest in many years. Steer slaughter, which also reached a peak in 1926, dropped off sharply until the close of 1928. Increases in the marketings of steers in 1930 and 1931 resulted in a slaughter in 1931 almost as large as that in 1927. There was a slight decrease in steer slaughter in 1932. The increase in inspected slaughter of all cattle in the first nine months in 1933 over that of the corresponding period in 1932 was approximately 10 per cent.

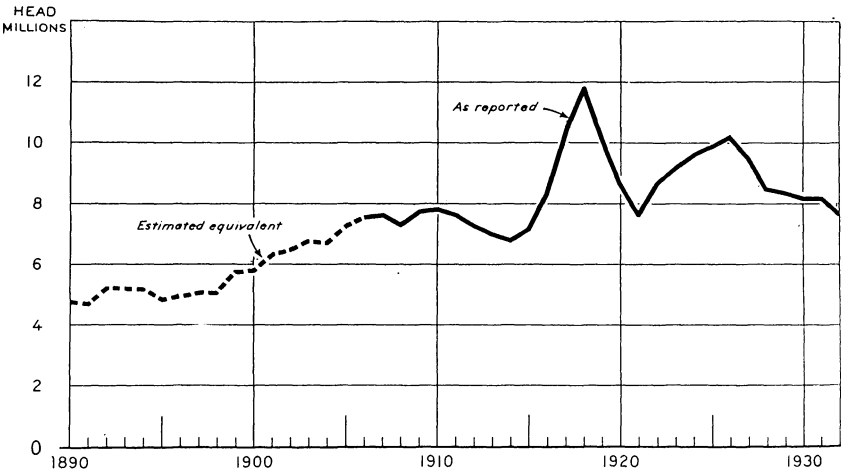

Fig. 25. Cattle Slaughtered under Federal Inspection, Estimated Equivalent and as Reported, 1890-1932

Production cycles are reflected in similar cycles of cattle slaughter which begin about two years later.

Most of the increase was in the slaughter of cows and heifers. During the first nine months of 1933, cow slaughter was 17 per cent larger than in that period in 1932, while steer slaughter was only 3 per cent larger. Even tho slaughter continued to increase at the same rate during the rest of the year, the increases would not be sufficient to offset the increase in calves born during 1933. The number of cattle on farms January 1, 1934, was the largest total ever reached in the United States (see Table 13).

The nature of the expansion that has taken place in cattle numbers is largely accounted for by the conditions that have prevailed in the cattle industry since 1927. The relatively high prices of all cattle from near the close of 1927 to the end of 1929 caused producers to hold back breeding stock as a means of increasing production. The drastic price

decline in 1930, which was especially marked in all grades of slaughter cows, tended to reduce the marketings of cows below what they normally would have been, and the continued low level of these prices through 1931 and 1932 further restricted the marketings of such cattle. In many cases the sale value of low-grade cows amounted to little more than transportation and marketing costs, if shipped any considerable distance to market. Many farmers have felt that with agricultural income from all sources at so low a level they would realize more by retaining their cows and raising calves than by sacrificing them at such low prices.

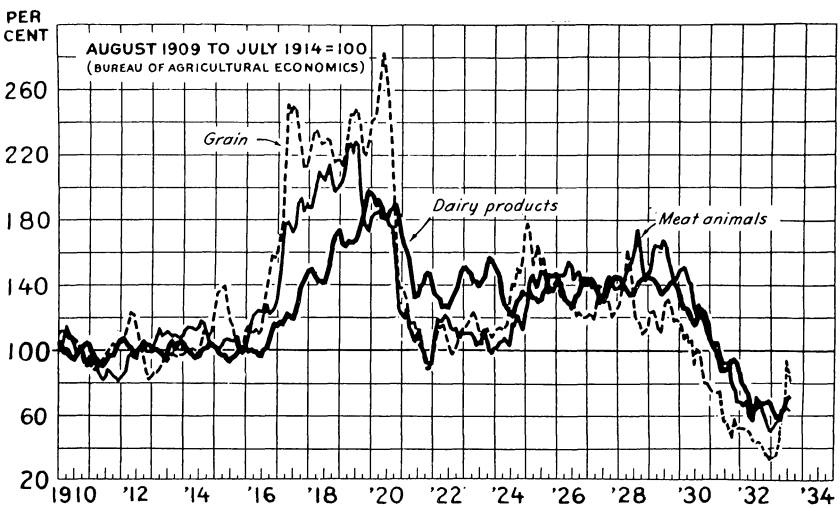

Fig. 26. Farm Prices of Meat Animals, Dairy Products, and Grain, 1910-1933
The price situation from 1928 to 1933 stimulated the production of livestock because feed crops were relatively cheaper than livestock and livestock products.

