EDUCATION MANUAL **EM 805**

Dairy Farming

A SELF-TEACHING COURSE

SELECTED AND PREPARED BY THE EDITORIAL STAFF
UNITED STATES ARMED FORCES INSTITUTE

FOR THE USE OF PERSONNEL OF
ARMY — NAVY — MARINE CORPS — COAST GUARD

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Dairy Farming

A Self-teaching Course

Based on "Dairy Cattle and Milk Production"

by Clarence H. Eckles
Ernest L. Anthony, and Leroy S. Palmer

PUBLISHED FOR THE UNITED STATES ARMED FORCES
BY THE MACMILLAN COMPANY

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Washington 25, D. C. 6 October 1944

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WHAT THE BOOK IS ABOUT AND HOW TO USE IT

How much can you learn about farming when you are not on a farm? Quite a lot. To be a successful farmer these days a man needs to know how to read and study. Neither this book nor any other will make you a farmer. But if you are a farmer, or intend to be one, good books will make you a better farmer.

From a book you can't learn how to milk. Milking is an art But from the book you can learn why some milkers get more from the cow than others. And you can learn why a cow responds to some milkers and not to others and you can learn what kind of treatment a cow likes and why she likes it. That's science.

It is just as important for you to estimate correctly the opportunities in dairy farming (and this book will help you do it) as to know how to ring a bull.

This is a book about the science of dairy farming. It is not meant to be a substitute for experience. But if you learn what is in these pages it will make your experience mean more to you. And when you go to dairy farming a knowledge of dairy science will help you find your way around with less of the error of trial.

The text from which this book was made contained chapters on feeding for milk production, on feed stuffs, silos, soiling crops and other matters a dairyman needs to know. Those items are omitted here, not because they are unimportant, but because it is not likely you will be feeding and caring for dairy cattle while in the service. However, many of you will see cattle, perhaps very good cattle, abroad. In some instances you will see them on their home grounds because, as you will learn in this book, no cattle are native to America. All were originally brought here from England or Europe. Study this book and you will be able to recognize them.

A good dairyman must know more than cows. You may want to study one or more of the other Armed Forces Institute courses in agriculture. There are five others: *What Is Farming*, *Livestock Farming*, *Poultry Farming*, *Soils and Crops*, *Managing a Farm*.

And there are many skills you can acquire in the Army or Navy

which will be useful to you on the farm. Some of them are carpentry, plumbing, electricity, gasoline engine maintenance, diesel engine operation, painting, masonry, bulldozing, grading. The more you can do along these lines the better farmer you will be.

Also the Armed Forces Institute offers you courses in Bookkeeping and Accounting, Fundamentals of Typewriting, English Grammar, Review Arithmetic, Auto-Mechanics, Biology, Chemistry, Physics, Electricity, Forestry, Rural Sociology. And these too are what the better farmer needs to know.

What has been said so far adds up to this: you can learn about farming wherever you are.

Now for a few words about the book. We have tried to make it short and clear. But this is a scientific book — not a magazine story. You will want to read thoroughly and thoughtfully. You want to be sure you understand what you are reading. You may want to go back and read it two or three times. Study is work but the more you study the easier it becomes to study efficiently.

To help you make certain that you understand what you have read and that you have really learned the most important things in the book, check-ups have been put in at the end of each chapter, or more often, to cover the material in the chapter and nothing else. Also there are two review check-ups that cover more ground, one halfway through the book, the other at the end. Answers to all these questions are in the key at the back of the book.

Nobody is going to grade you on these tests. They are put in so that you can find out for yourself whether you have learned what you want to learn. Be fair with yourself. Answer every question thoughtfully, and don't look up the answers until you have decided on your answer. Above all else, if your answer is wrong, go back to the text, find the right answer, and be sure you understand why it is the right answer.

Correspondence or Class Assignments. In addition to the check-ups and review check-ups in your book there is a group of "Correspondence or Class Assignments." If you are a regularly enrolled student in the USAFI and want help from an instructor as you work through this course, write out your answers to these assignments as you come to them and send the answers to the United States Armed Forces Institute at Madison, Wisconsin or to a branch of the Institute if there is one nearer than Madison. Be sure to enclose your name and address, the title and number of

this manual, and the numbers of the pages on which the assignments appear together with the number of the particular exercise or assignment.

You will receive from the Institute the suggestions of an instructor who has been over your work. He may be able to help you overcome any difficulties you are having with the course. *You are not obliged to send in these assignments.* They are included only for your help and convenience.

If you are working in a class under an instructor, the assignments may be used for outside written work or for class discussion. In any case, read through these assignments. If you are doubtful about the answers to any of them re-study your text until you are sure you could prepare satisfactory answers.

CONTENTS

		PAGE
	What the Book Is About and How to Use It	iii
I.	Introduction	1
II.	Origins and Classes of Domesticated Cattle	15
III.	The Dairy Type	23
IV.	Holstein-Friesians	44
V.	Jerseys	54
VI.	Guernseys	64
VII.	Ayrshires	71
VIII.	Brown Swiss	79
IX.	Minor Breeds	87
X.	Dual-Purpose Cattle	92
XI.	General Considerations in Selecting a Breed	105
	Review Check-Up 1	123
XII.	Selection of the Individual Cow	127
XIII.	Selection of the Cow by Records	140
XIV.	Selection, Care, and Management of the Sire	158
XV.	Cattle Breeding	179
XVI.	Calf Raising	200
XVII.	Raising Dairy Heifers	218
XVIII.	Pure-Bred Herds — The Business Side of the Pure-Bred Business	227
XIX.	Care and Management	242
XX.	Care and Management (*Continued*)	252
XXI.	Milking and Milk	260
XXII.	Stables for Cows	280
XXIII.	Manure and Bedding	300
	Review Check-Up 2	307

PAGE

APPENDIX

Number of Milk Cows, Two Years Old and Over, on Farms, January 1, 1943, by States and Geographic Divisions 311

Number and Kinds of Cattle in United States, 1930 312

Index 313

Key to Chapter Check-Ups, Review Check-Up 1 and Review Check-Up 2 325

A.H.B.

DAIRY FARMING

CHAPTER I

INTRODUCTION

IMPORTANCE OF DAIRY FARMING

Milk Use. Milk, with its products, serves as one of the most important sources of food for all civilized nations. The more highly developed and prosperous the people, the greater the amount of milk and dairy products they consume.

It has been pointed out that the native races of Africa, America, and Australia, which have never developed beyond the stage of barbarism, do not use milk as a food. The primitive races of Europe and western Asia made use of milk, as their descendants have done, and this fact may be a reason for the great intellectual development of Europe and America.

At least one authority in presenting the results of his investigations in human nutrition, which have changed the viewpoint of the entire civilized world on the subject, remarked: "The keeping of dairy animals was the greatest factor in the history of the development of man from a state of barbarism."

A large part of the best and highest priced agricultural lands of the world are utilized for the keeping of dairy cattle. It is a well-known fact that the most prosperous nations, as well as the best-developed physically and mentally, are those in which the dairy cow has long been the foundation of agriculture.

History. As far back as history records, man has been in possession of cattle and has made use of milk and of products made from milk. In the oldest parts of the Bible, references are made to milk, butter, and cheese. The people of ancient Greece used butter and cheese; and one of their writers described the composition of milk. The Romans used dairy products, and cheese became an important article of commerce. From Rome a knowledge of the use of milk and its products spread over Europe. By 800 A.D. the use of cheese was common in what is now Germany.

The Normans, who were powerful at this period, also used cheese as a common article of food.

During the Dark Ages the art of cheese-making was best known and largely developed in the monasteries. The monks for several centuries were the leaders in carrying on the business and in teaching it to others. By the year 1000 A.D., cheese had become an important article of trade in the cities of Europe, and by the fifteenth century some important cheese markets were in existence in Switzerland which were conducted very much as they are at present. One type of Swiss cheese introduced by the monks has been made in the same region and under the same conditions since about the tenth century.

Holland and Switzerland were the two early centers of development of the dairy industry in Europe, and they have retained this position to a large extent up to the present time. The English apparently learned the use of milk — especially in the form of butter and cheese — from the Romans.

We are indebted to Europe for our breeds of dairy cattle, for most of our basic knowledge of dairying, and for our earlier practices in regard to using milk and our methods of manufacturing products from it. Although the first cattle were brought to America by Columbus on his second voyage, the development of dairying in the United States was slow for more than a hundred years after the first settlement. The early settlers in practically all cases brought animals with them from their native homes. These were mixed indiscriminately, and from these sources are descended the cattle known as "natives."

For about two hundred years after the first settlements were made, practically no improved blood, in the present meaning of that term, was introduced from Europe or was available here. Improved blood means stock of the modern breeds. Beginning about 1820, however, importations were made, from time to time, of an individual or a small group of animals representing the various improved breeds which have become well established in America. It was not until nearly fifty years afterward that herd books were established for the registration of pure-bred animals of the present dairy breeds.

In colonial days in America the cow was seldom expected to produce milk in winter time. She calved in the spring, milked fairly well on grass, dried up in the fall, and sometimes died of

starvation during the winter. Children's health suffered for lack of milk. Utensils and methods were crude and the products inferior. Dairying was distinctly a home or domestic activity.

These conditions changed slowly up to 1850. Since that date more progress has been made in the dairy industry than had been made from the dawn of history up to that time. This progress was made possible by the use of science in dairy practices. This date marks the change from the art of dairying to the science of dairying. The great landmarks in the development of the dairy industry in America since 1850 may be enumerated as follows:

Shipping milk. The first milk train was run in 1850. At this time the milk supply of the cities either came from cows kept within the city, or was hauled from short distances.

The factory system. The introduction of the factory system of dairy manufacture has had widespread influence upon the entire industry. The first cheese factory was established by Williams in Oneida County, New York, in 1851; the first creamery by Stewart in Iowa, in 1871.

Condensed milk. Condensed milk was invented by Gail Borden, an American, in 1856. By 1920, 5.3 per cent of the milk production in the United States (the product of one and a third million cows) was used for this product. This no doubt was a high peak following the First World War. In normal times about 4 per cent of the total is now condensed and evaporated.

Dairy organizations. In 1850 there were no dairy organizations. The Dairy Breed Associations were established between 1860 and 1880 and the state dairy associations mainly between 1875 and 1895. The first cow test association in America was organized in 1905. The movement for cooperative manufacture and marketing of dairy products began between 1890 and 1900.

The centrifugal separator. The centrifugal separator was invented about 1877. The power size was put into use in 1879, and hand machines were introduced about 1890. The separator has revolutionized the dairy industry.

The Babcock test. The Babcock test for determining the amount of butterfat in milk was invented in 1890. Today cream and milk worth more than a billion dollars annually are sold according to this test.

Cold storage. Artificial refrigeration, introduced about 1880, has had a far-reaching effect upon markets and prices by making dairy

products available everywhere, thereby tending to stabilize prices and supply.

Relation of bacteriology to dairy products. As a result of discoveries in the field of bacteriology the close relation between bacteriological action and the quality of the manufactured dairy products is now recognized, also the importance of safeguarding dairy products designed for human food.

Educational agencies. Agencies have been established which include the organization of dairy instruction in agricultural colleges, in schools, and in extension activities.

Milk in relation to human nutrition. Beginning about 1910, investigations in nutrition have shown through the new knowledge of vitamins, proteins, and minerals, the true importance of milk in the diet.

Improvement in cattle. Between 1860 and 1880 widespread interest developed in importing carefully selected cattle of the various breeds from the best herds of Europe. This was the foundation stock from which most of our present dairy stock have descended. An average production of 225 pounds of butter per year for a herd was held as unusual in 1860. At present an average of 400 pounds for a herd would attract far less attention.

Number of Dairy Cows. Table 1 shows the ratio between the human population and the number of cows in the United States has remained essentially the same since 1850. This does not indicate that the consumption of milk per capita has remained constant. It has in fact increased considerably in recent years; but at the same time the average milk production per cow has also

TABLE 1. POPULATION AND NUMBER OF DAIRY COWS ON FARMS IN UNITED STATES EXCLUSIVE OF OUTLYING POSSESSIONS

YEAR	POPULATION	NUMBER OF DAIRY COWS	NUMBER OF PERSONS PER COW
1850	23,191,876	6,385,094	3.6
1860	31,443,321	8,585,735	3.7
1870	38,558,371	8,935,332	4.3
1880	50,155,783	12,443,120	4.0
1890	62,947,714	16,511,950	3.8
1900	75,994,575	17,135,633	4.4
1910	91,972,266	20,625,432	4.5
1920	105,710,620	23,724,148	4.0
1930	122,775,046	23,032,000	5.3

increased, making it possible to supply an increased demand with a somewhat smaller number of cows per thousand of people. There is a tendency to use less meat and more dairy products. This practice will undoubtedly continue in the future. Good roads and improved means of transportation have made it possible to provide everyone with a more complete daily supply of dairy products. This has been an important factor in increased yearly consumption. In time it may be expected that cheese will be consumed in larger quantities and will take the place of meat to a greater extent, as has long been the case in Europe.

Table 2 shows the total number of cattle and the classification of dairy cattle as enumerated by the *Year Book of Agriculture*, 1936.

TABLE 2. CATTLE ON FARMS (1936)

Total cattle	68,213,000
Beef cattle, total	32,261,000
Dairy cattle, total	35,952,000
Calves under one year	5,496,000
Heifers 1 year old and under 2	4,834,000
Cows 2 years old and over	25,622,000

The total value of dairy products in 1909 was, in round numbers, 596 million dollars; in 1919 it reached a total of one and a half billion — an increase in value of 148 per cent in ten years. It is now spoken of as the two billion dollar industry and is the leading source of income to American farmers.

Milk as Food. From the earliest historical times, all civilized nations have used milk and its products as food. It has long been observed that mankind seems to have a natural craving for milk, which is especially noticeable when he is completely deprived of milk and dairy products for several months. Its importance as a food for infants is also generally recognized. However, the full explanation of the important relations of milk to the diet has been forthcoming only within the past quarter of a century.

Before McCollum, Mendel, and others conducted their investigations, milk was valued as food from the same standpoint as other food products — that is, as a source of bodily energy and of protein. On this basis milk makes a very favorable showing. Now, however, as a result of the investigations referred to, it is recognized that the question of a proper diet is far more than one of supplying a sufficient amount of energy and of protein. The

proteins must not only be ample in amount but of suitable kinds and quality. Proteins from grains and vegetables are somewhat lacking in quality and their deficiencies are best made up by the use of some animal protein. Of all animal proteins, those of milk are the best adapted for making up what is lacking in a ration largely composed of cereals. This is true for animals as well as for man — as is illustrated by the remarkable results of adding skim milk to a grain ration received by pigs or fowls.

The second remarkable discovery that greatly emphasizes the value of milk as food was that of the vitamins. These substances, of which at least fourteen have been discovered so far, are necessary either for the growth or other functions of the young and for the well-being of mature humans and animals. They are produced primarily by plants, from which source man and animals must get them directly or indirectly. Four or five of the more important vitamins are found abundantly in milk, and many of the others to a lesser degree. One of these, vitamin D, is being added by various procedures to an increasing bulk of market milk. No other single food contains so many of the known vitamins, so that man has come to depend largely upon milk and dairy products for several of these indispensable substances.

A third great advance that has been made in the knowledge of nutrition concerns the mineral requirements. It has long been known that certain minerals are necessary for both man and animals. Only in recent years, however, has the extent to which man and domestic animals suffer from a deficiency of certain minerals been recognized. Lime is the substance most often lacking, although phosphorus — and at times iodine — are also consumed in too small quantities. Milk is an especially good source of lime and phosphorus.

McCollum says, "Milk is the great factor of safety in making good the deficiencies of the grains which form, and must continue to form, the principal source of energy in our diet. Without the continued use of milk, not only for feeding of our children but in liberal amounts in cookery, we cannot as a nation maintain the position as a world power to which we have arisen."

The experience of mankind for thousands of years has shown the absolute need of milk in the diet. Furthermore, the reasons why milk is an absolute necessity in the human diet are now understood and, as a result, the consumption of dairy products in the

future is certain to increase. It is also shown that the cow returns more human food from a given amount of feed than any other domestic animal.

CHECK-UP 1

What major points have you picked up thus far about dairy farming? Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. Our dairy breeds of cattle come from: (a) the Indians; (b) Asia; (c) Africa; (d) Europe.
2. The dairy industry developed most rapidly in America: (a) during colonial days; (b) in the early 1800's; (c) after 1850.
3. Landmarks in this progress have been: (a) shipping milk by train; (b) invention of condensed milk; (c) invention of the centrifugal separator; (d) the Babcock test; (e) cold storage; (f) the rubber-tired milk wagon.
4. Since 1850 the consumption of milk per capita has: (a) remained about the same; (b) decreased; (c) increased considerably.
5. It seems certain that in the future dairy products will be used: (a) more; (b) much less; (c) slightly less.
6. The leading source of income for American farmers comes from the two billion dollar industry of: (a) wheat growing; (b) dairying; (c) hogs.
7. Milk is an absolute necessity in the human diet because it is an excellent source of: (a) proteins; (b) vitamins; (c) minerals.

THE PLACE OF DAIRY FARMING IN A PERMANENT SYSTEM OF AGRICULTURE

Dairying a Permanent Industry. A study of agricultural development in the past removes any question as to the permanent character of dairy farming. The history of agriculture in all civilized nations shows that grain growing is usually the first type of farming developed. The next stage in the history of agriculture is a decline in the fertility of the soil and in grain production — the result of continued cropping. This results in greater attention to livestock of all kinds. As a rule, the first cattle industry of any size is that of beef raising, which is followed by a gradual change to dairy production, combined with more or less general farming. When this stage is reached, the fertility of the soil is

retained or improved; and a permanent form of agriculture is started. The dairy districts of Europe have gone through these stages; they were at one time chiefly grain-producing regions, later engaged in beef production, and in turn have become the dairy centers of the world.

A considerable portion of the United States has already passed through these successive stages. With other portions, the changes are still in progress. As examples of states where these stages of development are reasonably complete, the following might be mentioned: New York, Pennsylvania, Ohio, Wisconsin, Minnesota, and Michigan. The history of agriculture shows that dairying is a permanent type of agriculture; and in later paragraphs the reasons are explained.

The most practicable means of keeping up the fertility of the soil is the use of farm manure, made possible by the keeping of a liberal number of livestock. These facts furnish a firm foundation for the faith of the dairy farmer in the permanent character of his industry. Man has used dairy products as far back as history records and recent investigations have made clear the extent to which the human family has become dependent upon the cow.

Relation of Dairying to the Fertility of the Soil. It is agreed that the conservation of the fertility of the soil is the greatest problem of agriculture. The fact is established that it is possible to maintain the fertility of the soil where grain crops are sold from the farm. It is, however, certain that it is seldom done. So far, in our American history, grain selling has meant selling fertility that has been stored up in the past ages; and it has been followed by farmed-out soils and unprofitable agriculture. On the other hand, we find farms in almost every locality — and even entire countries can be pointed out — where the fertility of the soil has been vastly increased by livestock farming.

Important Soil Elements. Of the ten or eleven chemical elements apparently necessary for plant growth, only three are liable to be lacking in sufficient quantities in the soil. These are nitrogen, phosphorus — measured as phosphoric acid — and potassium — measured as potash. The fertilizing value of barnyard manure depends upon the amount of these ingredients contained. Commercial fertilizers used in enormous quantities in the older agricultural sections of the eastern and southern states supply one or more of these three elements. These commercial fertilizers have

a well-established market value which depends upon their content of these three elements. Each bushel of wheat, for example, takes from the farm fertility that would cost 27 cents if replaced in the form of commercial fertilizers. A bushel of corn removes fertility worth, on the market, 23 cents. A ton of alfalfa hay sent to market carries with it fertility worth $10.95 on the market.

Dairy products, however, take but little from the farm in proportion to their selling value. Milk carries from the farm about 13 cents' worth of fertility in each 100 pounds and taxes the fertility of the farm more greatly than does the sale of any other dairy product. Even then, at $2 a hundred for each dollar's worth of fertility sold in milk an income of $12.60 is received, while with corn at 75 cents a bushel each dollar's worth of fertility brings only $2.65 when sold. The sale of butter or cream takes from the farm so little of value as a fertilizer that it is hardly worth considering. Since butter fat contains only carbon, hydrogen, and oxygen, it has no value as a fertilizer. The only element of fertility in butter is the small amount of nitrogen contained in the curd, amounting in value to only 64 cents per ton, while the market value of this amount of butter at 35 cents per pound is $700.

Manure Value. A dairy cow weighing 1,000 pounds voids about 12 tons of solid and liquid manure in a year — worth, in round numbers, $28.00 at the market price of the three elements of fertility contained. Under proper conditions from 70 to 80 per cent of the manure voided by farm animals may be saved and returned to the soil.

The Ohio Experiment Station obtained an actual value of $4.69 per ton for manure when applied at the rate of 8 tons to the acre in a five-year rotation. The average of all their extensive investigations showed an average value of $2.97 measured in increased crops grown.

The Purdue Experiment Station reports crop increases worth from $2 to $8 with an average of $5 for each ton of manure applied, the variation depending upon the fertility of the soil and the rate of application.

But this does not tell all the story. The dairy farmer usually is a purchaser rather than a seller of grain, and by this means adds constantly to the fertility of his farm. The purchase of concentrated feeds adds a large amount of fertility to the farm. Furthermore, the keeping of dairy cattle usually means that a

large proportion of the land is kept in grass, consequently making it possible to prevent washing and erosion of the soil, which is responsible for the rapid deterioration of many farms.

It is a well-known fact that the yield of grain per acre of the agricultural lands of Denmark, Germany, and parts of England where dairy farming has been followed for a period of years, has materially increased during the past fifty years.

The Cow as a Cheap Producer of Human Food. Morrison says, "Among all the animals of the farm, dairy cows of good productive capacity are unequaled as producers of human food." The cow produces more human food from a given quantity of feed than is produced by any other farm animal. As producers of protein, hens are the nearest competitors of dairy cows, while as producers of energy the pig ranks second. However, both the hen and the hog require more concentrated food in proportion to the roughage or hay than the cow, and in this way, except as consumers of waste products, they are hardly as efficient.

Cow vs. Steer as Food Producer. Figures given in Table 3 have been compiled from data taken by the author to show the comparative production of food constituents by the dairy cow and by a high-class beef-steer. The comparison is made of the milk produced by a Holstein cow in one year with the composition of the carcass of a fat steer weighing 1,250 pounds.