The relationships between prices of feed and prices of calves, steers, and dairy products from 1928 to 1933 (see Fig. 26) tended further to encourage the retention of cows for production purposes. As long as those relationships were favorable to marketing feed crops through cattle, there was an incentive to retain large numbers of old cows on farms and ranches to raise calves. A considerable number of steers and feeder calves were carried over into 1933 partly because of the low prices of cattle, but largely because of the relative cheapness of feeds. This holding policy was reflected in the heavy marketings of fattened steers during the last half of 1933.

It was the shift in 1933 to an unfavorable feed price situation, together with the shortage of feeds in many areas and the necessity for obtaining cash receipts from any available source, that tended to offset low prices in restricting marketing. While the increase in slaughter in

1933 was no greater than the increase to be expected from the large supplies of cattle now on farms, it was larger than would have occurred at the prices prevailing if the feed situation had been more favorable.

With further increases in cattle numbers expected in 1934, the upswing in cattle and calf slaughter that got under way early in 1933 may be expected to continue for several years. With the present number of cows, the annual output of cattle and calves is equal to the largest yearly slaughter of such stock on record. In order to move this large supply of beef and veal into consumption, a further substantial increase in consumer buying power is necessary to avoid a reduction in prices in these meats.

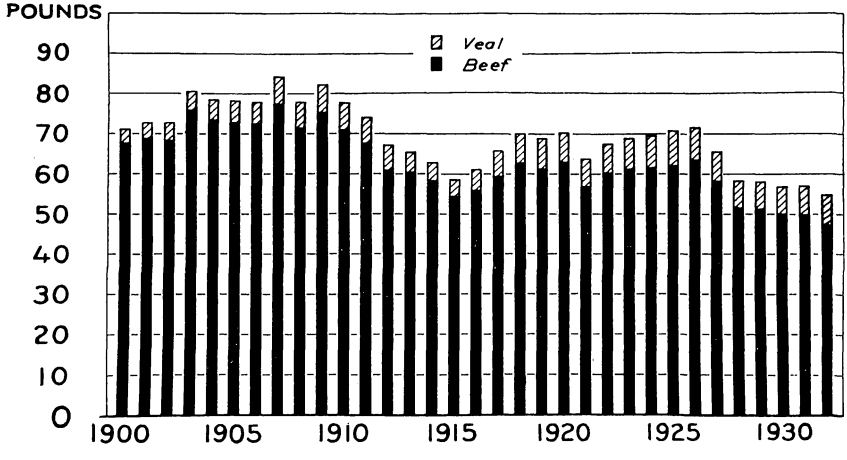

Fig. 27. Annual per Capita Consumption of Beef and Veal

The cyclical swings in the per capita consumption of beef and veal reflect the cycles in cattle slaughter. The general trend of per capita consumption during the last 30 years has been downward.

On the demand side, the general trend of consumer demand for beef, insofar as it is reflected in the per capita consumption of federally inspected beef and veal (see Fig. 27), has been downward for the past several years (as indicated by comparing 1907 with 1926, representing the tops of cycles, and 1915 with 1932, representing the bottoms of cycles). The average consumption was smaller in 1932 than in any year for which records are available. Total consumer demand has been supported somewhat by the increase in population. Increased demands as a result of population growth are relatively small and very gradual, however, and probably will tend to be less in the future in view of the slowing up in the rate of population growth.

Demand, as reflected in prices paid for the food products of cattle and other meat animals, has been closely associated with the trend in

business activity (see Fig. 28). A substantial general improvement in the demand for beef, along with other farm products, awaits recovery in the industries that produce durable goods, such as buildings, railroad equipment, and automobiles, where extensive unemployment exists. Legislative and co-operative efforts that are in operation in the fields of agriculture, industry, and finance have resulted in some beneficial effects in strengthening the demand for beef cattle and beef-cattle products. To the extent that these efforts stimulate widespread recovery in business activity, a further strengthening of the demand for beef and cattle may be expected. Demand for beef during 1934 may be stimulated somewhat as a result of reduced production of competing meats. But any improvement that may develop in the demand for beef during the next two years will be offset to a considerable extent by increases in supplies of cattle for slaughter.

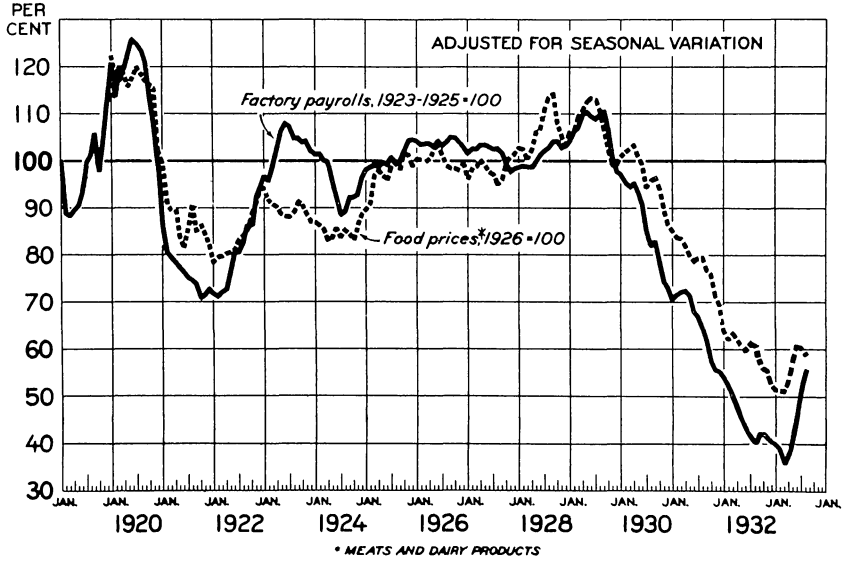

Fig. 28. Indexes of Wholesale Food Prices (Meats and Dairy Products) and Payrolls · The index of factory payrolls may be taken as an indication of the money available for purchasing agricultural products by a large group of city purchasers. As the quantities of food products marketed are fairly stable, marked reductions in purchasing power are reflected in sharp declines in prices.

A substantial reduction in cow numbers is necessary before the cattle industry will again be on a profitable production basis. In previous cycles slaughter has increased for three consecutive years before the expansion in numbers was checked. At the time this is written, it is not known what action the Congress will take on the proposal to include

beef cattle among the basic commodities covered by the Agricultural Adjustment Act. If a production control program is inaugurated for beef cattle, it undoubtedly will hasten the removal of the burdensome supplies.

Unless a production control program is put into operation and succeeds in reducing production sharply within the near future, beef cattle raisers are likely to be at a disadvantage during the next two or three years. The effect of the production reduction programs is likely to be noticeable more quickly on grains than on livestock because of the shorter production cycles and more rapid turn-over in the crops. Feed prices probably will continue to be high, relative to cattle prices, until numbers of cattle are drastically reduced. It will be difficult to make profits from feeding high-priced grain to low-priced cattle. Minnesota beef-cattle raisers must expect low returns during the next few years. The cattle enterprise should be adjusted to low-cost production methods.

Even tho the returns to Minnesota farmers from beef cattle are low and there is not much hope for improvement in the near future, many will find their farm incomes somewhat increased by continuing in beef-cattle production. It is only with cattle or other roughage-consuming animals that any returns can be obtained from land unsuited to tillage and from the large quantities of unsalable forage and other feeds that are available on many farms. Furthermore, beef-cattle raisers should not lose sight of the fact that when the turn comes between grain prices and livestock prices, the advantage is likely to be held longest by the livestock commodities. Beef-cattle farmers should be cautious, therefore, in depleting their foundation herds by disposing of their breeding stock beyond the point of quick recovery when curtailed supply and improved demand bring about price relationships that again are favorable to beef-cattle production.

The prospects for cattle feeders during 1934 are somewhat more promising than for cattle producers. In the fall of 1933 and early in 1934 market prices of thin or partly finished cattle of all kinds, both cattle for slaughter and stockers or feeders, were at the lowest point reached since prices turned downward in 1929. For some kinds the prices were near the lowest on record. Supplies of fed cattle during 1934 are expected to be somewhat smaller than during 1933. With feeder cattle and corn at present price levels, smaller supplies of fed cattle, and some further improvement in consumer purchasing power, the prospects for a favorable outcome for cattle feeding appear more promising than for several years.