TABLE 3. COMPARISON OF FOOD CONSTITUENTS PRODUCED BY A COW AND A STEER

CONSTITUENTS	COW, 18,405 LBS. MILK	STEER, WT. 1,250 LBS.
Protein	552	172
Fat	618	333
Sugar	920	
Ash	128	43
Total	2,218	548

A comparison of the feed consumed by the steer and the cow would be still more striking, since the steer required nearly two years of liberal feeding to build his carcass, and during the fattening period the ration was mostly grain. The product from the cow was made in less than one year, and largely from roughage. On

the other hand, the dairy cow has to be fed two years before she comes into milk, although when once mature she is productive for at least five or six years. It is also recognized that the labor requirements in caring for the cow are much more than for the steer.

The Cow as an Efficient User of Roughage. The special value of the cow as a domestic animal arises from her ability to consume and digest large quantities of roughage (hay) and to convert it into milk and meat suitable for the digestion of man.

The hog is a wonderful producer of meat, exceeding all other animals in regard to the amount of flesh produced from a given amount of feed, but the hog can use only limited amounts of roughage.

The sheep can utilize coarse feeds to advantage, but other factors prevent the keeping of a sufficient number of them to use the immense quantities of roughage available.

The production of large amounts of roughage is necessary in any good farm system and it is unavoidable in connection with the growing of crops. The cow and the steer must be relied upon almost entirely to convert this into a form suitable for human food. A considerable portion of the land in most agricultural sections is suitable only for pasturing because it is too wet or too dry, too hilly, or too rocky. Such regions naturally develop a livestock industry. On farms growing crops freely it is necessary to practice rotation of crops, resulting in quantities of hay and silage being available that can only be used by livestock of some kind, but best of all by cattle.

Meat from Dairy Cows. Although cattle of the dairy breeds are kept primarily for milking purposes, they furnish nearly one-half of the beef supply of the United States; and in addition they are the source of nearly all the veal that goes to market, amounting to more than nine million head annually.

As population becomes more dense and land values higher, a still larger proportion of the meat supply will come from dairy animals. This condition has long existed in Europe, where beef is primarily a by-product of dairying; and there is evidence that the same factors are at work in America.

From 1900 to 1936 the number of dairy cows in the United States increased 67 per cent, while the increase in those classed as beef animals was only 0.8 per cent. Between 1900 and 1910

the numbers of beef animals actually decreased, while the dairy herds were materially expanded. The fundamental reason for this is the greater efficiency of the dairy cow as a producer of human food, as shown earlier in this chapter.

Dairying a Safe Business. One of the advantages of dairy farming which appeals to the farmer — especially a farmer with limited capital — is the quickness and the certainty of the returns. The dairy cow gives an immediate return and her product is always marketable. The returns, while not large at any one time, are steady throughout the year and may be depended upon. The market price of dairy products varies on the whole less than almost any other class of farm products.

As a result of these conditions the development and expansion of dairy farming, particularly in the Mississippi Valley states, has in the past developed with the greatest rapidity during periods of financial depression in agriculture. The general farmer at such times finds it desirable to produce sufficient dairy products to meet his current expenses at least.

The Labor Question. The problem of securing sufficient and satisfactory labor is generally considered the greatest difficulty encountered in operating a dairy farm. This difficulty arises from the necessity of treating the cow carefully at all times, and especially from the fact that the work becomes somewhat monotonous because it has to be done regularly every day. Although the labor problem is a serious one, it is no worse than that experienced in almost any other branch of farming; and, in fact, under proper conditions it may be less serious.

Dairying a Year-around Job. Dairy farming does require the constant attention of the owner or employees; but there are advantages as well as disadvantages to this situation. A bricklayer working one-half the year will seldom accumulate much property; neither will the farmer whose productive labor is confined to a few months out of the year, as is the case when a single crop is grown for market. In the long run, the farmer, as well as the mechanic, who has work and who works throughout the year, at reasonable wages, will prosper the most. Dairying gives the farmer an opportunity to use his time regularly throughout the year. Members of his family also find work adapted to their age and strength.

The grain farmer crowds his work into a few months and requires

a large amount of help for a few days or weeks only; and he finds this help almost impossible to secure, since he has no work to offer for the remainder of the year. He has little reason to complain if an abundance of extra labor is not at hand for the short period he is willing to utilize it. Labor on the dairy farm is distributed throughout the year, and arrangements may be made accordingly.

Labor Dissatisfaction. The objections raised by hired help to labor on the dairy farm are the long hours, the steady, regular work, and to some extent, the nature of the work itself — or rather to the conditions under which it is done. To reduce the labor problem to the minimum, first of all the hours must be made as reasonable as in other types of farming in the same community. Arrangements should be made so that the milkers are through with their work as early as men doing field work. Some provision must also be made for regular time off by each laborer in turn. If the owner is doing his own work he should realize that he should follow the same practice himself and take some time away from his work, otherwise in time he will come to dread the monotony of it.

The objections sometimes made to the nature of the work come almost entirely from the conditions under which the work is done. If the cows are milked in a clean, well-lighted, comfortable stable at reasonable hours, and modern methods of handling the manure and feed by overhead carriers are installed, the objections to the work will largely disappear. In most localities a man with a family, if provided with a comfortable house, may be employed by the year with the best satisfaction to both the laborer and his employer.

CHECK-UP 2

Did you pick up major points as you read?
Underline the correct answer.

1. The first type of farming to appear in a civilized community was: (a) grain; (b) cattle; (c) sheep; (d) apples.
2. The most practicable means of keeping up the fertility of the soil is by the use of: (a) fertilizer; (b) manure; (c) alfalfa; (d) straw.
3. The greatest problem in agriculture is: (a) milking cows; (b) conservation of soil fertility; (c) control of diseases in cattle; (d) pitching hay.

4. The outstanding value of the cow as a farm animal is her ability to: (a) use roughage; (b) use grain; (c) understand English; (d) produce large quantities of manure desirable as fertilizer.

5. The most important product of dairy cows other than dairy products is: (a) veal; (b) glue; (c) leather; (d) beef.

CORRESPONDENCE OR CLASS ASSIGNMENT 1

If you are a regularly enrolled student in the USAFI and want help from an instructor as you work through this course, write out your answers to these assignments as you come to them and send the answers to the United States Armed Forces Institute at Madison, Wisconsin, or to a branch of the Institute if there is one nearer than Madison. Be sure to enclose your name and address, the title and number of this manual, and the numbers of the pages on which the assignments appear as well as the number of the particular exercise or assignment.

You will receive from the Institute the suggestions of an instructor who has been over your work. He may be able to help you overcome any difficulties you are having with the course. *You are not obliged to send in these assignments.* They are included only for your help and convenience.

1. Discuss dairy farming as an occupation touching upon: (a) two or more of its advantages and one or more of its limitations; (b) consideration of these advantages and limitations in the area where you would plan to have a dairy farm.

2. Describe dairy farming as a business including: (a) kinds of products produced; (b) nature and location of markets; (c) sources and regularity of income the dairy farmer may expect.

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CHAPTER II

ORIGINS AND CLASSES OF DOMESTICATED CATTLE

Origin of Cattle. There are no cattle native to America. All those found in North and South America are descended mainly from animals brought from Europe. The domesticated cattle of Europe are descended from wild forms that originally lived in Europe and Asia.

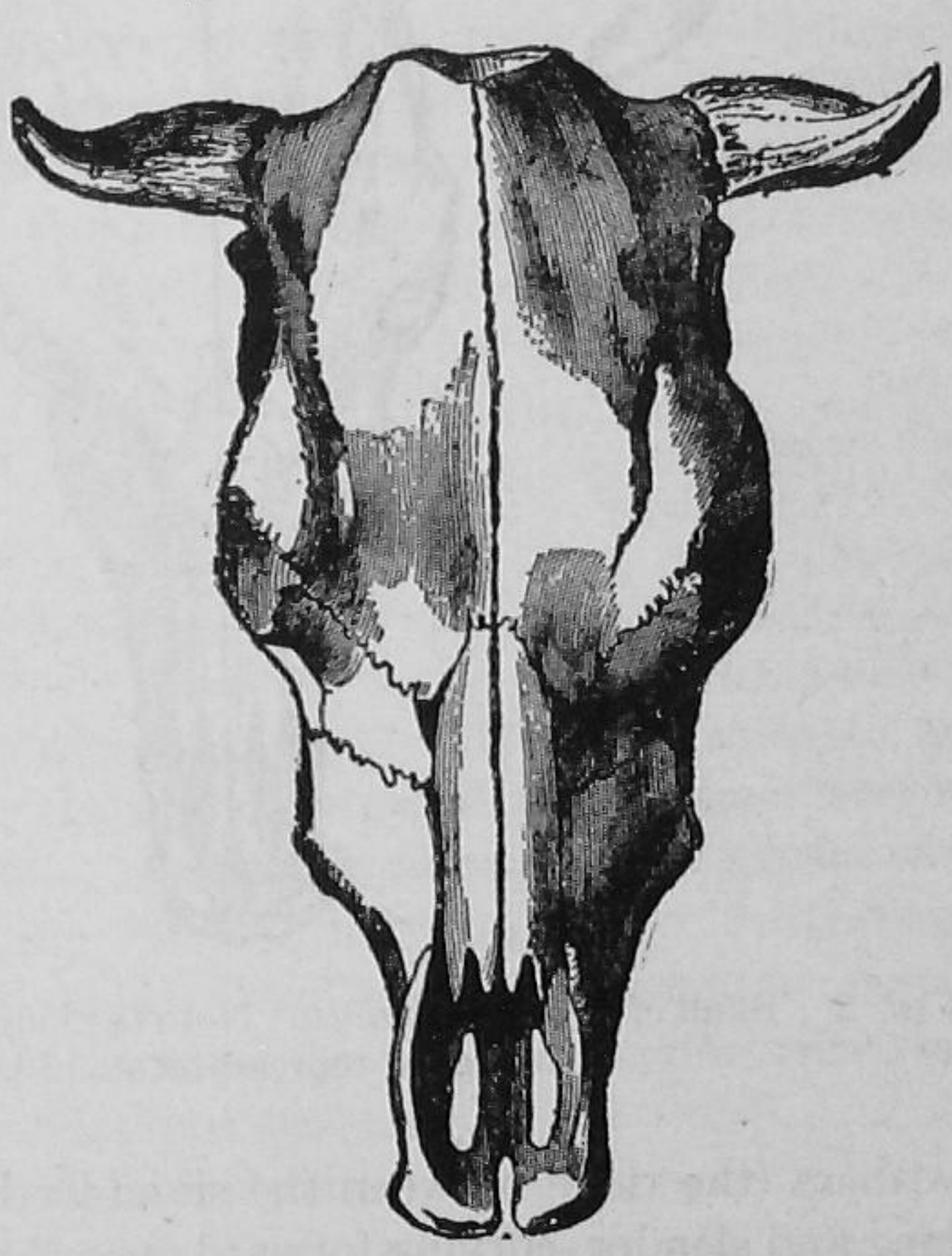


FIG. 1. Skull of *Bos longifrons* or *Bos sondaicus*. Note the broad head and short horns. This type is well represented by the Jersey breed.

Original Types or Species. Although there is a wide divergence of opinion concerning the origin of domesticated cattle, most investigators of the subject agree that the cattle of Europe are descended from two original types or species. One is called the *Bos longifrons* by some authors, while other authors use the term *Bos sondaicus*. The second type is known as the *Bos primigenius*.

The *Bos sondaicus* Type. Cattle of this type were brought into southern and eastern Europe during the great migrations that took place and were spread over the greater part of that continent. At that time these cattle were small in size, and short-bodied, and had small horns. From this type probably most of our breeds in use today are descended, including the Brown Swiss,

Jersey and Guernsey. However, the Shorthorn and Ayrshire, while having this type as a foundation, were probably mixed in the early days of the breeds with the blood of the *Bos primigenius* type, through crossbreeding principally with Holland cattle.

The *Bos primigenius* Type. This type originally was an immense, powerful animal, standing six to seven feet high at the

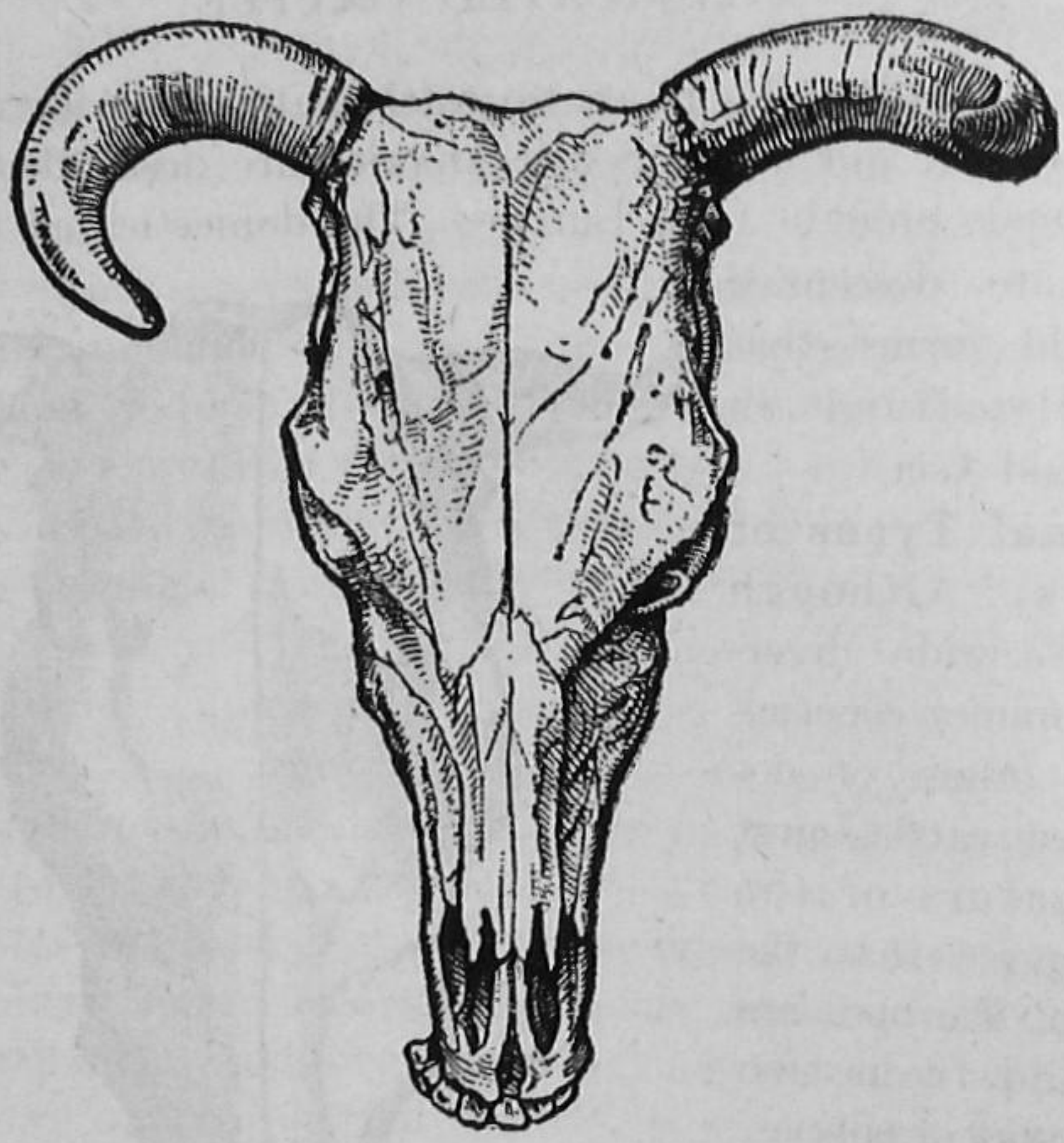


FIG. 2. Skull of *Bos primigenius*. Note the long narrow head. The Holstein is a good representative of this type.

withers (the ridge between the shoulder bones). The horns were long and slender, curving forward near the middle and ending with the points slightly upwards. This animal was apparently domesticated in northern Europe. From it are descended the cattle of Holland and other parts of North Europe.

The most fundamental difference between the two original forms of cattle was the shape of the skull, and this difference is still evident in modern breeds. The *Bos primigenius* was characterized by a long, narrow head. This type of skull is well illustrated by the modern Holstein, whose long narrow head is taken to indicate descent from the original long, narrow form. The

remains of the *Bos longifrons*, or the *sondaicus* type, show a broad short head, which characteristic is best illustrated by the short broad head of the typical Jersey.

Origin of Breeds. A breed is a recognized further well-defined subdivision of a type or species. The number of breeds and sub-breeds of cattle is great. On the continent of Europe alone between forty and fifty distinct breeds are described by German and French writers. Great Britain is the home of eleven breeds, which have been imported to the United States, and in addition to this as many more minor breeds are described by English writers as of local importance.

With few exceptions these numerous breeds have been long established and historical records are not available to indicate their definite origin. One exceedingly important factor, however, was the ancestry of the breed as between the two forms of wild cattle from which our present domesticated forms are descended. This difference in origin is presumably the greatest factor in causing the wide differences between the Holstein and the Jersey breeds — these two representing better than other common breeds the two lines of descent from the original wild forms.

Influence of Migration and Conquest. Another factor in the formation of breeds was the conquest of one country by another, whereby a new mixture generally resulted from the cattle introduced by the invaders. In early historical times whole peoples migrated at times for long distances, taking their cattle with them. For example, the Simmenthaler breed in Switzerland reveals the same characteristics of skull as found among the original cattle of Sweden, from which localities the Burgundian tribes are supposed to have migrated about 400 A.D.

Next to these two factors already mentioned come conditions of environment, such as climate, food, and topography (physical features) of the country. In early times, with no organized means of transportation, little exchange of animals took place from one locality to another except as in the cases mentioned, when a whole people migrated or conquerors brought in a new type of animal. In these times there was little if any attempt at improvement. The effects of natural conditions were allowed to work out almost undisturbed by the selection of man. Breeds formed by such means may be called natural breeds.

Birth of Art of Breeding. Up to about 1770 these natural condi-

tions and the introduction of new types by the means of conquest and migration were the chief factors in the development of distinct breeds. Beginning about 1770, a great interest was aroused in England in the improvement of the quality of cattle and other domestic animals of Great Britain. This exceedingly important movement known as the art of breeding seems to have started largely as the result of the work of Robert Bakewell. This pioneer in the art of breeding began active operations about 1760 and continued until his death in 1795. The activities of the Collings brothers in improving the Shorthorn breed, beginning about 1780, rank next to those of Bakewell in calling public attention to the possibilities of livestock improvement. The remarkable movement initiated by these men for the improvement of domestic animals spread over Great Britain and influenced the entire civilized world as well; the beginning of modern improved breeds is to be traced back to it.

The Principles of Livestock Improvement. The methods developed and emphasized by these pioneer breeders are essentially the same as those followed today; careful selection of breeding animals, liberal feeding, and general good management. Bakewell was the first to understand and practice in-breeding and line-breeding as a means of fixing desirable characteristics. A certain amount of crossing was also done in the early history of some breeds — with the Ayrshire and the Shorthorn, for example.

At the present time the efforts of cattle breeders are directed toward further improvements in the breeds already in existence and not towards the establishment of new breeds. The reason for this is the realization that breeds are now in existence that are adapted to practically any conditions under which cattle may be profitably kept. Furthermore, to develop a new breed with as well-established characteristics as those already in use would require more than the lifetime of a man, and would not be financially remunerative. There is every indication that we probably will have fewer breeds in the future.

Inheritance Value of Breeds. The breed is only one of many factors to be considered in carrying on profitable milk production. In some cases the value of the breed is overestimated, but more often the reverse is true. Our present dairy breeds represent the efforts toward improvement in certain definite lines made by several generations of breeders. It would be folly for a man to

attempt to start at the beginning to build up for himself what has taken a century or more for others to build. By making use of animals of a highly developed breed, adapted to the purpose for which they are to be used, he is taking advantage of all the work that has been done and starting at the highest point of advancement reached by other breeders.

Pure breeds have been bred generation after generation with certain objects in view, and in the course of time these characters become fixed as breed characters, and are transmitted. It is easy to understand why the chances are good for getting a good dairy cow if the ancestors are the Holstein — known to have been bred about 2,000 years in one locality and noted for hundreds of years as great dairy animals — or if the parents are Jerseys, bred for 500 years, or longer, along one line.

Market Value of Breeds. Cows of a distinct dairy breed usually — and rightly — sell for more than the same number of cows of mixed or unimproved breeding, even if the latter are known to be equally good as dairy cows. The cows of a distinct dairy breed are worth more to the buyer, because he can reasonably expect these animals to show the typical character of the breed to which they belong in production of milk, in disposition, and in other breed characters. A cow of mixed breeding, even if a good dairy cow, or an unusually good milker in a breed where milking qualities are not generally found, cannot be counted upon to reproduce herself in her offspring. It is a well-known fact in animal breeding that the longer a certain character has existed in a breed, the more certain it is to be transmitted.

Classification of Cattle. Various classifications of cattle have been made, some based upon geographical distribution, as lowland and mountain cattle, others upon their anatomy, especially the shape of the skull, and others as to their domestic use. Today American writers arrange them according to the economic value as beef breeds, dairy breeds, and dual-purpose cattle.

No system of classification has yet been devised that can be applied in more than a general way to the individuals that make up the great mass of cattle. If we undertake to arrange them by breeds, we find, in addition to the numerous pure breeds, animals with all possible mixtures of the blood of two or more breeds, or with more or less improved blood mixed with the scrub, or unimproved. If we should attempt to arrange them according to the

purpose for which they are adapted or kept, we would have a constant gradation from the extreme beef to the extreme dairy development.

It is difficult even to arrange a suitable classification of the pure breeds, since the animals may vary greatly within a breed on account of environment and treatment. The following descriptive terms are in common use:

Scrub. A scrub is an animal of mixed or unknown breeding, without the type or markings of any recognized breed. Other terms used with practically the same meaning are native, mongrel, or unimproved, as well as other names of a local character, such as "piney woods." These terms indicate that the animal has only a small amount of the blood of any of the improved breeds. Typical scrubs are not numerous except in those sections where very little attention is given to cattle raising. The term "scrub" is often applied also to inferior animals of recognized breed type.