SUMMARY

This study is based on detailed accounting records of the farm business on a group of beef-cattle farms in Rock and Nobles counties, on experimental trials in beef-cattle feeding at University Farm, St. Paul, and the Northwest Experiment Station, Crookston, and on other available data. Conditions in Rock and Nobles counties affecting farming are representative of southwestern Minnesota, the part of the state within which beef-cattle farming is most widely practiced.

Until about 1890 the beef-cattle enterprise in the state was based largely on pasturage and hay, with most of the animals grown to maturity and sold directly in the markets with only such finish as could be secured with the prairie grass.

Interest in beef cattle during the decade of the nineties was overshadowed by interest in wheat farming.

After 1900, the shift away from wheat farming in Minnesota toward an increased acreage in feed crops and the change in market demand toward lighter animals were accompanied by the establishment of an increasing number of small herds of cows of the beef type on medium-sized farms, particularly in the southwestern part of the state, for the purpose of raising calves to be fattened on the same farm for marketing as baby beeves or fat yearlings.

As an integral part of a diversified system of farming, the principal functions of the beef-cattle enterprise on Minnesota farms are: (1) To facilitate economical marketing of grains and roughages, (2) to provide a means for marketing pasturage and otherwise unmarketable roughages, (3) to equalize productive employment throughout the year, and (4) to provide manure for maintaining the fertility of the soil.

Thirty per cent of the total number of cattle on farms in Minnesota in 1930 were classified as beef cattle by the Fifteenth Census of the United States.

Sixty-five per cent of the beef cattle in the state were in 34 counties, 40 per cent were in 17 counties. Rock, Nobles, Jackson, Martin, Fillmore, and Olmsted are the leading counties in respect to the number of beef cattle per 1,000 acres of land in farms.

If the number of beef cattle in each county is expressed as a percentage of the total number of cattle in the respective counties, the proportion of beef cattle in the Red River Valley and west central Minnesota compares favorably with the proportion in the southwestern and southeastern parts of the state.

The availability of larger quantities of fattening grains in southwestern Minnesota, as compared with the southeastern part of the state,

makes possible the marketing of a higher proportion of the cattle from southwestern Minnesota with a grain finish.

Three systems of beef-cattle farming—baby-beef, milk-and-beef, and fattening of purchased feeders—are practiced in the state.

The unit factors of cost incurred in the production of beef cattle in southwestern Minnesota under each of the three systems of management are summarized and discussed. Standards of accomplishment are presented which may serve (1) as a base for individual farmers in checking the effectiveness with which they are utilizing feed and labor in the production of beef cattle, and (2) as basic quantities, when properly adjusted to the individual farm, in budgeting the beef-cattle enterprise.

A baby-beef herd provides the maximum utilization of a combination of concentrates, roughages, and pasture per unit of labor expended. In comparison, a dairy-cattle herd uses smaller quantities of grain proportionately to roughages and provides a market for a much smaller quantity of total feed, including pasture, per unit of labor expended.

The milk-and-beef system of beef-cattle management represents an attempt to combine the merits of beef-cattle production for utilizing large quantities of feeds and pasture with those of dairying for labor utilization.

Purchased feeder cattle rank next to hogs in the use of concentrates per acre of pasture used and per unit of labor expended.

The total investment associated with farm-herd units of the different classes of livestock, based on 1929-1931 values was: baby-beef herd, $4,146; milk-and-beef herd, $3,239; purchased-feeder unit, $2,770; dairy herd, $4,480; sheep unit, $2,870; hog unit, $1,008.

The distribution of the labor demands of either beef cattle or sheep are better suited to supplement crop work on most cornbelt farms than are those of dairy cattle.

A beef-cattle farm in southwestern Minnesota on which 25 baby beeves and 20 litters of hogs are raised and fattened should be approximately 300 acres or more in size if blue-grass pasture is used.

A milk-and-beef herd of 20 cows and their offspring would use about the same number of acres in grain and roughage as a baby-beef herd of 33 cows and their calves, but it would use approximately 30 acres less in blue-grass pasture.

For 40 yearlings or two-year-old feeders in addition to 20 litters of hogs, the farm should be 280 acres in size or larger, depending upon the normal yields of corn.