Cross-bred is a term used to indicate that the animal is the offspring of parents of distinct breeds, either high grades or pure-bred.

Grade. This term is generally used with a certain breed name, as Grade Jersey or Grade Shorthorn. This means that the animal in question has one-half or, usually, more of the blood of the breed mentioned. When the proportion of the pure blood is large, the animal is called a "high grade." The proportion of the blood predominating may be so great that for all practical purposes the animal is the same as a pure-bred; but it cannot be called a pure-bred, no matter how many crosses have been made, and such animals cannot be registered in any of the various herd books.

Pure-bred. The term "thoroughbred" is often improperly used for the proper term, "pure-bred." The term thoroughbred is properly applied only to the well-known English breed of horses. Pure-bred cattle, as understood in America, are those whose ancestors came from the native home of the breed in question and conformed to the requirements of this breed here. This blood must have been kept pure and unmixed, and records must be available showing the descent from these ancestors. The records of descent of these animals are kept in a systematic manner by associations formed for the purpose by those interested.

The breeds of cattle common in America are usually classified as dairy, dual-purpose, and beef.

Dairy Breeds	Dual-Purpose	Beef Breeds
Holstein	Shorthorn	Shorthorn
Ayrshire	Red Polls	Hereford
Jersey	Polled Durham	Aberdeen Angus
Guernsey	Devon	Galloway
Brown Swiss		

In addition to the above, small numbers of French-Canadian, Dutch Belted, Kerry, and polled Jersey cattle, all to be classed as dairy breeds, are found in certain localities of America.

CHECK-UP 3

If you have read this chapter carefully you should have a good general idea of the origin and classes of the various breeds of cattle common in the United States. You also should have reached a few general conclusions as to the general nature of cattle breeds and the trend of cattle breeding today. Have you?

A. Below is a list of eight statements with a blank line after each. If the portion of the statement in italics is true circle the letter T but do not write anything on the blank line. If the portion of the statement in italics is false circle the letter F and write the correct answer on the blank line provided. After the eighth statement there is a conclusion. Underscore the phrase that gives the best conclusion.

1. T F All North and South American cattle *are descended* from stock imported mainly from Europe. _____

2. T F European cattle descend from *one* original type or species. _____

3. T F The skulls of the modern Holstein and Jersey indicate that these breeds descend from *two* different original types of cattle. _____

4. T F There is a *small* number of breeds and sub-breeds. _____

5. T F The wide differences between Holstein and Jersey breeds is caused largely by their long line of *separate* descent from different original types. _____

6. T F Natural conditions, conquests and migrations resulted in so-called *natural* breeds. _____

7. T F Controlled breeding of cattle first was developed in England in the late *1800*'s. _____

8. T F The present tendency of cattle breeders is *to develop* new breeds. _____

Conclusion: Underscore the phrase or expression that expresses the most appropriate conclusion you may reach on the basis of the facts indicated above.

Because fundamental breeds of cattle are definitely established: (a) years are needed to establish new breeds; (b) it is best not to attempt to improve natural breeds; (c) it is best to concentrate on improving breeds already established.

B. Some of the following listed items apply to dairy cattle. Others do not. Underscore each item that is desirable in dairy cattle. Circle each that is undesirable in dairy cattle. Some items should not be scored at all because they do not refer directly to the selection of dairy cows.

1. Dairy cows of mixed breeding; 2. Pure-bred cattle descended along one line; 3. classification of cattle; 4. dual-purpose cattle; 5. "native" breeds; 6. "scrubs"; 7. grade Shorthorns; 8. "thoroughbred"; 9. Hereford; 10. pure-bred Guernsey; 11. "high-grade" Holsteins.

C. Breeds of cattle in America are commonly classified as: *Dairy*, *Dual-Purpose*, and *Beef*. If the breeds named are *Dairy* place the letter D in the proper parentheses; if *Dual-Purpose* write D-P in the parentheses. Write the letter B in the parentheses if the breed is *Beef*. If the terms refer to other than established breeds write the letter X in the parentheses.

1. ( ) Devon	6. ( ) Mongrel	11. ( ) Hereford
2. ( ) Holstein	7. ( ) Guernsey	12. ( ) Aberdeen Angus
3. ( ) Jersey	8. ( ) Polled Durham	13. ( ) Ayrshire
4. ( ) Natural	9. ( ) Brown Swiss	14 ( ) Galloway
5. ( ) Red Polls	10. ( ) Scrub	

What breed was omitted from this list but appears in the list on page 21? The _____ breed was omitted from the above list because it is listed on page 21 as both Dual-Purpose and Beef.

CHAPTER III

THE DAIRY TYPE

There is but one entirely satisfactory way to select cows for dairy purposes, and that is by records of production of each individual, as determined by the use of scales for weighing the amount of milk and the Babcock test for measuring the amount of butterfat in the milk. Official testing of pure-breds and cow test association, or dairy herd improvement association work, have made commendable progress during the past decade; but there are still vast numbers of cows used for dairy purposes on which no tests for milk and butterfat production have ever been made. In determining the value of such animals for dairy purposes the estimate must be based upon conformation (shape or build), or the degree to which the animal approaches what is known as the dairy form or type. While such estimates may be very inaccurate, the development of the function of milk production through generations of selection and breeding in that direction has brought about certain characteristics in the conformation of the animal that may be taken into account in judging of the development of these functions.

The breeders on Jersey Island in 1834 formulated the first scale of points for dairy cattle. At the present time the breeders' associations have prepared for each breed a carefully drawn scale of points that are of assistance in acquiring a skill in the selection of cows by conformation. A scale of points undertakes to describe the conformation of the animal that, in the judgment of the author, denotes the highest development of the characteristics sought. The comparative importance of the parts described is represented by points that total 100 for the perfect animal. The lack, up to the present time, of a real scientific basis for preparing a scale of points makes them unsatisfactory in many ways, but they are of great general value, especially to the beginner.

The General Characteristics of the Dairy Type. "Type," in this connection, refers to the conformation of the animals which indicates or suggests the purpose it serves. A person familiar with cattle in general, but not with highly developed dairy cattle,

looking for the first time upon a high-class dairy cow in full flow of milk would have his attention especially directed to three points as follows:

1. The extreme angular form, carrying no surplus flesh, but showing evidence of liberal feeding by a vigorous physical condition.

2. The extraordinary development of the udder and milk veins.

3. The marked development of the barrel (body) in proportion to the size of the animal.

These three points should be kept in mind as describing the special characteristics of the dairy animal in comparison with those bred for beef, or with inferior dairy animals. Sometimes the error

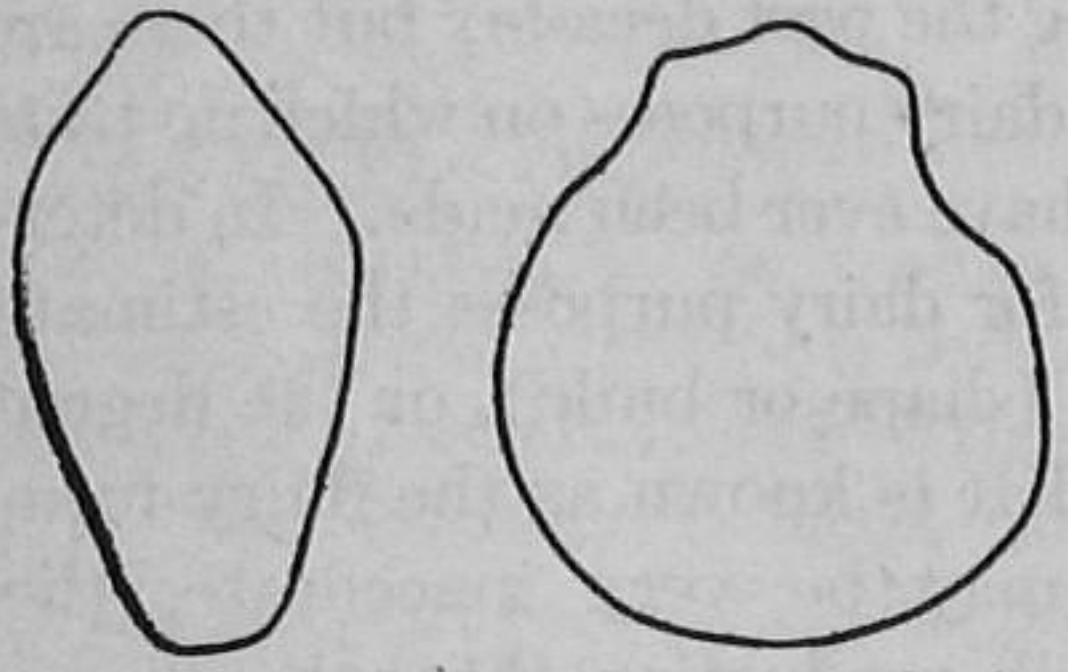


FIG. 3. Cross-sections of a high-class dairy cow at the heart girth and the paunch. Correct dairy form shows a series of angles rather than smoothness.

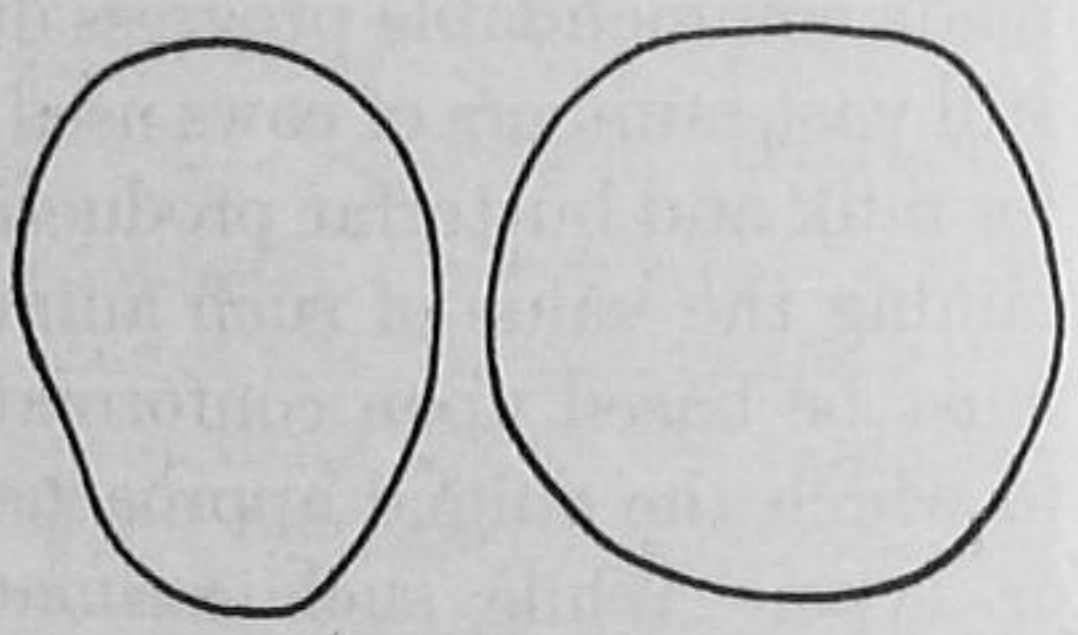


FIG. 4. Cross-sections of a high-class fat steer at the heart girth and the paunch. Contrast the smooth round withers and loins of the steer with the angularity of the cow in these parts.

is made of attributing this lack of flesh, so characteristic of a good dairy cow, to insufficient feeding. The dairy cow does not, however, have the same appearance as an animal not of the dairy type that is in thin flesh because of insufficient feed. A high-class dairy cow never carries much flesh when in full flow of milk. The stimulation to produce milk is so strong that all the feed she can consume and digest above that needed for maintenance is utilized in producing milk. Such an animal, although thin in flesh, has an alert, vigorous appearance, her hair is soft and healthy, her skin pliable and loose, her eyes are bright, her paunch is full, and a general appearance of thrift and contentment is noticeable. An animal thin in flesh on account of insufficient food has a stupid appearance and shows a lack of vigor, while the rough, long hair stands on end. The paunch may be large or not, depending on the bulkiness of the feed consumed by the animal.

The Dairy Form. The modern high-producing dairy cow is a result of selective breeding. This means that her ancestors have proved their productive ability and that they approach the breeder's ideal of good dairy form. Their function has been to produce large quantities of milk, and observant breeders have found that this function demands that the animal be so formed that she has the bodily equipment to carry on the work of milk secretion (production). Breeders have found that certain characteristics of form are always associated with high productive ability,

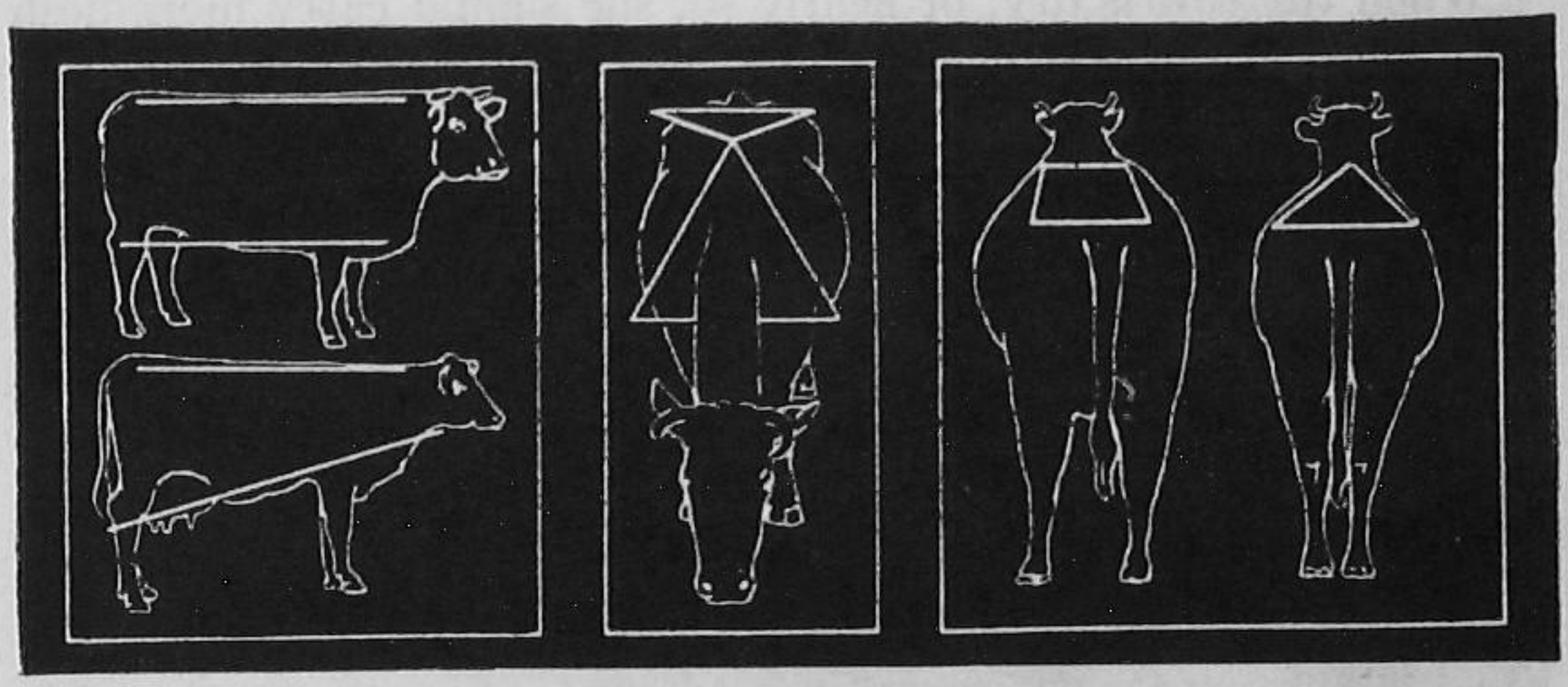


FIG. 5. The body form of the dairy cow should be wedge-shaped, while that of a beef animal is rectangular.

and they consider these features in selecting their breeding stock. First among them is the general shape of the animal.

The Dairy Conformation. The body of the dairy cow should be angular in shape as viewed from the front, the side, and over the top or withers. This angularity or sharpness of points has been commonly spoken of as the wedges. Angularity and sharpness of withers are associated with dairy production and are in contrast to the fleshy, well-rounded, and rectangular form as found in the beef type.

Dairy Temperament. It should be understood that it is natural for a cow to fatten considerably toward the end of her milking period and when dry. This surplus fat is usually lost during the first three or four weeks after calving. It is impossible to fatten a high-class dairy cow with any ration during the best part of her milking period, or even to keep the fat that is on her body at calving time from being removed during the first few weeks she is in milk.

The cow that shows these characteristics to a marked degree is said to have a good dairy temperament. This means she is endowed by nature with a strong stimulation to produce milk, and uses practically all the nutrients she can digest for milk production. This accounts for the spare form and absence of any surplus fat, even when the animal evidently has abundant food. As a result of the above, a high-producing cow when in milk is usually thin and sharp over the withers, her backbone strong and prominent, and her hips and pelvic region stand out almost free from flesh.

When the cow is dry, or nearly so, she should carry more flesh than when in full flow of milk, and she should not be criticized on

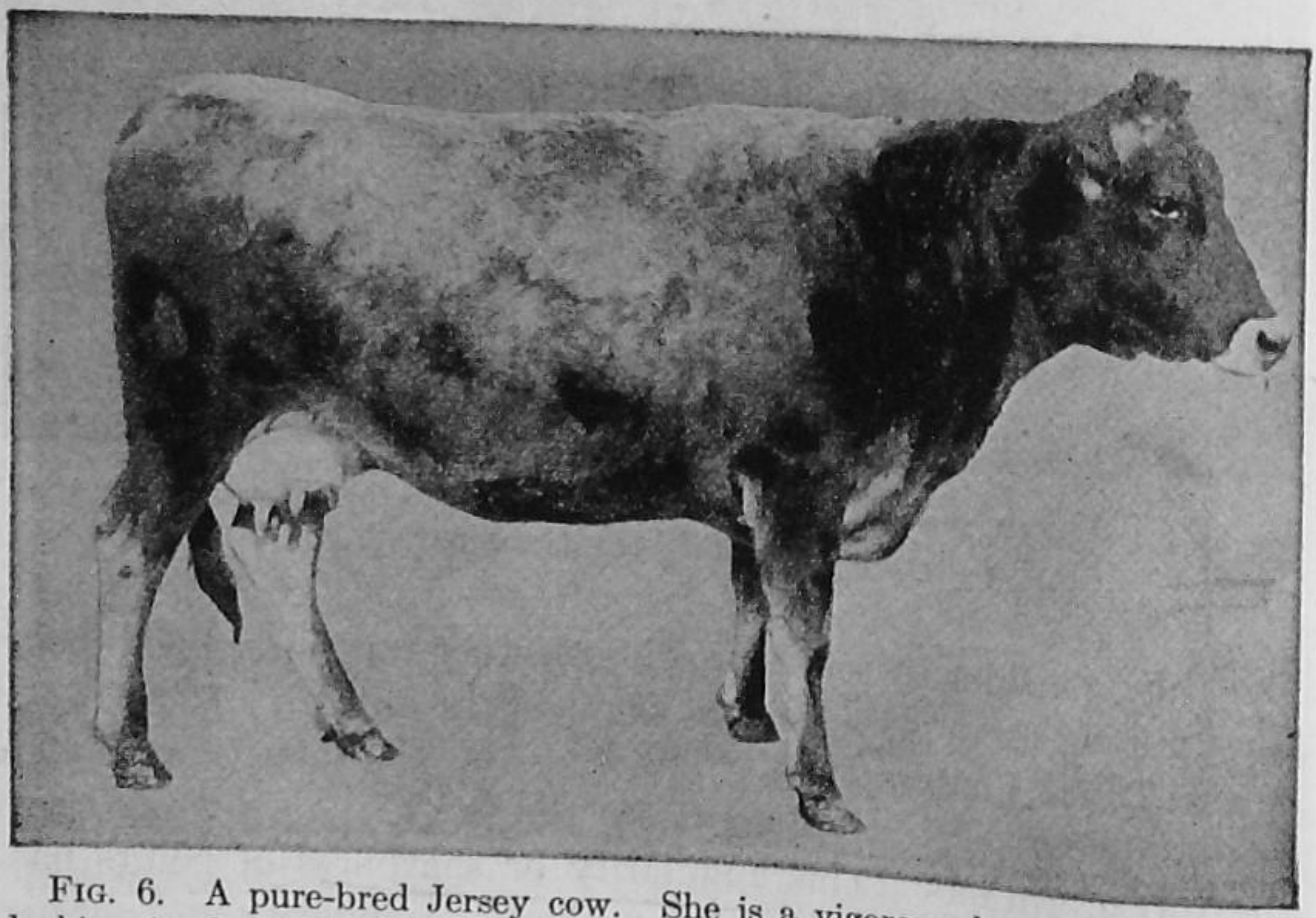


FIG. 6. A pure-bred Jersey cow. She is a vigorous, healthy animal but lacking in dairy conformation or dairy temperament. Average record for 4 years was only 2,501 pounds milk and 122 pounds of fat.

this account. The breed type should be taken into account as well, and the mistake avoided of judging all by the same arbitrary standard.

Types of Cows. Fig. 6 is a good illustration of a cow lacking in dairy temperament, although she is a pure-bred animal of one of the leading dairy breeds. This animal has a capacious barrel and an unusually large heart girth. She lacks the stimulation necessary to use her food for producing milk. This is shown by her lack of udder, thick withers, thick covering of flesh over the

back, and general smooth, beefy appearance. Fig. 7 illustrates the other extreme. This cow has so strongly developed the tendency to produce milk that she uses the greater part of all the food she can eat and digest for this purpose and carries no surplus flesh. Her withers are thin and sharp, and her back and pelvic region angular and bony. Her udder is also well developed.

A cow should be expected to carry somewhat more than her normal flesh for a short time after calving, but this beefy appearance should disappear within a month or less.

Limitation of Selection by Type. The selection of dairy cows by type, as indicated, is often uncertain. Still, the practical breeder

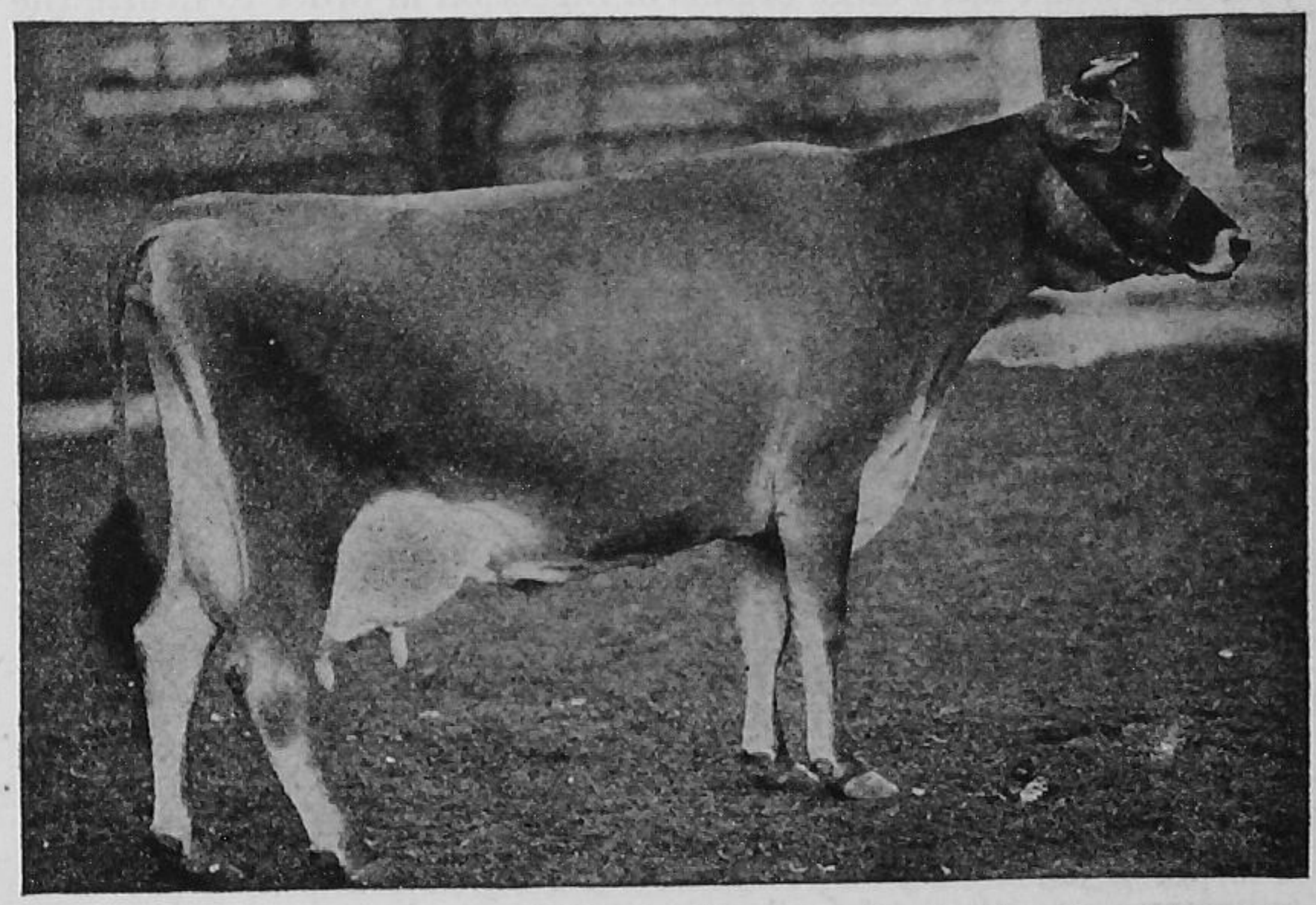


FIG. 7. A typical dairy type. This cow shows excellent udder, dairy temperament, and body conformation.

or dairyman must select most of his animals in this way. The limitations should be understood. Anyone familiar with dairy type will seldom fail to choose between a high-class animal and an inferior one — as, for example, between the cow shown in Fig. 6 and that in Fig. 7. Usually it is easy to choose between a cow producing 350 pounds of butterfat in a year and one producing 150 pounds. However, as between the good and the extraordinary cow, type gives little upon which to base selection.

One seldom sees a cow of extraordinary dairy quality that does

not conform to the descriptions given in the following pages. While in some cases cows may fail to score high by failure to conform to the score card in some particular point such as a weak fore udder or a sloping rump, they nevertheless show the important characteristics of good dairy type. To judge a dairy cow with any accuracy, she must be in milk, and preferably near the best stage of her milking period. A dry cow offers in most cases very little upon which to base judgment. A dairy cow thin in flesh from underfeeding is also in a condition that makes it almost impossible to form an estimate of her value.

Development of the Barrel. The dairy cow that is a heavy producer must have large organs of digestion in order to utilize the

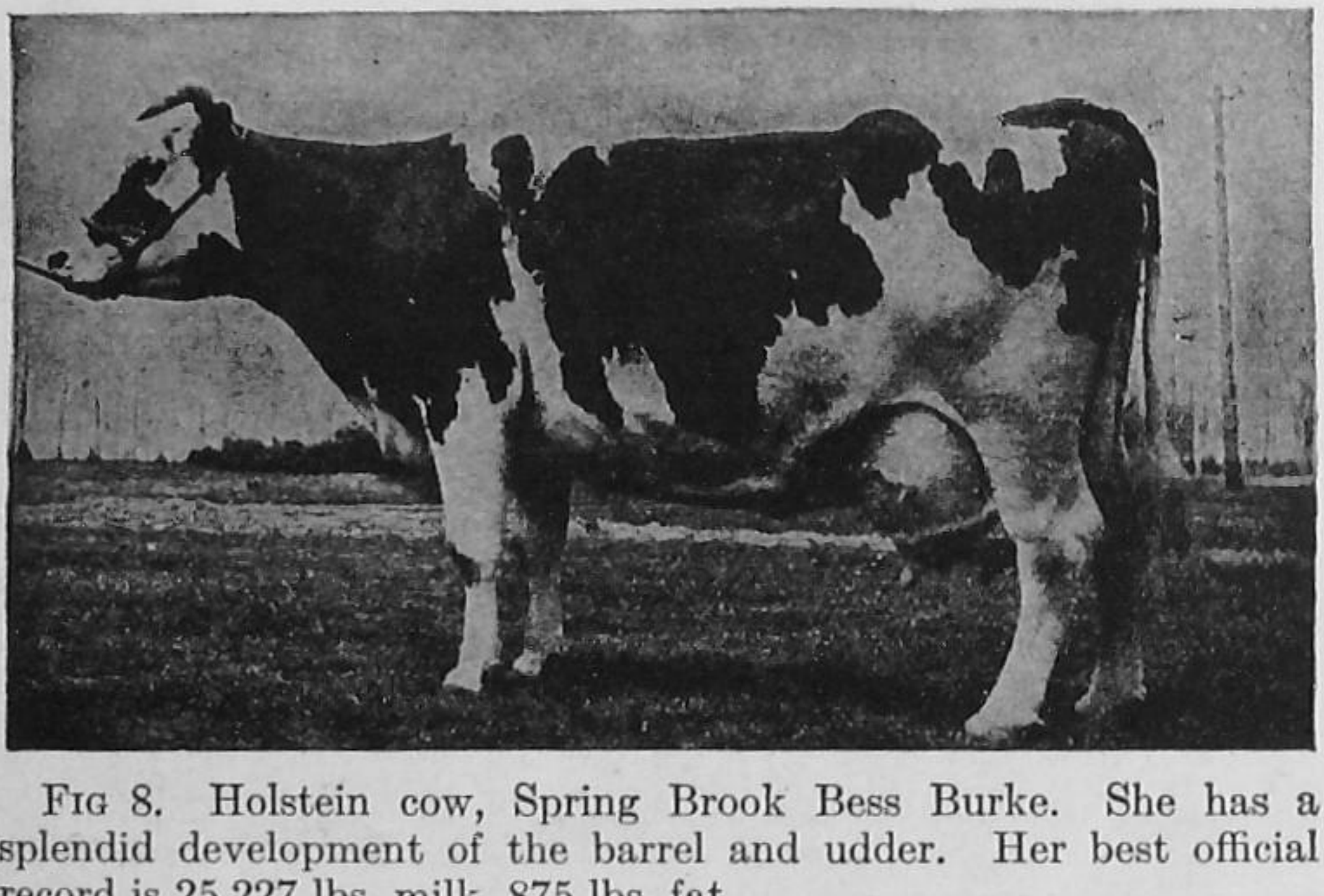


FIG 8. Holstein cow, Spring Brook Bess Burke. She has a splendid development of the barrel and udder. Her best official record is 25,227 lbs. milk, 875 lbs. fat.

enormous quantities of feed necessary to produce large quantities of milk. This results in the development of a large barrel, as that part of the animal's body between the fore and rear legs is commonly called. A high-producing cow has wide-sprung ribs far apart. The ability to lay three fingers of the hand between the ribs is an accepted measure. She should have a deep abdomen, giving great capacity for the digestive tract and other vital organs. An animal lacking in this barrel capacity cannot use sufficient feed to be a large producer. The age of the animal has some influence on the size and depth of the abdomen. The depth of the barrel naturally increases some with the age of the cow. The feeding of a ration consisting mostly of bulky feeds, as hay and silage, also

tends to give the appearance of greater barrel capacity from the greater contents of the digestive tract. In considering the barrel development of a cow, the depth as viewed from the side should be observed, then the width as viewed from behind. Some animals show a great depth, but on account of being narrow have no more real capacity than another animal with less depth, but greater width.

Fig. 8 is an illustration of a Holstein cow of great capacity. She shows an exceptionally good development of the barrel. Fig. 9 is a Holstein equally as well bred as the former, but at the other extreme in dairy capacity. She shows an unusually small development of the barrel, in keeping with her inferior dairy qualities.

Circulation. After the food is digested and absorbed into the circulation it must be carried to other organs of the body and

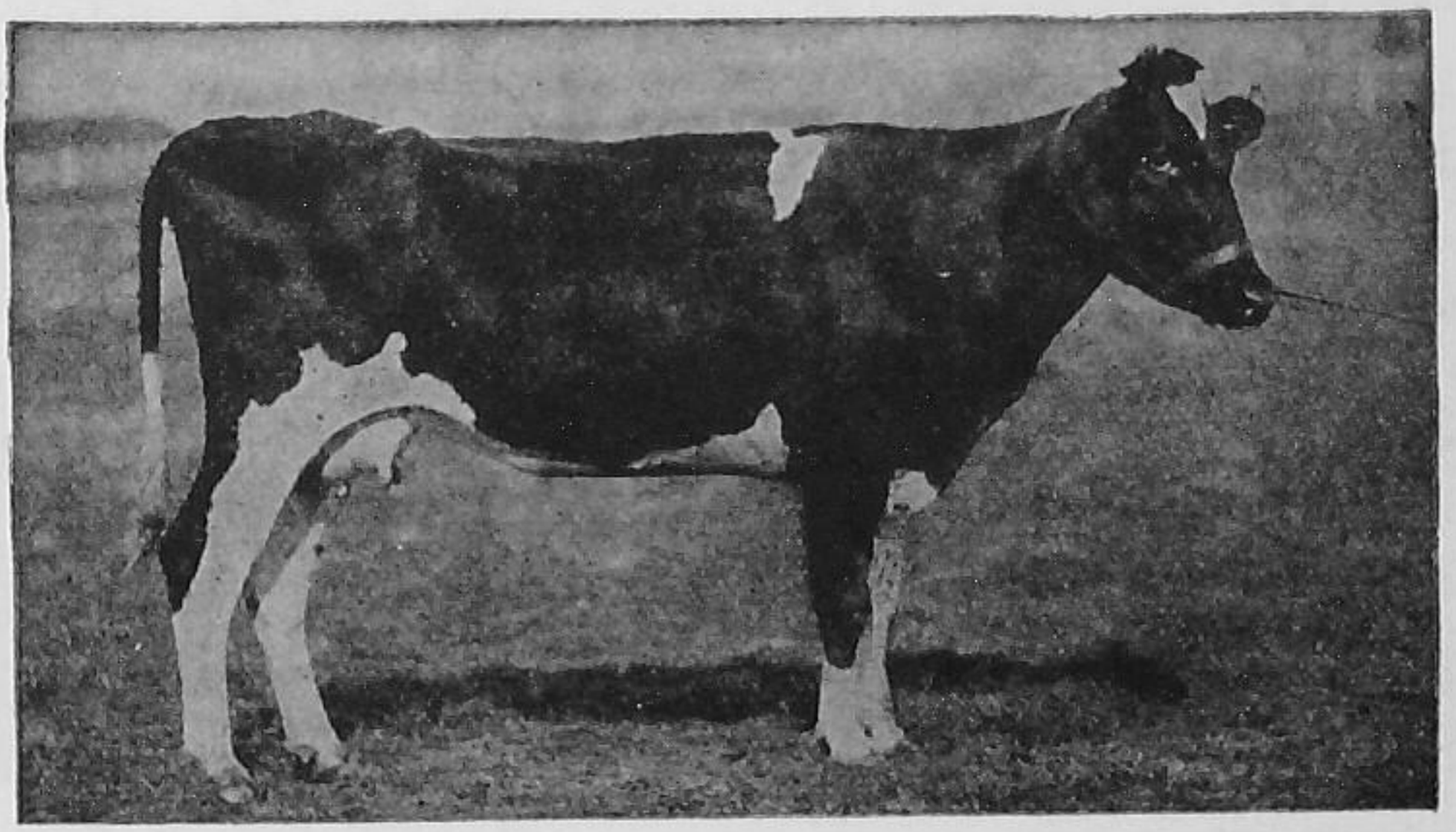


FIG. 9. A pure-bred Holstein cow, an extreme example of a lack of capacity in the barrel. A cow of this type should be avoided.

undergo many changes before it is secreted in the form of milk. A strong, active circulation is of great importance, since without it the whole organism lacks tone. The circulatory system includes the heart, lungs, arteries, and veins. A large heart girth is usually assumed to indicate a large capacity of the heart and lungs. There is, however, some question as to the relation between body measurements and milk production. Gowen found some definite correlation between milk production and live weight; body length; body width; and body girth; but little correlation between milk production and height; hip and thurl width; or rump length. A

soft, pliable skin is also an indication of a good circulation. When the animal has good "handling qualities," it means the small blood vessels below the skin are active and that the animal is in good health. A clear, bright eye is also an index of a good circulation. When the cow is sick, or is by nature dull and sluggish, circulation is poor and the skin feels dry and hard, with rough upstanding hair, and her eyes lack luster.

The Milk Veins and Milk Wells. The most important point to be observed regarding the circulation is the development of the milk veins. The blood, after supplying the udder with material

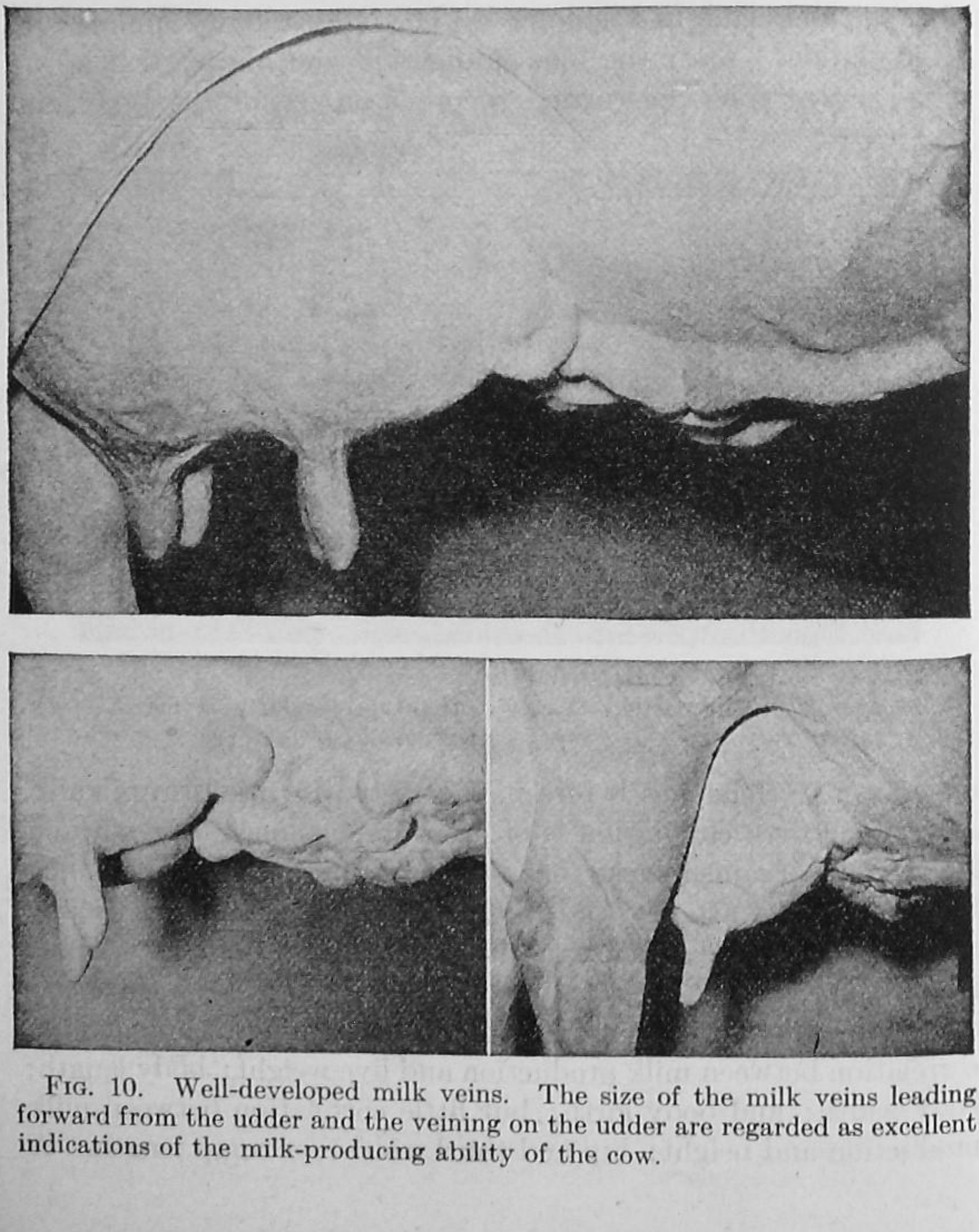


FIG. 10. Well-developed milk veins. The size of the milk veins leading forward from the udder and the veining on the udder are regarded as excellent indications of the milk-producing ability of the cow.

for milk secretion, starts back towards the heart through the milk veins. One of these opens on either side near the front line of the udder attachment to the body, and passes forward just beneath the skin. These veins crook back and forth more or less, in some cases divide into two or more branches, and finally pass upwards through one or more openings in the wall of the abdomen into the body cavity. The portion of the veins from the udder to the opening through which it passes into the abdomen is called the milk vein. The opening in the abdomen through which the vein passes is popularly known as the milk well. Fig. 10 shows exceptionally good development in this respect. The milk vein is one of the reliable indications of dairy capacity, since a large production of milk calls for a large quantity of blood to pass through the udder, and a large milk vein indicates such a circulation. The size of the milk vein is influenced to a great extent by the age of the cow. In a young animal the vein is smaller and more elastic than in the aged cow. When a cow is producing the maximum amount of milk, the veins are larger than is the case when the same animal is dry. The milk wells, on the other hand, remain practically a constant size after the cow is once mature. In judging a dry cow, or one far advanced in the period of lactation (milking), the size of the milk well is of greater importance than the size of the milk veins.

The Udder. The development of the udder is of the greatest importance in selecting a cow, especially in regard to its size and shape. In the manufacture of milk, the food of the cow is first digested, then absorbed into the blood, which passes by circulation to the udder. The udder consists of two large glands which are more or less distinctly divided to correspond with each of the four teats. The duct of each teat enters a small cavity called the milk cistern. The main body of the udder is made up of glandular or secretory tissue, connective and fatty tissue. Since this gland is responsible for the secreting of milk from the blood, its size and development are the most important of all as indicating the dairy qualities of the cow. Fig. 11 illustrates breed differences in good udder formation.

It is not the size of the udder alone that is important, but the number of active secreting cells. An udder gland filled with inert cells and fatty tissue is not effective. This is illustrated by the meaty udder in Fig. 12. This is a large, well-formed udder, but

For show purposes especially, the shape and symmetry of the udder is particularly important. From the standpoint of production the essential thing is to have sufficient udder capacity to admit of the secretion of a large amount of milk, with teats of such size as to admit of convenient milking. When a cow is dry it is impossible to judge accurately of the development of her udder. However, a large number of loose folds of skin, showing an abundance of room for expansion when the udder is filled, may be taken as an indication that the udder will develop in a satisfactory manner. When judging a dry cow length of the attachment to the body should be especially noted. But little can be judged regarding the future size and shape of the udder in the calf or heifer until the time of calving approaches. The size and placing of the teats may be observed and judged with more accuracy than can the future development of the udder.

Other Features. Size and shape of the body, udder, and milk veins, are the most important points to consider in selecting dairy cows, but dairy type and temperament are also indicated elsewhere. Fine, clean-cut features about the face and head; wide muzzle and open nostrils; prominent, bright, active eye; long, thin neck, lacking thickness or coarseness at the throat, and joined smoothly to the shoulders; fine, smooth withers; prominent and strong backbone; roomy pelvic region with hip- and pin-bones wide apart; thighs thin and incurving, with plenty of room between for udder development; and fine, clean bone throughout — all are features associated with cows of pronounced dairy temperament and large productive ability.

Breed Type. This term ordinarily embraces most of the foregoing characteristics indicative of temperament and capacity, and includes a number of other points which appeal to the eye, such as the long level rump, straight top lines, shapely udder, well dished or clean-cut face, and large, prominent eye. All these features are desirable, and are found in the good representatives of the various breeds, but they do not of necessity contribute very much to the productive capacity of the animal.

The Score Card. The score card, as applied to dairy cattle, is a concise description of the conformation of body desired with a numerical expression of the relative importance of each point considered. Perfection is, in most cases, represented by 100 points.

The first attempt to formulate a score card seems to have been

made by the breeders on Jersey Island in 1834. The first score card carried only 26 points. About the time the importations of Holstein cattle to America began in the early seventies, the breeders of Holland also published a scale of points for their cattle. The American Jersey Cattle Club first published a score card in 1889 and the Holstein-Friesian Association of America in 1885. In both cases these were modifications and improvements of those originally developed by the European breeders. The other breed associations later adopted score cards suited for their purposes.