The cropping system on a beef-cattle farm should provide concentrates and roughages in excess of the requirements for the work stock

and the hog and poultry enterprises in proportions about as follows: For a baby beef herd, one pound of concentrates to 1.8 pounds of roughages; for a milk-and-beef herd, one of concentrates to 1.7 of roughages; for purchased feeders, 2.4 of concentrates to one of roughages. The proportion of corn to small grain, in pounds, was approximately 4 to one for a baby-beef herd and 6 to one for purchased feeders on farms in southwestern Minnesota. Approximately 40 per cent of the roughages for a baby-beef herd were such low-grade roughages as wild hay, straw, corn fodder, and cornstalks.

If the pasture is blue grass or other tame grasses, approximately 25 per cent of the farm should be in pasture for a baby-beef herd and 20 per cent for a milk-and-beef herd. Purchased feeders ordinarily are fed in dry lots.

With the customary labor supply on farms organized as previously described, a baby-beef herd supplements crops most advantageously in the utilization of labor. A milk-and-beef herd may provide a better utilization on farms having an unusually large supply of family labor. Purchased feeders use much less labor than either a baby-beef or a milk-and-beef herd.

The advantage of beef-cattle in comparison with alternative enterprises, and the system of management to employ on a particular farm, can be determined by using the data presented in Tables 2 to 8 and Figures 7 to 16, in combination with the best information available on prices, in budgeting alternative production programs. The probable returns from the system or systems of farming including beef cattle, as contrasted with those from other systems not including beef cattle, will indicate the comparative advantage or disadvantage of beef cattle under the conditions assumed for the particular farm and in the market.

In the management of the beef-cattle herd, it is important that the animals be capable of producing regularly beef-type calves of high quality. But economy must be practiced in making cash outlays for breeding stock, and buildings and equipment. Low-cost rations for the cow herd are also important.

Getting value received for the money invested at the time of purchase of thin cattle for fattening so as to give a reasonable assurance of a margin in the selling price of the fattened animals is of greater importance than the particular type or grade of cattle fattened.

The selection of feeds and the preparation of the rations offers a wide opportunity for the display of judgment and skill in cattle fattening.

The price of beef cattle, relative to the price of other livestock and livestock products, is influenced upward or downward by fluctuations in supply.

Cattle numbers tend to move in fairly regular cycles. These cycles range in duration from 14 to 16 years. Cattle numbers have been increasing since 1928, and they are expected to increase through 1934.

The present upward trend differs from previous cycles in that the increase in cattle numbers on farms thus far has been confined largely to cows and calves; the number of steers has shown little increase. The exceedingly low levels of prices for all grades of slaughter cows during 1931, 1932, and 1933 restricted the marketings of such cattle. The relationships between prices of feed and prices of calves, steers, and dairy products from 1928 to 1933 tended further to encourage the retention of cows for production purposes.

With the further increases in cattle numbers that are expected in 1934, the upswing in cattle and calf slaughter that was started early in 1933 by the unfavorable feed situation and the necessity for obtaining cash receipts from any available source may be expected to continue for several years. The present annual output of cattle and calves is equal to the largest yearly slaughter of such stock on record. In order to move so large a supply of beef and veal into consumption, a substantial increase in consumer buying power is necessary to avoid a reduction in the prices of these meats.

The demand for beef has been closely associated with the trend in business activity. Legislative and co-operative efforts in the fields of agriculture, industry, and finance have had some beneficial effects in strengthening the demand for beef. As these efforts stimulate widespread recovery in business activity, a further strengthening of the demand for beef and beef cattle may be expected. Demand for beef during 1934 may be stimulated somewhat as a result of reduced production of competing meats. But any improvement that may develop in the demand for beef during the next two years will be offset to a considerable extent by increases in supplies of cattle for slaughter.

During the next few years the beef-cattle enterprise on Minnesota farms should be adjusted to low-cost production methods, and the cull animals should be disposed of as rapidly as possible. Beef-cattle farmers should bear in mind, however, that it is only with beef cattle or other roughage-consuming animals that any returns can be obtained from nontillable land and unsalable feeds. Caution should be exercised in depleting foundation herds beyond the point of quick recovery when the turn in the industry is reached.

The prospects for cattle feeders during 1934 are somewhat more promising than for cattle producers.