A study of the score card as adopted by the several breed associations reveals wide variation in the credit assigned certain points. For example, the Holstein score card gives 30 points to udder, teats, and milk veins, the Jerseys 38, the Ayrshire 30, and the Guernsey 20. Similar variations are found if other points are compared.

The student should bear clearly in mind that in formulating the score card consideration was not given to milk production alone. Breed type — that is, the conformation which is desirable from the standpoint of appearance — also received a considerable share of attention. It is clear in some cases that still another point was given attention. Certain breeds tend to be deficient in certain respects — for instance, the Jersey breed in the fore udder — and it was hoped that through emphasizing the value of such points by assigning a rather large value the defect would be gradually eliminated from the breed.

As indicated, certain points of conformation — for example, the large development of the udder and barrel and a general evidence of using the feed for milk rather than for flesh production — clearly have to do with a capacity for milk production. On the other hand, there is no evidence that level rump and the dished face of certain breeds are correlated with milk production. These points are emphasized from the standpoint of appearance; having to do with a pleasing appearance they are none the less desirable, but it should be clearly understood that most score cards, especially those developed by breed associations, look to both utility and beauty of form.

Use of the Score Card. While there is ample ground for a difference of opinion concerning the make-up of the score cards in use, their value — for the beginner particularly — is unquestioned. The use of the score card is especially valuable as a means of

impressing the points to be taken into account and their relative importance. Its value decreases as experience is gained. Before using the score card the student should be familiar with the points of the animal as described in Fig. 13. After the student has progressed to the point of being reasonably familiar with judging, the score card is best discarded and the judging done by comparison alone. Judging of cattle in the show ring is done entirely by comparison.

Since the essential facts concerning dairy type are much the same regardless of breed, it has been a common practice in teaching the

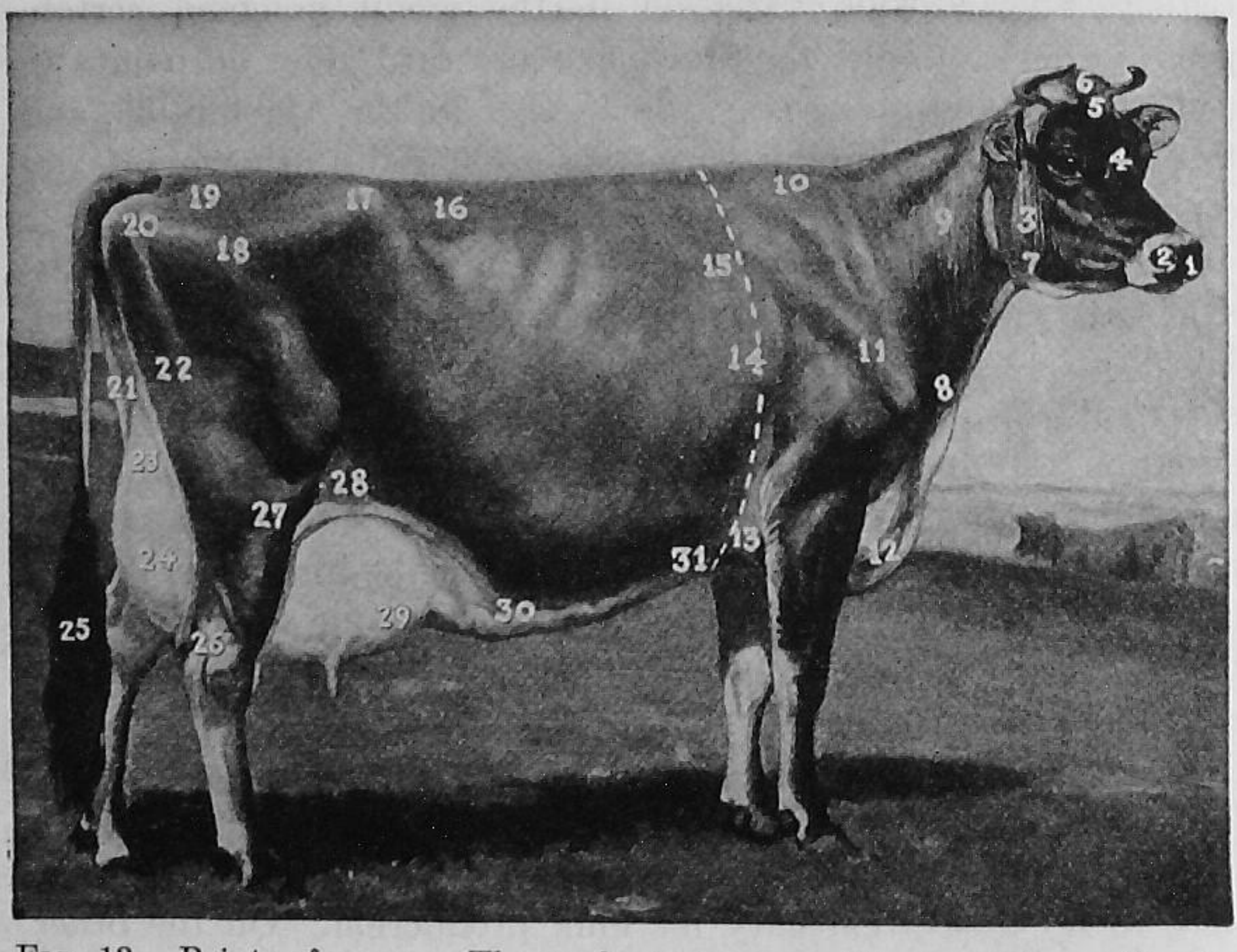


FIG. 13. Points of a cow. The student of dairy cattle should know the descriptive terms used in judging.

1. Muzzle
2. Nostril
3. Jaw
4. Breadth between eyes
5. Forehead
6. Poll
7. Throat
8. Dewlap
9. Neck
10. Withers
11. Shoulder
12. Brisket
13. Chest
14. Heart-girth
15. Crops
16. Loins
17. Hips
18. Thurls
19. Tail-setting
20. Pin-bones

17–20. Rump

21. Escutcheon
22. Thighs
23. Rear attachment of udder
24. Rear udder
25. Switch
26. Hocks
27. Stifle
28. Flank
29. Fore udder
30. Milk veins
31. Milk wells

AH67

judging of dairy cattle to make use of a general score card which aims to present the points of conformation indicating a high development of dairy quality regardless of particular breed characteristics. The beginner may well start with a score card of this type, making a study of dairy type in general. Later the breed score cards should be used and attention directed towards the points most emphasized. The score card given is an example of the class used for a study of the dairy type in general.

SCORE CARD FOR DAIRY COWS
(APPROVED BY THE AMERICAN DAIRY SCIENCE ASSOCIATION, 1922)

SCALE OF POINTS	PERFECT SCORE	PERCENT CUT	STUDENTS' SCORE	CORRECTED
I. Characteristics Indicating Dairy Form				
A. Style and general appearance—20 points				
1. Head erect, clean cut; neck slender, eye prominent, alert and placid.	3			
2. Back—straight and strong, hips wide apart and level	4			
3. Rump—long, wide and level; thurl wide apart and high; level tailsetting	5			
4. Legs—straight, bone fine . . .	3			
5. General build—rugged and large for the breed without coarseness; Jerseys 950 lbs., Guernseys and Ayrshires 1,100 lbs., Holsteins 1,350 lbs.	5			
B. Dairy Conformation—15 points				
6. The cow should be clean cut with feminine appearance; absence of tendency to lay on fat . .	5			
7. Shoulders, withers, vertebræ, hips and pin-bones prominent and free from fleshiness. (Period of lactation to be considered) . .	4			
8. Loin wide, ribs long and wide apart	3			
9. Disposition active, with good nerve control	3			
II. Characteristics Indicating Constitution, Vigor and Condition—15 points				
10. Chest—broad and deep with well-sprung ribs	8			
11. Nostrils—large and open . . .	2			
12. Condition—thrifty and vigorous, in good flesh but not beefy . .	5			

SCORE CARD FOR DAIRY COWS (*continued*)

SCALE OF POINTS	PERFECT SCORE	PERCENT CUT	STUDENTS' SCORE	CORRECTED
III. Characteristics Indicating Ability to Consume and Digest Feeds—15 points				
13. Muzzle large, mouth broad . .	1			
14. Skin mellow, loose, medium thickness showing good circulation and secretion, hair soft . . .	4			
15. Barrel—deep, wide and long, well supported, ribs far apart . .	10			
IV. Characteristics Indicating Well-Developed Milk Secreting Organs—35 points . .				
16. Udder:				
a. Capacity—large in size . .	7			
b. Quality—pliable, free from lumps	7			
c. Shape—extending well forward and well up behind, level on floor, not pendulous, quarters full and symmetrical . .	6			
17. Milk veins—large, long, crooked and branching; milk wells large and numerous	7			
a. Milk veins on udder crooked, numerous and large . . .	3			
18. Teats—convenient size, uniform and well placed	5			
	100			

NOTE: In case of any marked deficiency or any serious abnormality, as many as fifty points may be deducted from the total score of an animal. Beware of giving a thin beef cow as good a score as a dairy cow.

CHECK-UP 4

The purpose of this chapter is to familiarize you with the types of dairy cattle. As you read you found that there are many ways by which you can judge a good milker from an average milker or a poor milker. Should you want to start a dairy farm you will want to know what are the distinguishing characteristics of a good milker. You will want to take advice from those who are already in dairy farming but you will also want to know enough about the selection of good milkers so that you will have a reasonable idea of what you are getting when you start to buy cows.

What Are the Characteristics of a Good Dairy Type?

A. Underscore the phrase or expression that correctly completes each of the following statements. There may be more than one correct response to a statement.

1. The only completely satisfactory way to select good milkers is by: (a) an accurate record of the amount of milk produced by weight; (b) reports of the Babcock butterfat test; (c) judging the qualities of the cow according to its heart girth and paunch.
2. Records of milk-weight and butterfat content are available in many cases through: (a) cow-test associations; (b) official reports concerning pure-breds; (c) study of the conformation of the animal.
3. Standards for judging dairy cattle have been established by: (a) the Holstein-Friesan Association of America; (b) the American Jersey Cattle Club; (c) score cards adopted by many breed associations.
4. A good dairy type usually has: (a) no surplus flesh although the skin and hair have a definitely healthy, vigorous look; (b) well-developed udder and milk veins; (c) smooth round withers and loins.
5. A high-class dairy cow when in full flow of milk: (a) usually has considerable surplus fat; (b) never has much surplus flesh; (c) has soft hair, pliable, loose skin, full paunch and bright, alert eyes.
6. A good dairy cow has a: (a) wedge-shaped body when viewed from the side; (b) rectangular shape viewed from the side; (c) well-developed, rounded withers; (d) wedge-shaped, angular withers.
7. In choosing a cow with a good dairy temperament select a cow that: (a) is thin over most of the milking period; (b) has a prominent backbone and pelvis; (c) has a wedge-shaped body when viewed from the side.
8. A cow can best be judged when: (a) she is in full milk production; (b) she is dry; (c) she has just calved.
9. If you can place three fingers between the ribs of a cow she is probably a good producer because she has: (a) wide-sprung ribs; (b) a large barrel or trunk; (c) been underfed.
10. If a cow's circulatory system is good, which is another guide to milk production, her: (a) skin will be soft and flexible; (b) eyes will be bright and clear; (c) milk veins will be small.
11. The milk well is usually a good guide to milk capacity because: (a) a large milk vein indicates good blood circulation in the udder; (b) small milk veins indicate that the cow's circulation is not being over-taxed; (c) the milk well of a dry cow or of one nearly dry is a better guide than is the size of the veins in the udder.
12. The best type of udder: (a) has prominent veins and soft, flexible

skin; (b) small veins and much fleshy or meaty tissue; (c) shows much loose skin and is greatly reduced after milking.

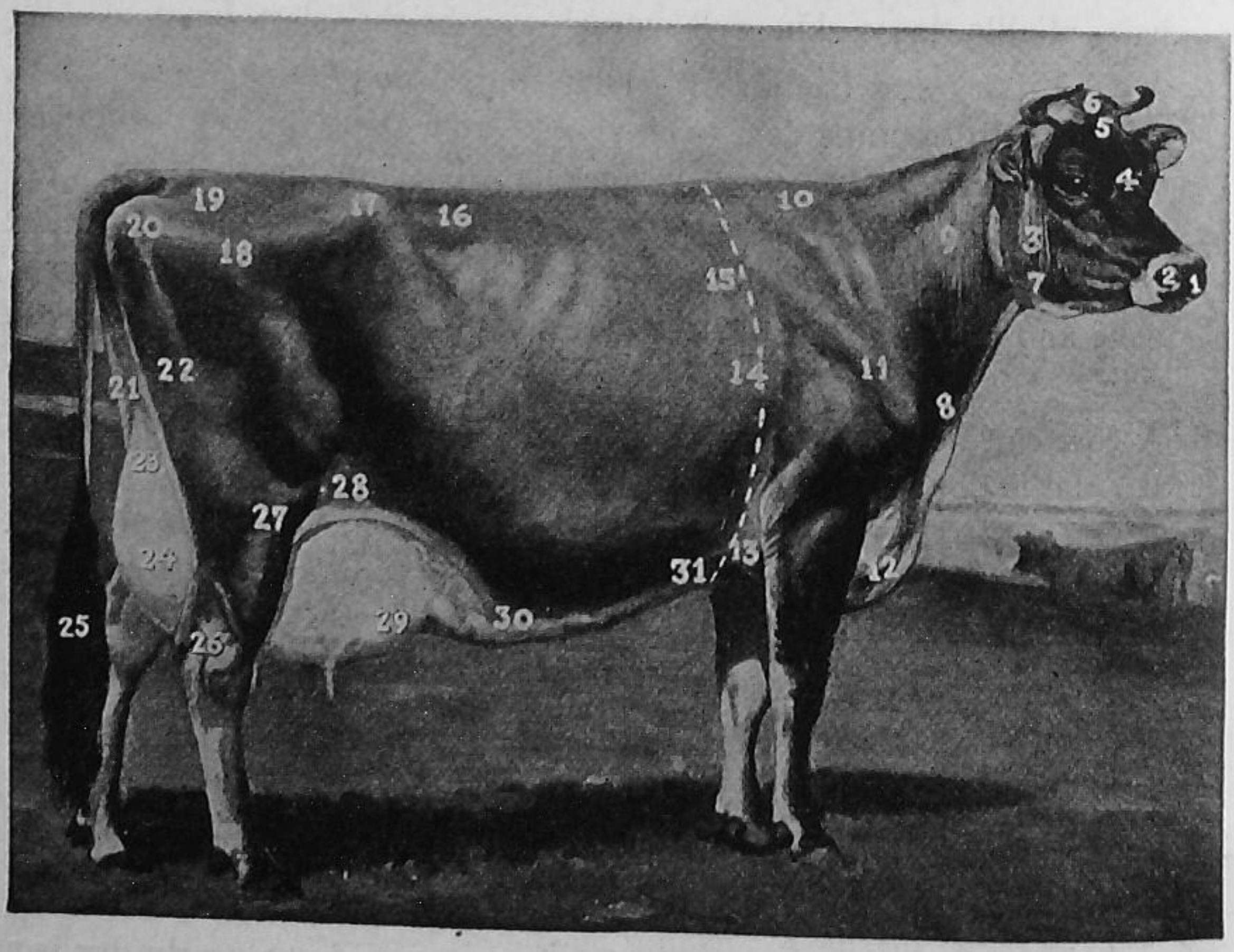
13. The udder of a good dairy cow should: (a) be long and narrow; (b) be wide and extend well up behind; (c) join the abdomen well forward.

14. The probable size of the udder of a dry cow may be determined by: (a) a considerable number of folds of loose skin; (b) attachment well forward and behind with good width; (c) taut, contracted skin.

15. In addition to appropriate shape and size of body, udder, and milk veins, a good milker should also have a: (a) narrow muzzle; (b) broad muzzle; (c) long, thin neck; (d) short, muscular neck.

Can You Name the Points of a Cow?

B. Study carefully Fig. 13 on page 36. Then use this same picture reproduced here without the explanatory table beneath it and on the line after each of the 31 items on the next page write the appropriate phrase or word. When you have done the best you can, check your list against the one on page 36.



1. _____	11. _____	21. _____
2. _____	12. _____	22. _____
3. _____	13. _____	23. _____
4. _____	14. _____	24. _____
5. _____	15._____	25. _____
6. _____	16. _____	26. _____
7. _____	17. _____	27. _____
8. _____	18. _____	28. _____
9. _____	19. _____	29. _____
10. _____	20. _____	30. _____
	17–20. _____	31. _____

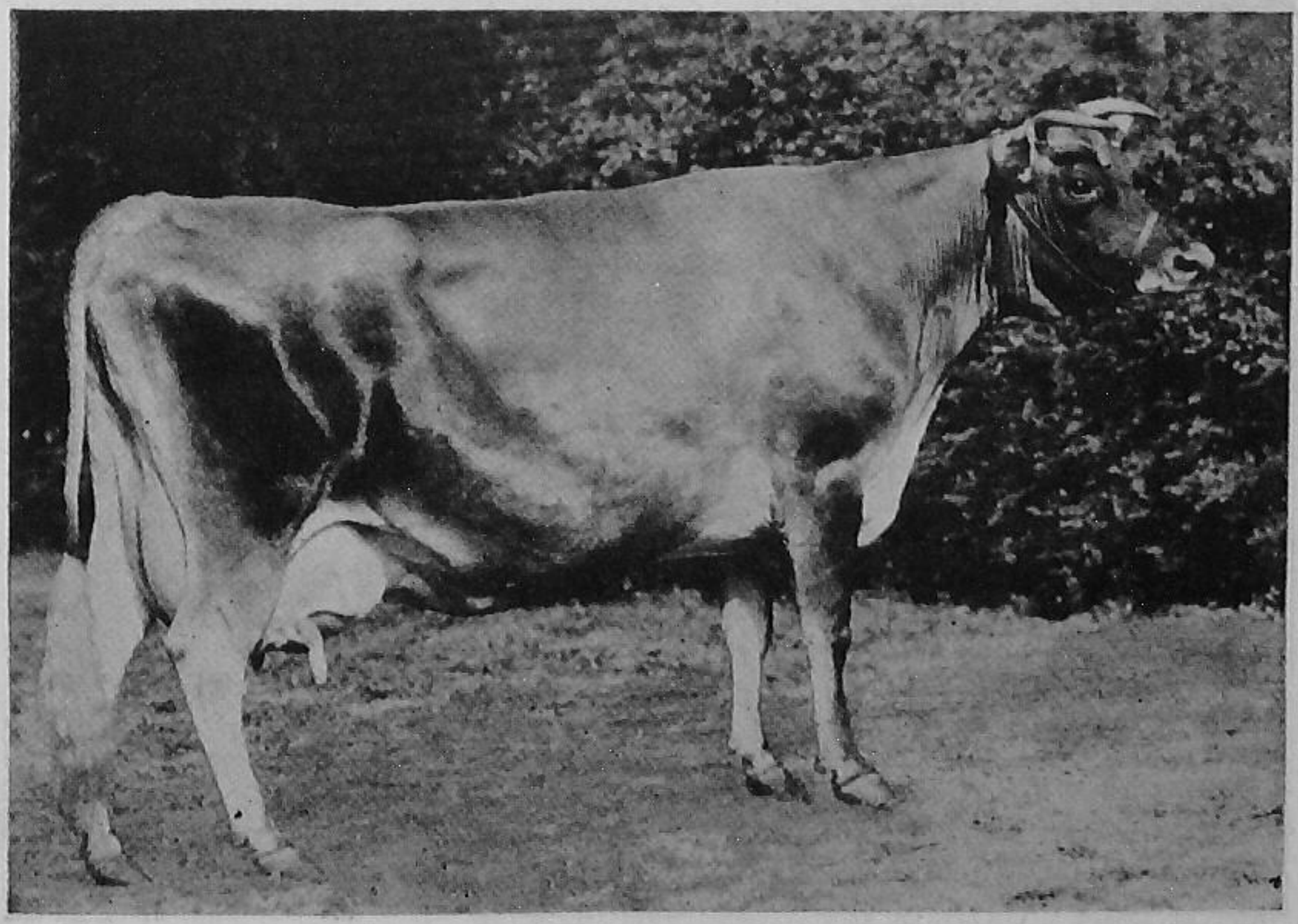


FIG. A

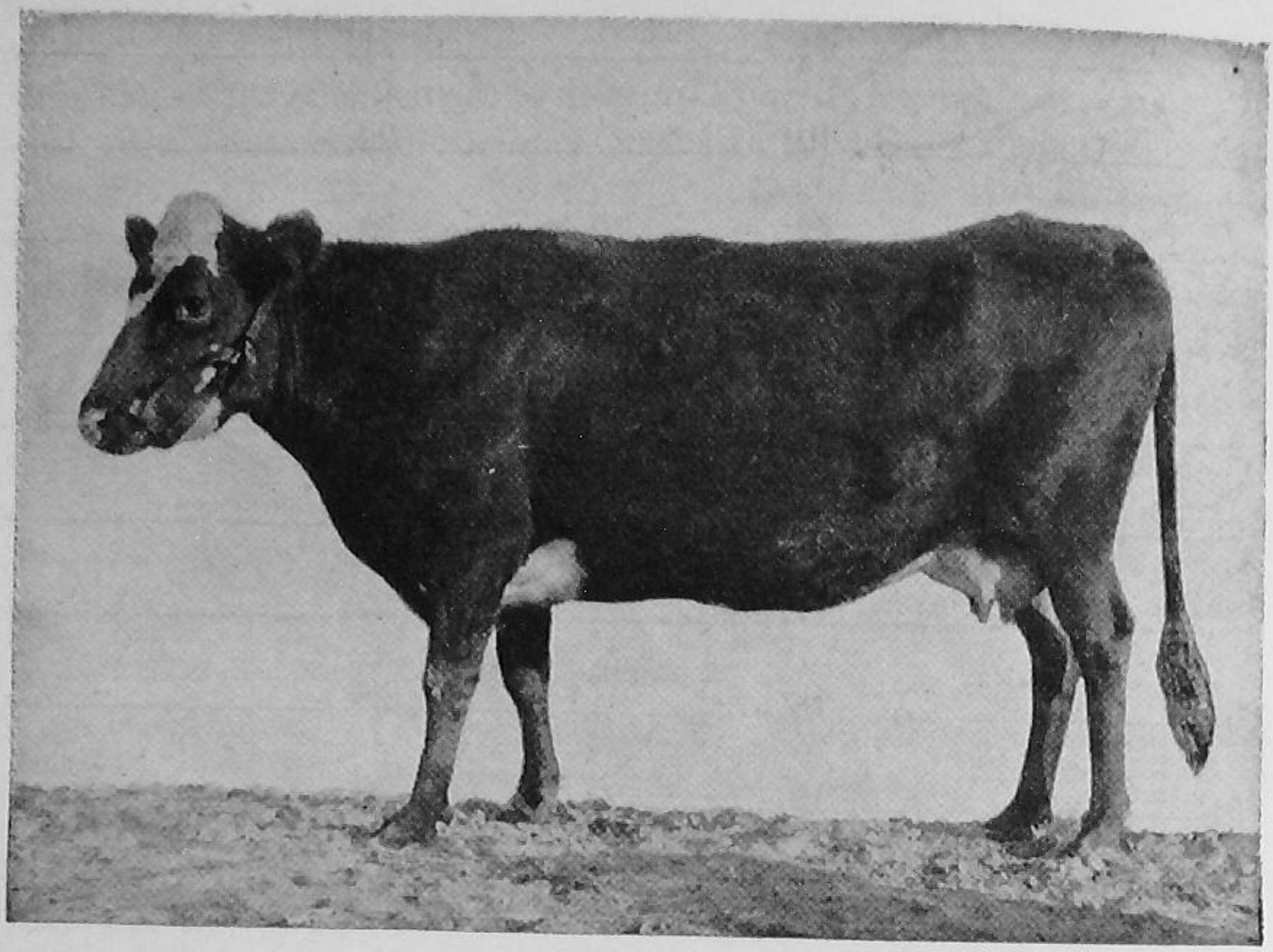


FIG. B]

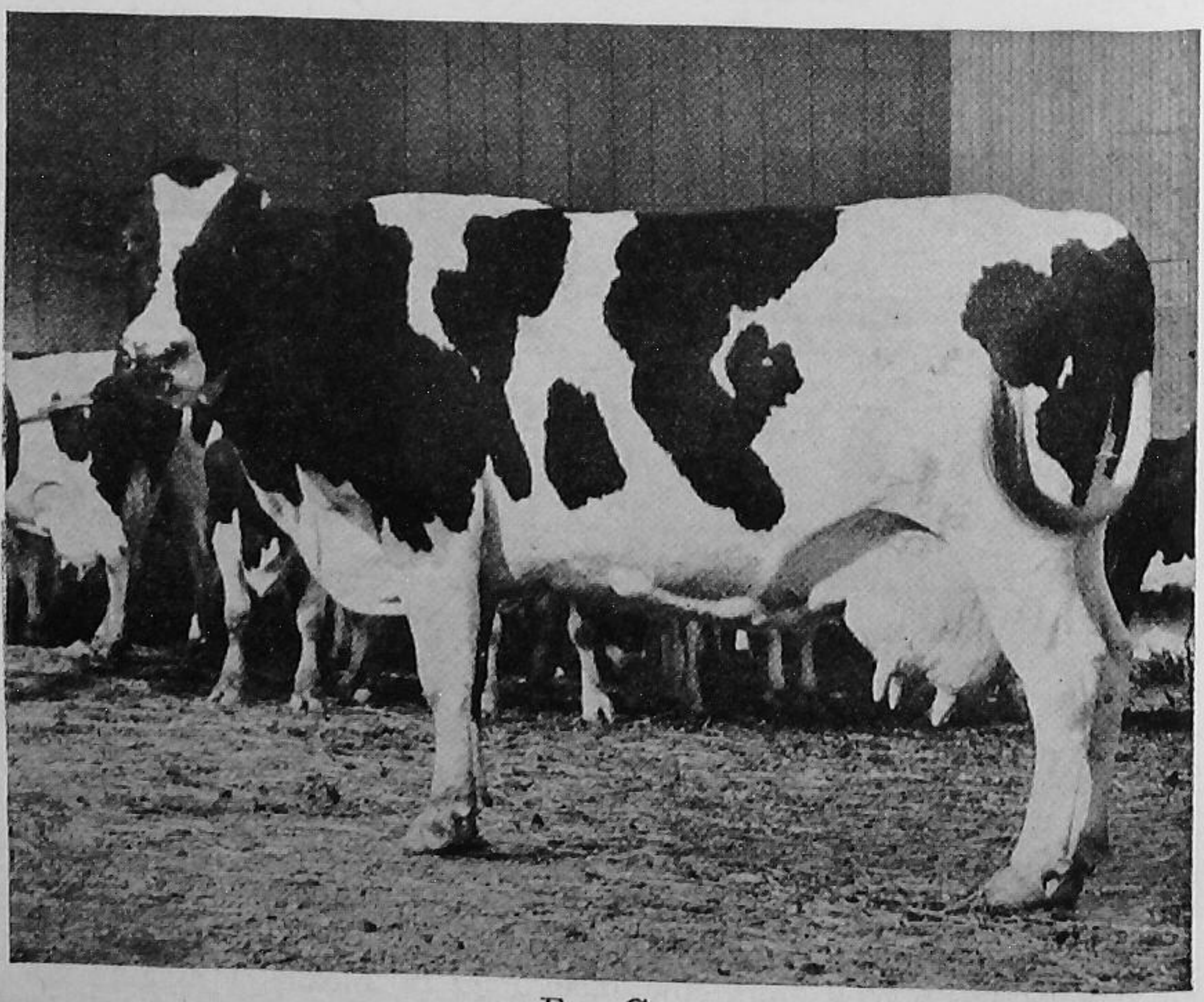


FIG. C

Judging a Good Dairy Type:

C. Compare Figures A, B and C on each of the points in the Score Card for Dairy Cows on pages 37 and 38. Compare your score with the editor's at the back of the book.

	Fig. A	Fig. B	Fig. C
I.			
A.			
1.			
2.			
3.			
4.			
5.			
B.			
6.			
7.			
8.			
9.			
II.			
10.			
11.			
12.			
III.			
13.			
14.			
15.			
IV.			
16a.			
b.			
c.			
17			
a.			
18.			

CORRESPONDENCE OR CLASS ASSIGNMENT 2

1. Describe in detail good conformation in a dairy cow.

2. Describe the major points to keep in mind, other than good conformation in selecting a good dairy cow, including: (a) means of judging the health of the cow; (b) use of records; (c) record of the cow's sire.

CHAPTER IV

HOLSTEIN–FRIESIANS

Origin and Distribution in Europe. This breed originated in Holland, and more especially in the province of Friesland in the northern part of that country. It is not, as the name would indicate, native to the duchy of Holstein, which is a province in North Germany. The compound name Holstein-Friesian, the official name of this breed in America, resulted from a union of the Holstein Breeders' Association and the Dutch Friesian Association in 1885. In common usage now in America the breed is generally called Holstein.

The ancestor of the breed was the *Bos primigenius.* The breed is one of the oldest in existence. Historical references indicate that these cattle have been bred in the same region for at least 2,000 years, and probably there has been only limited mixing with outside blood. In the time of Cæsar the region now part of Holland was famous for its cattle. This reputation has been maintained ever since, and during all these centuries cattle rearing has been almost the exclusive business of the Holland farmer. The caring for cows, the growing and preparing of feed for them, and the utilizing of milk for butter and cheese manufacture monopolize the attention of the farmers.

Influence on Other Breeds. The Holstein-Friesian breed is best developed in its native home, the province of Friesland and across the Zuyder Zee in North Holland. The Holland cattle are now distributed over a large portion of North Europe, extending into Russia. In the seventeenth and eighteenth centuries Holland cattle were taken to England where they were a factor in the formation of the Teeswater or Shorthorn breed, from which our modern improved Shorthorns are descended. It is also believed by good authorities that Holland blood was an important factor in the foundation stock from which the present Ayrshire breed is descended.

Conditions in Holland. The best part of Holland lies almost entirely below the level of the sea, which is kept out by enormous

dykes. The land is very fertile, and almost exclusively is used for growing grass. The farmers, who are mainly tenants, pay from $30 per acre upwards annual rent. The land, which is seldom bought or sold, is valued at from $800 to $2,000 per acre.

In no other part of the world does the cow receive such careful attention as in Holland. About the first of October the cattle are placed in the stable, which is often separated only by a door from the living room of the family, and remain there, constantly as a rule, until the first of May. The stables and the cows are kept in a condition beyond criticism from a sanitary standpoint. If an animal becomes soiled with manure, she is washed and cleaned carefully before milking. The feed is mostly hay and grass silage, with a small allowance of linseed or other oil meal.

In the summer season the cattle are kept on the pastures and not brought to the barn. Pasture rotation is practiced and Holland has the best pastures in the world. The milkers carry the milk from the pasture rather than fatigue the cows by driving them. If a cold wind blows up, the cows are at once blanketed in the pasture. Great care is taken in raising stock only from the best animals. Only a few bulls and about one-fifth of the heifers are raised, and these from the best milkers only. The surplus calves are sold for veal, and the cows as a rule are sold for beef at an age of eight or nine years. In Friesland the milk is used largely for butter making and in North Holland mostly for cheese making. It is not possible to say what effect the German occupation of Holland in the Second World War has had upon Holland's dairy industry.

Importations and Distribution in America. A few Holsteins were imported into New England as early as 1795, but were not kept pure. The first importations that were kept pure were made into Massachusetts in 1861. Only a few were brought over before 1875; but between this date and 1885 about 10,000 were imported, and from these are descended most of the animals of this breed now in America. The only animals imported since 1885 were a few in 1903. The explanation of the small number imported since that date is the high fee required by the Holstein-Friesian Association for registering imported animals and the almost constant prevalence of foot and mouth disease in Holland, which has resulted in a quarantine during most of the past thirty-five years.

There are approximately 500,000 living registered Holsteins in

the United States. The five leading states in numbers are New York, Wisconsin, Pennsylvania, Ohio, and Michigan. The numbers in the southern states are limited. The distribution of grades of this breed, as with other breeds, coincides with that of the pure-breds. There are entire counties in New York and Wisconsin where few dairy cattle of any other breed are to be seen.

Breed Organizations. The first breed association, known as the Holstein Herd Book Association, was organized in 1873, and five years later the Dutch Friesian Association of America was formed. In 1885 the two united under the name Holstein-Friesian. The registration of Holsteins increased with great rapidity from 1900 to 1920. Up to 1938 the total number registered was 2,722,655. Of these about one-third were bulls. Registration for 1937 was 16,689 males and 62,421 females. The 1930 census shows 649,739 pure-bred Holsteins on farms for that year.

Size and Type. The Holsteins are the largest of the dairy breeds. The desired average weight of the mature cow is 1,300 pounds, although individuals vary from 1,100 to 1,800 pounds. The bulls vary, as a rule, from 1,800 to 2,200 — occasionally an individual reaches a weight of 2,500 or even more. The tendency in recent years seems to be toward a somewhat larger type. The tendency has been encouraged by the fact that the cows holding the largest official records are in practically every case far above the average of the breed in size. Some of the best-known cows of the breed in recent years have weighed 1,800 or in a few cases over 2,000 pounds.

American vs. Holland Type. On the average the cattle of this breed, as found in Holland, show somewhat more of a beef type and a less pronounced dairy type than those found in America. The Holland farmer generally sells his cows for beef while they are still comparatively young, and he also expects a considerable income from veal production. For these reasons he insists on some meat-making capacity. The Holsteins brought to America have generally been those having the best-developed milking indications, since their reputation in America is based upon their milk-producing capacity.

Color Marking. The color markings are variegated black and white. As a rule the breeders have preferred animals on which the two colors are about evenly divided. The colors are always sharply defined and not blended. Fortunately this breed has

never been injured by a color fad, although in recent years there has been some tendency to favor those having more white than black.

Breed Characteristics and Adaptations. As a breed, the Holsteins have the best disposition or temperament of any dairy breed. In this respect they resemble the Shorthorns more than any other breed. While cows of the breed as a rule have plenty of nervous energy, which is necessary for high dairy production, they are not

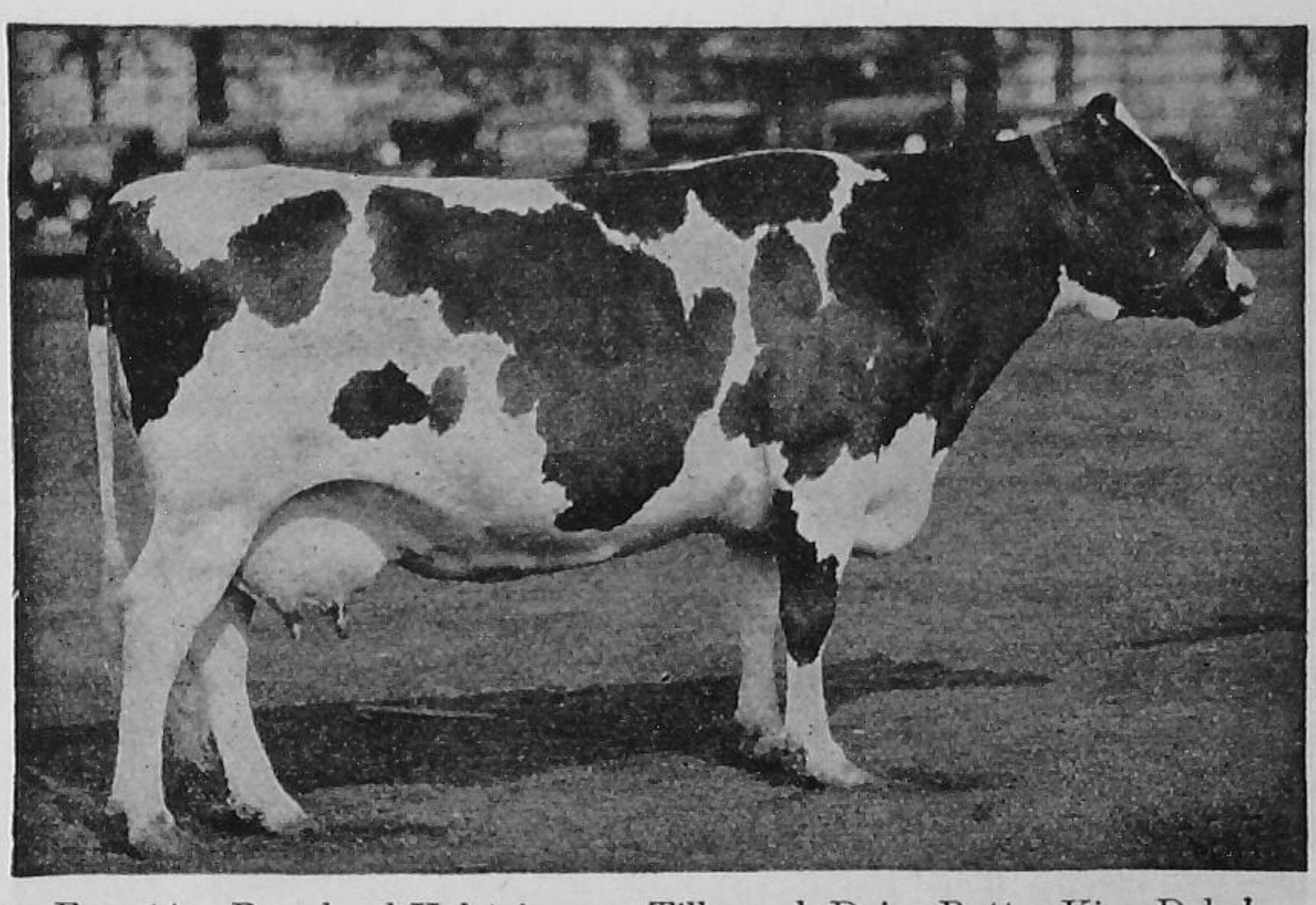


FIG. 14. Pure-bred Holstein cow, Tillamook Daisy Butter King Dekol.

nervous in the common meaning of that term. Where Holsteins and other more excitable breeds are kept together, the contrast is easily noticed. A change of milkers, or any sudden disturbance, as the presence of a stranger or a dog, will produce little or no effect on most Holsteins, while cows of some other breeds will show a marked change in milk production. The Holstein is less alert and active than the other dairy breeds, but her nerves are well under control. This is of considerable advantage because of the usual need for having dairy cattle handled by one or more hired men.

The Holstein cow, because of inheritance and long selection, is best adapted to rather level, rich pastures, and where liberal feeding is practicable. As grazers on hilly or scanty pastures the breed is easily surpassed by the Jersey and Ayrshire — especially the latter.

The reproductive function of cows of this breed is good, being equalled among dairy breeds only by the Brown Swiss. Considerable trouble with sterility and shy breeding is experienced with all highly developed breeds, but the Holstein gives as little trouble as any in this respect. The calves are large, weighing, on the average, 90 pounds at birth; and they are strong and vigorous, giving the minimum trouble in raising. At birth the Holstein calf is the largest of all breeds except the Brown Swiss, and on the average it

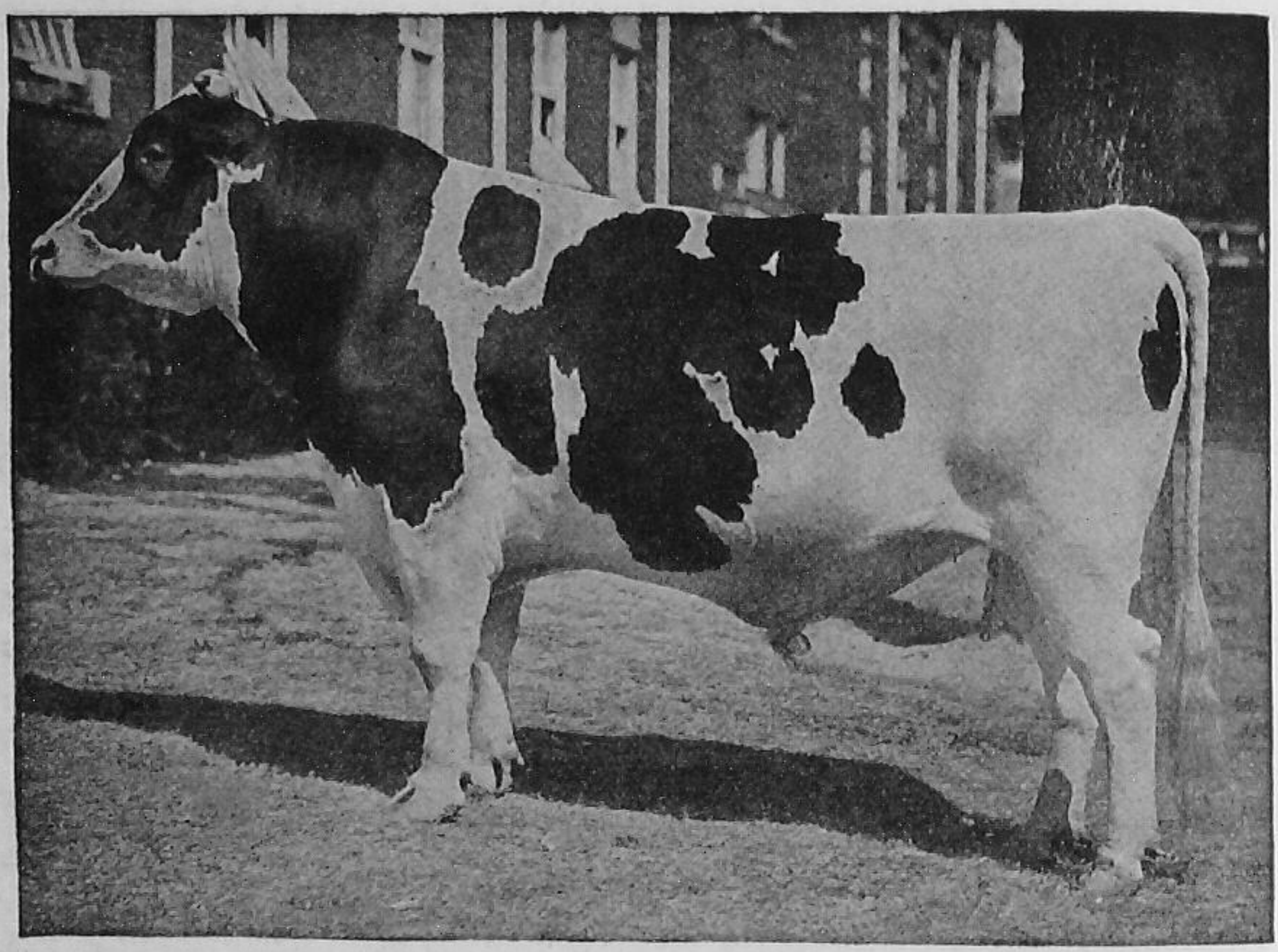


FIG. 15. Holstein bull, Illini Princess Mabel Lad, All-American three year old, 1938.

represents 8 per cent of the weight of its mother. The Jersey calf, on the other extreme, averages 6.5 per cent of its dam's (mother's) weight.

Beef Possibilities. As beef producers, the breed ranks high for a dairy breed. As in the case of the other dairy breeds, the gains in weight are made as rapidly and as cheaply as by animals of the beef breeds. The market price for Holstein steers is generally lower than for animals of the beef breeds, perhaps partly as a result of prejudice, but mainly — as in the case with the other dairy breeds — because of the lower dressing weight, the smaller

proportion of high-priced cuts, and the greater amount of offal (waste or inedible) fat.

The calves are especially well adapted for veal production because of the large weight at birth and the rapid gains made during the first few weeks.

The Holstein does not withstand hot weather as well as some other breeds. This fact is readily observed where cows of this breed and of others are kept under the same condition in a rather hot climate. The ability of other breeds such as the Jersey to endure heat better than the Holstein undoubtedly has some relation to the fact that the Jersey is the leading breed in the southern part of the United States and the Holstein in the northern part.

The breed does not mature especially early. The animals reach the maximum of growth in skeleton between the ages of four and five years, while the maximum weight is reached about two years later. Usually the heifers are sufficiently mature to come into milk between 28 to 30 months. Freshening (giving birth to a calf) at an earlier age is not advisable, as the tendency is to check growth and to result in undersized cows.

Milk and Fat Production. No satisfactory statistics are available which show the average production of any of the dairy breeds under practical farm conditions. An abundance of data may be had which give results from official testing. However, the value of such records is limited as a basis for judging results under conditions such as exist on farms where the bulk of the milk supply of the country is produced. On the other hand, figures of production by herds on average farms, while of value, would not be satisfactory as indicating the capacity of a breed to produce milk and fat, since in too many cases the low production shown by such figures is due largely to poor feed and management and does not, therefore, represent the real capacity of the breed.

A compilation of published yearly records of cows owned by Experiment Stations shows an average annual production by cows of the Holstein breed of approximately 9,000 pounds of milk containing 3.45 per cent of fat, and an average yield of 310 pounds of fat. These figures are fairly representative of average yield under good conditions. The most valuable figures would probably be those representing entire herds on farms where a reasonable amount of culling of inferior animals is done; where the cows are well fed, but not pushed by excessive grain feeding to the point of

lowering the economy of production, and are bred to calve at intervals of twelve months. Under such conditions in a Holstein herd, an average of at least 8,500 pounds of milk and 300 pounds of fat should be expected each year for all cows in milk, including animals of all ages.

Occasionally an average of 10,000 pounds is reached under such conditions for a term of years for an entire herd, but this is unusual and represents exceptionally well-bred animals with unusually good methods of feeding and management. On the other hand an average of less than 7,500 pounds should cause the owner to examine most carefully into his methods of selecting and feeding. The average fat percentage for the herd will not vary much in any case from 3.45, the average for the breed. Cows testing 3 percent or below are discriminated against by most breeders.

Characteristics of Holstein Milk. The Holsteins produce more milk, on the average, and at a cheaper cost for 100 pounds, than any other breed. The percentage of fat averages the lowest. It is claimed by some breeders that the percentage of fat has been increased by American breeders. While it is possible that the strong efforts now being made in this direction by the leading breeders has resulted in richer milk from certain herds of selected animals, there is little evidence to show that the average of the breed has been changed.

There is a tendency to criticize the Holstein unduly because of the well-known low fat content of the milk. If butterfat is marketed the total quantity produced is the most important fact. It has long been known from practical experience that milk with an unusually high fat content is not as desirable for calf feeding as is milk with an average, or even a lower, percentage of fat. This belief on the part of practical cattle men has been confirmed in recent years by research work both with man and animals.

The total solids of Holstein milk contain on the average 28 per cent of fat as compared with 34 per cent for the Channel Island breeds.

Color and Size of Fat Globules. The fat globules are small, rather variable in size, and show the least yellow color of any of the breeds. Because of the small size of the fat globules, the cream does not separate so quickly nor so completely by gravity as is the case with larger fat globules. However, when a centrifugal cream separator is used the difference in the loss of fat in the skim milk

from different breeds is too small to deserve consideration. The lack of color in the fat results in the milk and cream showing much less color than if it were of equal quality, but from a Jersey or Guernsey cow. The lack of color is of some disadvantage in selling market milk or cream, since in the popular mind a yellow color is considered an index of richness.

The small fat globules are of some advantage when the milk is to be transported to market, as it makes possible the necessary handling of the milk with the minimum danger of churning.

Families. There are no well-defined families among the Holsteins, as is the case with some other breeds. Holstein breeders often refer to certain animals in a way that would suggest a family — for example, speaking of a De Kol, a Johanna, or an Ormsby. Such a statement indicates that the animal in question is a descendant of the noted animal mentioned. Unlike the Jersey breed, in which the families are as a rule traced to a bull as progenitor and who gives the family its name, the Holstein breeders trace their lines of breeding ordinarily back to a great foundation cow. A foundation cow is one that transmits characteristics desirable for that breed to a high degree. In most cases the exceptional qualities of such animals are not recognized until their days of usefulness are long past.

During the early development of the breed in America, certain cows rather than bulls were given prominence in Holstein breeding operations. This is still true although not to the same extent. Cows with large official records, and their descendants, are in the greatest demand although, since a large number of official records have been recorded, the value of certain bulls as sires of high-producing cows has been more fully recognized. As a result, bulls of high-transmitting ability are in great demand and their descendants are much sought after.

Advanced Registry. The Advanced Registry has been one of the important factors in the increase of popularity of this breed in America. The Holstein-Friesian Association should be credited with the introduction of this system — since adopted in somewhat different forms by all other dairy cattle associations in America. The plan is to make record of dairy performance, in addition to regular registration.

The first entries were made in 1886. Under the original plan the animals were admitted on making certain milk and butter

records as the result of tests made and reported by the owners themselves, and after an inspector had scored and examined the animal. This association was the first to adopt the Babcock test as their official method, which was in 1894. At first it adopted the plan of printing the records in the form of butter, calculated on the basis of 80 per cent fat. Later the rules were changed, and since that time the test supervisor reports the milk and fat yield. The common practice, however, on the part of Holstein breeders is to express the results in terms of butter, calculated on the 80 per cent fat basis. A 1,000-pound cow, as the term is used in breed literature, means one that produced 800 pounds of fat in a year, and a 30-pound cow one that produced 24 pounds of fat in seven days.

Some Advanced Registry Results. Table 4 gives the ten leading cows in fat production for 1937.

TABLE 4. TEN HIGHEST FAT RECORDS FOR HOLSTEIN-FRIESIAN COWS

COW	LBS. MILK	LBS. FAT
Carnation Ormsby Butter King 1165152	38,606.6	1,402.0
De Kol Plus Segis Dixie 295135	33,464.7	1,349.0
Carnation Ormsby Nellie 1326284	35,886.9	1,328.8
Calamity Nig of Elmwood Farms 1560447	34,615.7	1,327.9
Carnation Ormsby Segis Beauty 1203395	31,264.3	1,290.4
Daisy Aaggie Ormsby 3rd 571569	33,140.0	1,286.2
Carnation Prospect Ormsby Gluck 1042591	33,347.7	1,225.4
Femco Johanna Bess Fayne 1073533	32,727.1	1,220.4
May Walker Ollie Homestead 300043	31,610.6	1,218.6
Hollywood Lilith Palmyra Abbekerk 400491	31,858.8	1,206.8

In 1938 there were 191 breeders testing 2,174 cows in the Advanced Registry.

The Holstein-Friesian Association has its central office at Brattleboro, Vermont.

CHECK-UP 5

Have you picked out some of the main points discussed in the chapter?

A. In each of the following incomplete sentences write the appropriate item or items in the blank space or spaces.

1. Holstein Friesian cattle originated in _____.
2. In size Holsteins are the _____ breed of dairy cattle.

3. Compared with other breeds of dairy cattle the Holsteins have the _____ disposition.
4. Holsteins produce a _____ quantity of milk than any other breed.
5. The percentage of butterfat in Holstein milk is _____ than in other breeds.
6. Holland blood is in the ancestry of the _____ breed and the _____ breed of cattle.
7. Among the five leading states in numbers of Holstein cattle are _____ and _____ and _____.
8. Holsteins like pastures that are _____ and _____.
9. Because of the large weight at birth Holstein calves are well adapted to _____.
10. A Holstein cow that produces 10,000 lbs. of milk in a year containing 3.45 per cent fat will yield _____ lbs. of fat.
11. The cream does not separate readily from Holstein milk because the fat globules are _____.
12. In shipping milk it is an advantage to have _____ _____ fat globules.

How well do you know the characteristics of a good Holstein cow?

B. Below are listed a number of traits in dairy cattle. Place the letter Y (yes) in the parenthesis in front of each characteristic for which good Holsteins are noted or the letter N (no) if the characteristic is not typical of good Holsteins.

1. ( ) Small size
2. ( ) Quiet disposition
3. ( ) Yellow milk
4. ( ) Ability to consume large quantities of hay and other roughage
5. ( ) Indifferent breeder
6. ( ) Adaptable to continuously warm climate
7. ( ) Efficient milk producer
8. ( ) Beef and veal production
9. ( ) Evenly distributed brown and white markings

CHAPTER V

JERSEYS

Origin and Distribution in Europe. The Jersey and the Guernsey breeds are often called the Channel Island breeds. They take their names from the islands of the same names, which are a part of the group called the Channel Islands. This group, which includes the Islands of Jersey, Guernsey, Alderney, and Sark, lies in the entrance to the English Channel about nine miles from the coast of France and about seventy from England.

The cattle from these islands were formerly classed together and called Alderney, after the third island in size of the group. The cattle on these islands are supposed to be descendants of the cattle of Normandy and Brittany in France. They belong to *Bos sondaicus* type, and are therefore related in origin to the Brown Swiss, the Devons, the Kerry, and more or less to other cattle of England, but not to the Holsteins. When they were brought from France to the Islands is not known, but it is known that they have been kept relatively pure for a long time. Since 1789 a law has been in force on Jersey Island which entirely prohibits the importation of cattle except for slaughter. A few years later Guernsey adopted a similar law.

Outside of Jersey Island the Jersey breed is quite numerous in England, but only a few are used elsewhere in Europe. The first demand for them outside of their native island came from England, where they were placed on the estates of the nobility largely on account of their beauty. Even to the present time the breed has not contributed very much to the total dairy products of England.

Conditions on the Isle of Jersey. Jersey Island is eleven miles long and about nine wide. Its area is 36,680 acres, of which 25,000 are tillable. The population is about 60,000. This island rises from the level of the ocean on the south, in a long graduate slope to the north side, which has cliffs about 200 feet high along the ocean. Because of the influence of the Gulf Stream, the climate is mild and even. The grass remains green throughout the year and is rather fine and nutritious. The cattle are pastured during the day

by the tethering system. The tether is a rope or chain which permits the animal to range over a small area. From May to October the cows, as a rule, remain outdoors all the time. In winter the cows are out in the daytime, and in the evening they are housed and fed hay, roots, and a small ration of bran, or oil cake. But little grain is fed at any time.

Intensity of Jersey Farming. The agriculture on Jersey is very intense. At least two crops of some kind are raised each year on the same land. The average annual rental is over $50 per acre, including the ground occupied by the dwelling house and barn as well as for the cultivated land. The island was at one time in a very low state of fertility, but its productiveness has been increased until it ranks among the highest developed agricultural regions in Europe. About 10,000 cows are kept on the island, or one to every 2.2 acres of cultivated land.

The cattle have been bred and improved with special reference to butter production for over 100 years. In 1834 a scale of points was made out for both cows and bulls, and prizes were offered for the animals conforming most nearly to the scale of points. The breed began to improve more rapidly from that time on. At the present time the cattle on the island are a very uniform lot, but their average production is probably lower than that of equally good representatives of the breed in America, largely because they are fed a less liberal ration of grain, and they average smaller in size than the American Jerseys.

Importations and Distribution in America. In 1850 several Jersey cows were imported to Hartford, Connecticut, and in 1868 S. S. Stephens of Montreal, Canada, imported nine animals, from which have descended some of the most famous producers in the Jersey breed. After 1868 importations were numerous until about 1890, then followed a period of several years when few were imported. During the last decade several importations have generally been made each year. The interests of the breed in the United States are looked after by the American Jersey Cattle Club. Over 1,570,000 head have been registered in the United States up to March, 1938, of which one-fourth are bulls. Some 35,600 females and over 8,700 bulls were registered in 1937.

Numbers and Popularity. The 1930 census estimated that there were about 350,000 registered Jerseys in the United States. The Jerseys rank second in number among the dairy breeds. The

Jersey is found in all parts of America, but most numerous in the eastern and southern states. According to the census figures the five leading states in numbers are Ohio, Texas, New York, Pennsylvania, and Missouri. The breed is making rapid progress on the Pacific Coast, especially in Oregon. The popularity of the breed has been helped by the fact that it was introduced at an early date and further by the skill shown by the American Jersey Cattle Club in looking after its interests.

At an early date this breed was afflicted by a color fad, which injured it somewhat for several years. The fad was for solid colors, which means no white markings, and for a black tongue and switch (see Fig. 13, p. 36). At present little attention is paid to color, although the majority of the Jerseys found in this country have the solid colors and black points. In the late seventies and early eighties a great boom struck the breed in the United States. Cows of the St. Lambert breeding brought enormous prices. As high as $25,000 was paid for a single Cow. In 1893 twenty-five animals each of the Jersey, Guernsey, and Shorthorn breeds competed in a dairy test at the World's Fair, Chicago. In both the production of cheese and butter the Jerseys won first place on total production and economy of production. This gave the breed greatly increased popularity, and their numbers increased very rapidly in the following years. They also stood first in the dairy test at the World's Fair in St. Louis, in 1904, with the highest average production and the greatest economy of production of butterfat.

Size and Type. The Jersey is the smallest of the dairy breeds, with the exception of the Kerry. The weight of the average cow is generally between 800 and 900 pounds. The bulls, as a rule, range from 1,200 to 1,700 pounds. The breeders in America have generally favored the larger animals, and for this reason, and possibly also because of the more liberal feeding practiced, it is generally believed the breed tends gradually to increase in size after a few generations in America. Cows weighing 1,000 pounds are quite common here, but unknown on the Jersey island. A good Jersey cow is the model of what is generally taught to be the dairy form. She has the pronounced wedge shape, an immense barrel for her size, and a well-developed udder, and she does not carry a pound of surplus fat while in full flow of milk.

Island vs. American Type. The difference is so marked between

the imported, or their near descendants, and those descended from the early importations that the two types are generally recognized as the American and the Island types. The American type is well represented by animals of the so-called St. Lambert breeding. More recently Sophie's Tormentor, St. Mawes, and Golden Glow familes have gained prominence as American-bred families. This type is larger and coarser than the Island type, and less beautiful; and it is often deficient in fore udder development, it is inclined to coarseness in the head and pelvic region, and often lacking in general symmetry. Cows of the American families have so far held most of the milk and butterfat records for the breed.

The Island type is smaller and more refined and beautiful in form, and splendidly developed in the udders, especially in front. They have fine symmetrical heads and necks, and level, flat rumps. They generally are the favorites in show ring competition, and have included the most fashionable breeding and highest priced animals of the breed.

Influence of the Early English Breeders. The Jersey breed and the practices of the Jersey breeders have been influenced more by Philip Dauncey than by any other individual. Dauncey began his breeding operations in 1826 and first made the breed well known in England through his remarkable breeding operations, which covered forty-one years. His ideal was to develop large, rather coarse animals of great constitution and with remarkable milking qualities. W. G. Duncan began his breeding operations in 1849, making use of the Dauncey blood, and continued the development of the same type, which is that now known in the United States as the American type.

In-breeding an Influence. In developing the type these breeders selected animals of the type they desired, and then inbred freely and continuously. They also bred heifers to calve at three years of age, which was an important factor in developing a large animal. The early importations to America were largely cattle from the Duncan herd, or were descendants of the Dauncey herd. These facts show that the ancestors of many American herds were taken from Jersey Island nearly a hundred years ago and that the origin of the so-called American type of Jerseys should be mostly credited to Dauncey and Duncan. It is also interesting to note the influence Dauncey's practices still has upon American breeders. He practiced in-breeding persistently and the practice

has been followed by breeders of this class of cattle ever since, although it has never been adopted to any extent by those interested in other dairy breeds. The fad for solid colors, once so strong in America, and which still persists to some degree, originated with these two English breeders.

Breed Characteristics and Adaptations. The color of the Jersey varies greatly. It may be any shade of yellow, except orange, from almost white to very dark squirrel gray or black. The most common color is fawn with black shadings below and on the head. White spots may appear most commonly on the underline, but they are not generally looked upon with favor, especially among breeders of the American type. More and more broken color is to be found in recent importations from the Island and some of the best recent show animals have been of broken color. The tongue and switch are generally black. The muzzle is intensely black, incircled by a light colored ring. The bulls are as a rule darker in color than the cows.

Nervous Temperament. Cows of this breed are quite sensitive, because of a highly developed nervous temperament which is not

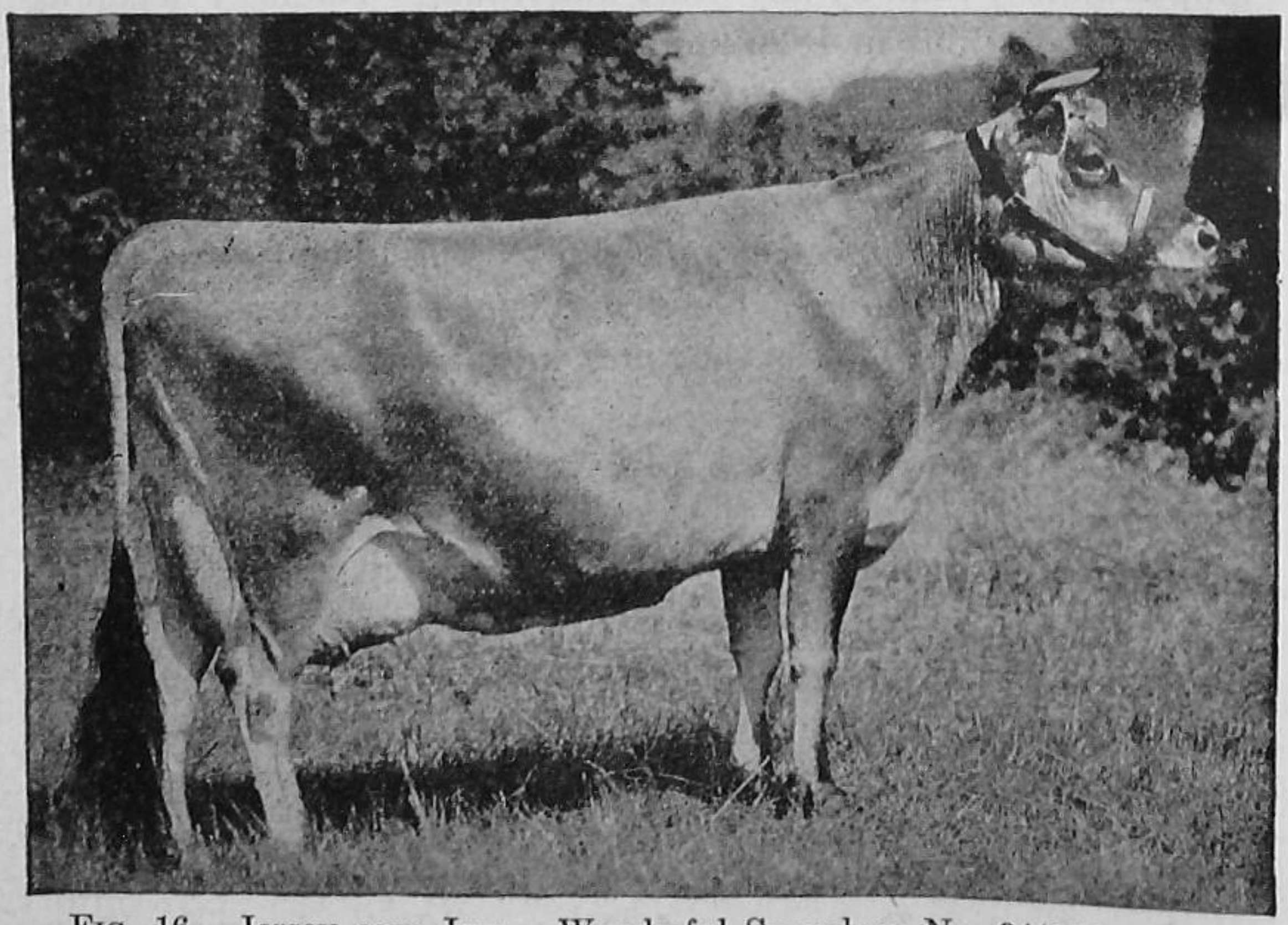


FIG. 16. Jersey cow, Imp. Wonderful Snowdrop No. 941016. Reserve Grand Champion Jersey cow National Dairy Show, 1937. Record: 5 years 4 months, 545.36 lbs. butterfat, 10,135 lbs. milk—305 days—Class AAA. She represents an excellent combination of breed and dairy type and production.

well under control. However, when carefully handled, they become exceedingly gentle. On the other hand when carelessly handled or abused, they become very much the reverse. They are more easily disturbed by unusual surroundings than other dairy breeds.

Jerseys are easy or economical keepers; but like all dairy animals, they need good pastures and liberal feeding for good returns. They do better than the Holsteins on rough and scanty

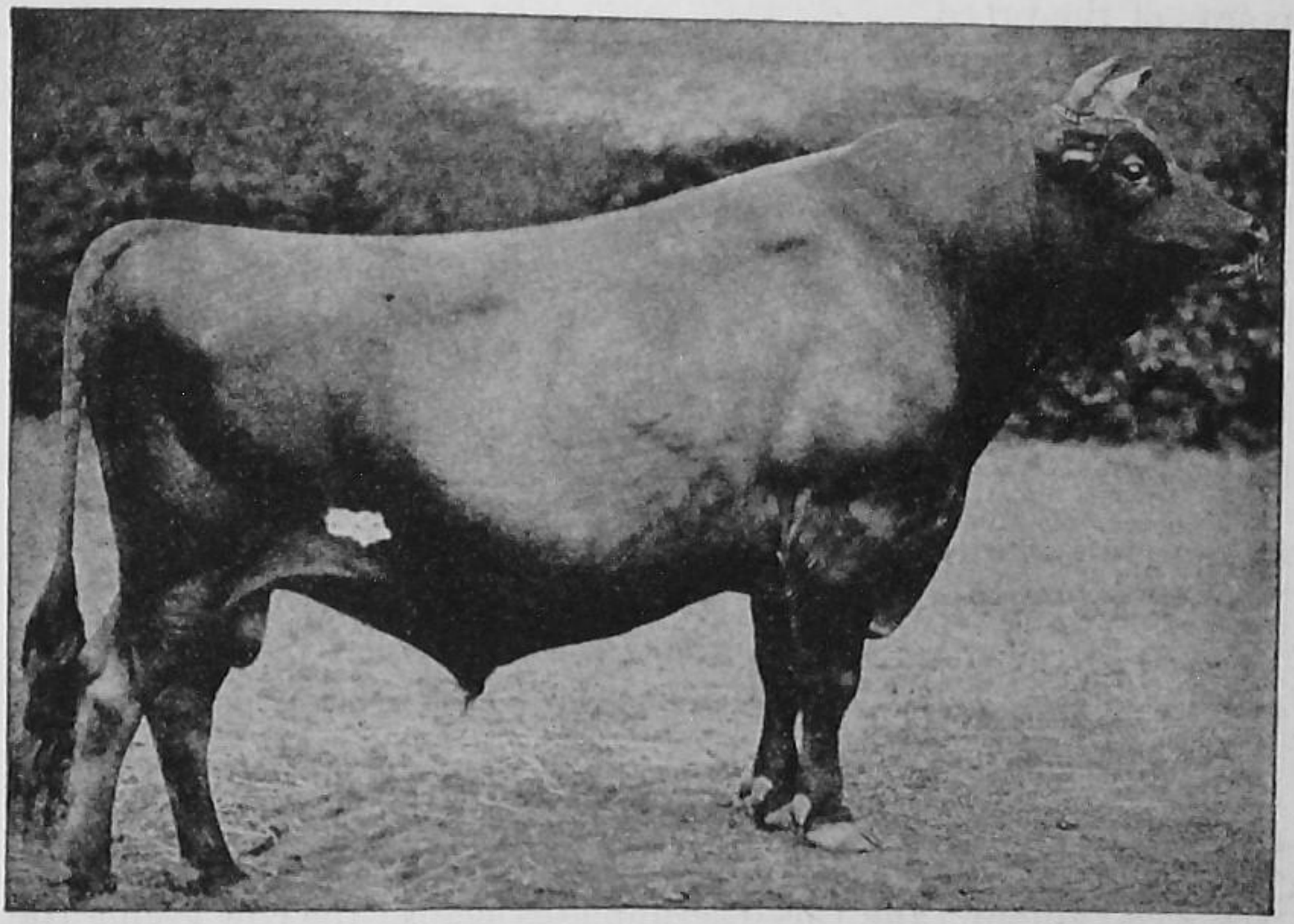


FIG. 17. Jersey bull, Brampton Standard Sir 276574, Gold and Silver Medal Bull and Superior Sire. an outstanding sire. He won first prize get-of-sire, first prize production get-of-sire at the National Dairy Show 1935; first prize get-of-sire and first prize production get-of-sire at the same show in 1936 and in 1937.

pastures, but they are not equal to the Ayrshire in this respect. They seem to thrive in warm southern climates better than some other breeds.

Beef Possibilities. As meat producers they stand low, even for dairy breeds. The body fat is very yellow and is not well distributed. The calves are small, weighing between 50 and 60 pounds at birth, and do not gain rapidly for the first few weeks. For this reason they are not well adapted for veal production. If Jersey

calves are raised for meat, they should usually be sold by the time they are eight or ten months old.

The breed is very prepotent when crossed upon common cattle or grades of other breeds which means that the cross usually partakes strongly of the Jersey type and milking qualities. The heifers (young females) mature early. They are usually sufficiently well developed to come into milk at the age of 24 to 26 months. The lack of vigor in the calves at birth and the mediocre breeding qualities of the cows are generally considered the weakest points of the breed.

Dairy Characteristics. Under good farm conditions an average yearly production of 5,500 pounds of milk and 275 to 300 pounds of fat including all females of milking age would be considered fair results. An average of 8,000 pounds of milk, or more, would be unusually high, but is obtained under the best conditions. The fat percentage varies between 4.5 and 6.5 with an average of about 5.14.

In quantity of milk the Jersey breed is excelled by several others, but in fat yield it ranks equal to any. Because of its richness Jersey milk cannot be produced and sold in competition with that from other breeds where weight or quantity is the basis of payment. Even where milk is purchased for market purposes or for condenseries it is often the practice to pay a price per hundred for milk with a minimum fat content, usually 3.5 per cent, with a small increase for each tenth of a per cent or "point" above 3.5. The price paid for the fat above the minimum is less than that for the basal amount and this discriminates against the cow giving the high-testing milk. For these reasons the Jerseys are not used to any great extent in localities marketing whole milk.

Economy of Fat Production. As an economical producer of butterfat the Jersey and her near relative, the Guernsey, are unsurpassed. The Jersey milk has the highest per cent of fat of any dairy breed common in this country. In economy of production of fat this breed has always led, where opportunity has been given to make fair comparison with other breeds. The economy of fat production by these breeds, as explained elsewhere, is to be attributed to two factors. One is the fact that the fat represents a greater proportion of the solids than in other breeds; in other words, less skim milk is produced to the pound of fat. The second is the smaller proportion of the ration used for maintenance. A

Jersey weighing 900 pounds will produce as much fat on the average as a Holstein weighing 1,250 pounds. In this case the cost of maintaining the larger cow adds to the feed cost of the fat produced.

Butterfat Characteristics. The most prominent and best known characteristics of Jersey milk are the high per cent of fat, the pronounced yellow color, and the easy creaming of the milk. The latter characteristic is due to the unusually large fat globules. The large fat globules also cause the fat to churn easily, which is something of an advantage in butter-making. The same ease of churning is a slight disadvantage when the milk is to be handled much, as in the market milk business, because it results in small masses of butter appearing on the surface.

The Jersey a Family Cow. In persistency or length of period of milking the Jersey ranks very high, probably the highest of any breed. Cows of this breed are general favorites as family cows because of the richness of their milk, its easy creaming characteristics, their persistency of milking, their easy keeping qualities and gentleness. The Jersey cow finds her special adaptation as a family cow or as an economical producer of butterfat. The Jersey is sometimes called the farmer's cow because it is generally believed that more farmers themselves drink Jersey milk than any other kind.

Advanced Registry. At present cows are entered in the Register of Merit in three classes: class AAA, class AA, and class A, the classification depending on age and calving requirements.

Testing for the Register of Merit is conducted under the usual conditions. The owner weighs and records the milk at each milking during the year. For two days each month, or bi-monthly as the owner may elect, a representative of the Superintendent of Official Testing for the state weighs the milk and determines the fat percentage. The Register of Merit has made rapid strides in recent years and many very creditable records have been reported. On March 1, 1938, some 234 breeders had 1,823 cows on Register of Merit test.

A Herd Improvement Registry was established in 1928 as a branch of the Register of Merit. The special purpose is to obtain a record on the entire herd. All registered cows in the herd must be included in the testing and the period covered in the published report is a calendar year. Records made in Herd Improvement Associations are accepted if certified by the official in charge of

Register of Merit testing in the state where the herd is located. The results are safeguarded by frequent retests of all cows showing a high level of production. This type of testing has become very popular not only with Jersey breeders but with all other breeds as well. On March 1, 1938, some 317 Jersey herds with more than 7,000 cows were enrolled in Jersey Herd Improvement testing. The American Jersey Cattle Club has its central office at 324 West 23rd Street, New York City.

Herd Classification. In 1932 the American Jersey Cattle Club adopted a herd classification plan for type by which, on application, any breeder may have his entire herd officially classified by an official inspector or judge designated by the Jersey Cattle Club. The animals so classified are rated in six classes: 1. Excellent, 2. Very good, 3. Good plus, 4. Good, 5. Fair, 6. Poor.

TABLE 5. SIX HIGHEST BUTTERFAT PRODUCERS FOR THE JERSEY BREED

Cows	Lbs. Milk	Lbs. Fat
Stockwell's April Pogis of H. P. 694544	17,880	1,218
Abigail of Hillside 457241	23,677	1,197
Darling's Jolly Lassie 435948	16,425	1,141
Groff's Constance 367292	17,942	1,130
Prince's Emma of H.S.F. 359390	18,437	1,109
Mayflower's Pogis Surprise 705971	18,012	1,105

Prominent Jersey Families. There are some fairly well-marked families in this breed. The first to gain prominence was the St. Lambert. This family originated in Canada, and is descended from the cattle imported by Stephen of Montreal and St. Clair of Vermont. The bulls Stoke Pogis and Stoke Pogis 3d are supposed to be predominant factors in the formation of this family, which included many of the best-known animals of this breed in America. Animals of this early family, as a rule, are large in size and often rather coarse in make-up, generally fawn or gray in color, and seldom black. It has produced many remarkable dairy cows. Like other prominent Jersey families, it is deeply inbred.

Other families which have gained distinction are the Golden Glows, Eminents, Raleighs, St. Mawes, Owl-interests, Majestys, and Sophie's Tormentors. Each of these families has descended from a great foundation bull whose blood has been concentrated by close line-breeding or in-breeding.

CHECK-UP 6

What general information have you acquired about the Jersey breed?

A. Some of the following statements are true, some are false, others may be opinions. If the statement is true circle the letter T; if it is false circle the letter F.

1. T F The Jersey is one of the Channel Island breeds.
2. T F The Jersey ranks second in number among dairy breeds in the United States.
3. T F The Jersey is the largest of the dairy breeds.
4. T F The color of the Jersey varies greatly.
5. T F In butterfat yield the Jersey is the equal of any other breed.
6. T F The Jersey is closely related to the Holstein.
7. T F You will see many Jerseys in Europe.
8. T F The Jersey is found in all parts of America.
9. T F A good Jersey cow is a model of dairy form.
10. T F There is no perceptible difference between the Island and American type Jersey.
11. T F Jerseys do not do as well on rough, scanty pastures as do Holsteins.
12. T F Jerseys are prepotent when crossed with scrub cattle.

What are some of the characteristics of good Jersey cows?

B. Below are listed a number of traits in dairy cattle. Circle the letter Y (yes) in the parenthesis in front of each characteristic for which good Jerseys are noted. Circle the letter N(no) if the characteristic is not typical of good Jerseys.

1. Y N Generally solid colors, black points, jet black muzzle.
2. Y N Pronounced wedge shape and large barrel.
3. Y N Large size.
4. Y N Unusually docile temperament.
5. Y N Undisturbed by unusual surroundings.
6. Y N Adapted to continuously warm climate.
7. Y N Beef and veal production.
8. Y N Yellow milk.
9. Y N Persistency of milking.

CHAPTER VI

GUERNSEYS

Origin and Distribution in Europe. The Guernsey breed originated on the island of the same name. Like the Jerseys, they are presumably descended from the cattle of France, but their true origin has not been distinctly determined. Early accounts indicate that in the year 960 an order of monks settled on the Island of Guernsey and brought with them small native cattle from Brittany. About 1061 another monastery was established, and the monks in this monastery introduced the larger brindle cattle of Normandy. The crossing of these two stocks is believed to have laid the foundation for the present Guernsey breed. A century ago the cattle on the islands of Jersey and Guernsey were practically the same in form and color, but even then the Guernsey is said to have been a little larger. In 1824 laws were passed prohibiting the importation of cattle into Guernsey, and since that time the breed has been kept relatively pure.

In 1845 the cattle of Guernsey and Jersey were essentially the same, although the former were larger, rounder, and the bones less prominent than with the cattle on Jersey Island. It appears that these two breeds at that date were nearer together in type than is now the case, but that the Guernsey showed the same characteristics in general as at present. There appears to be fairly substantial evidence of an occasional introduction of Jersey blood several generations back. The present marked difference between the two breeds is doubtless due largely to the developments of the past century.

The Guernseys have been taken to England, especially to the southwestern part, but on the whole they are of iittle importance in that country from a dairy standpoint because of their comparatively small numbers. They are not found elsewhere in Europe to any extent.

Conditions in Guernsey. The conditions on Guernsey Island are practically the same as in Jersey. The island is second in size of the Channel group, and has a population of about 45,000. It is ten miles long, with an area of about 16,000 acres — of which

12,000 are tillable. The climate is a little more severe than that of Jersey, as it is exposed toward the northwest. The south coast rises from 200 to 400 feet above the ocean, and slopes to the level of the ocean on the north.

The system of agriculture and the general management of the cattle is much the same as that followed in Jersey. Like Jersey, the farms are very small and the agriculture very intensive. Much

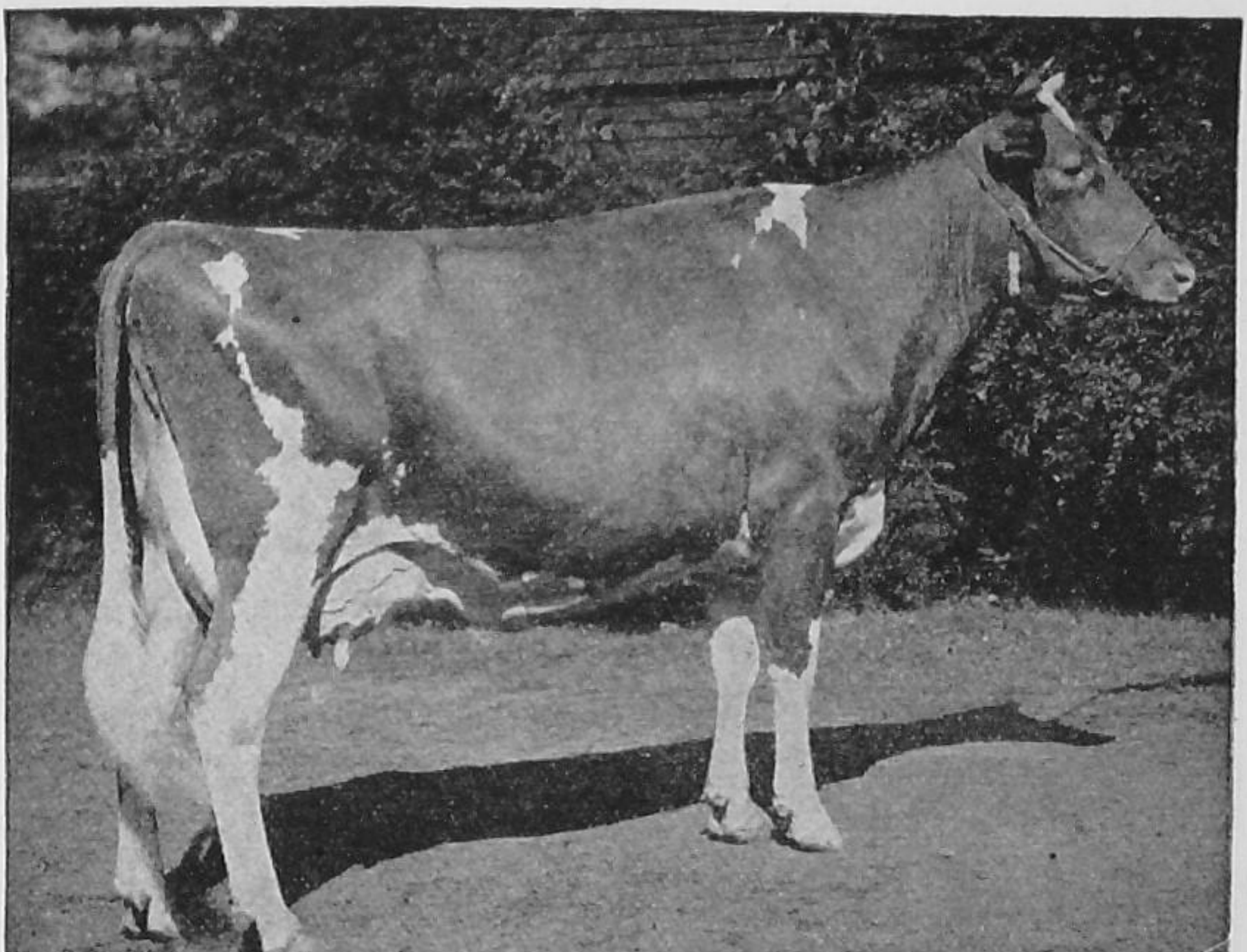


FIG. 18. Guernsey cow, Bournedale Martha No. 406060, Grand Champion cow 1937 National Dairy Show. Record: 10,766 lbs. milk, 578 lbs. fat. Age 2½ years. She combines ideal modern Guernsey type with production.

vegetable production is carried on under glass. There are about 8,000 cattle on the island, and they are mostly in small herds of three to six cows. Green feed is available throughout the year. In addition the cattle are fed largely on hay and roots; but the practice of feeding grain in addition is being more generally adopted and is resulting in improved condition of the cattle. The Guernsey breeders have kept in view the idea of utility alone, and have given less attention to the development of the beauty of their breed. In 1830 a scale of points was adopted to establish uniformity in the

breed. This has been continued with occasional modifications to the present time.

Importation to America. The first Guernsey cattle introduced into this country on which acceptable records were kept were an importation by a Mr. Prince, of Boston, Massachusetts, about 1830. Descendants of these cattle have been recorded by the American Guernsey Cattle Club. Small numbers were brought in at infrequent intervals, but it was not until about 1880 that they began to arrive in appreciable numbers. About that time S. C. Kent, of Pennsylvania, became one of the most active importers. There was a lull in the movement from 1895 until 1901, when importations were renewed and have continued up to the present time.

The American Guernsey Cattle Club was founded in 1877. Up to March 1, 1938, there have been 808,400 animals registered in the Guernsey Register, the first volume of which was issued in 1878. Of these, close to one-third are bulls. In 1937, 11,752 males and 35,270 females were registered.

Guernseys are distributed most abundantly in the East, especially in New York, Massachusetts, and Pennsylvania; and in the West in Wisconsin and Minnesota. Pennsylvania is at present the leading state. Their rapid increase in popularity within recent years has been brought about to no small extent by the excellent system of yearly records established by the Guernsey Cattle Club and by the excellent records made.

Form and Characteristics. The Guernsey cow weighs about 1,000 pounds on the average, ranking in size about the same as the Ayrshires, and at least 100 pounds larger than the Jersey. This breed is coarser boned and more irregular in conformation than the Jersey. The common colors are a reddish yellow, or lemon or orange fawn, with white markings. The white markings are usually found on the face, flanks, legs, and switch, but may be on any part of the body. A cream-colored nose is desired and many breeders are prejudiced against black muzzles.

Dairy Temperament. The temperament of the Guernsey cow is good. She is alert and wide-awake, but not nervous and irritable. She has a good dairy conformation, and gives the impression of a plain animal bred for utility. While the breed still lacks uniformity in type to some extent, there has been a marked improvement in this respect in recent years. As a breed they do not mature

quite as early as do the Jerseys. The heifers should come into milk at the age of 26 to 28 months. Like the Jersey, this breed has little adaptation for meat production.

Dairy Characteristics. In the yield of milk and fat percentage the Jersey and the Guernsey are not far apart, the Jersey leading slightly in richness of milk and the Guernsey in total milk production. A summary of records from herds owned by Experiment

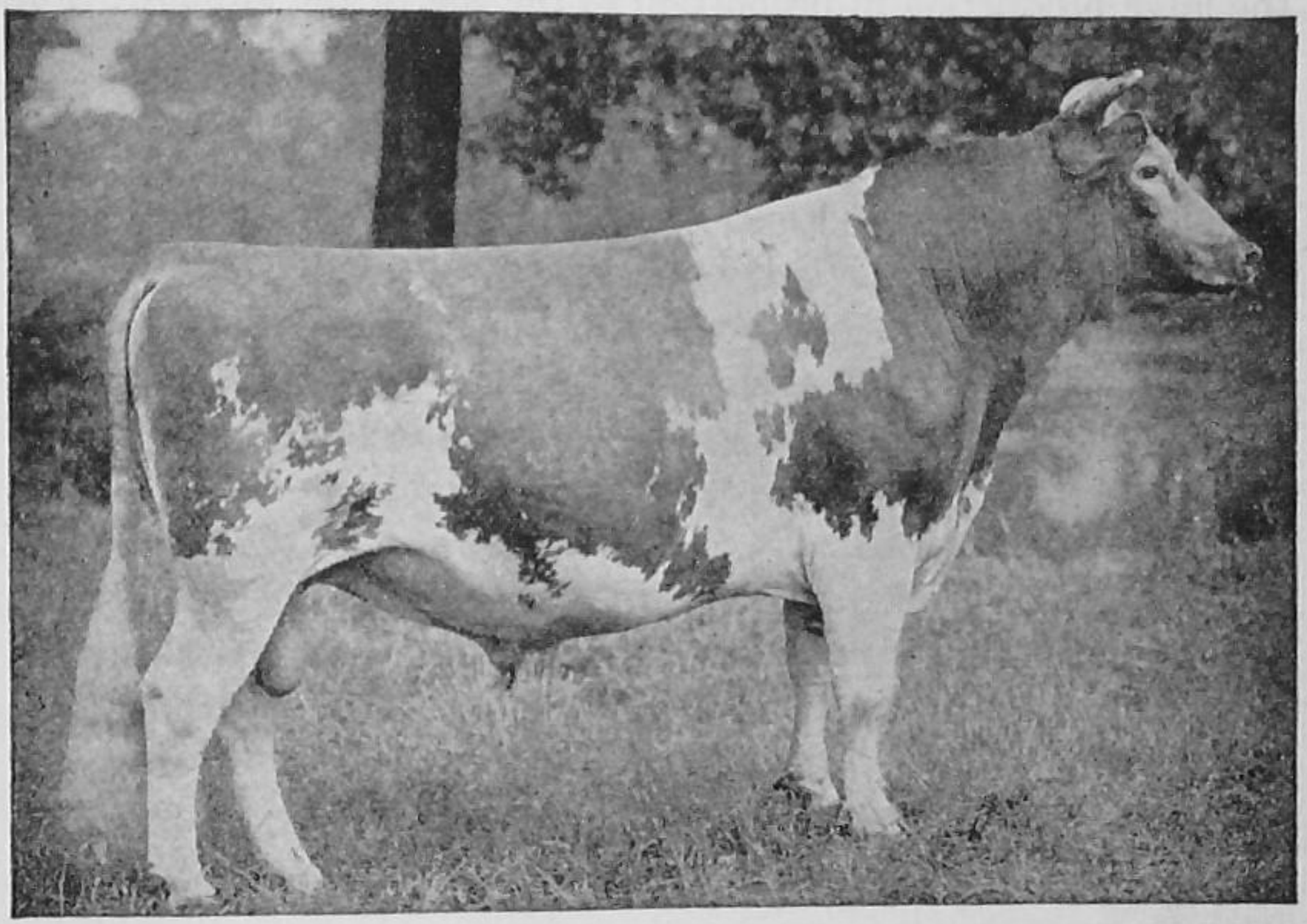


FIG. 19. Guernsey bull, Alfalfa Farm Philosopher No. 203950, Grand Champion 1937 National Dairy Show. A bull of excellent modern Guernsey type.

Stations shows an average yearly production for all ages of 5,500 pounds of milk and 274 pounds of fat.

Under farm conditions a yield of about 5,500 pounds of milk yearly should be expected as an average for all cows in milk, including the usual proportion of heifers. An average yield of 6,000 to 6,500 pounds is possible under exceptionally good farm conditions.

Butterfat Characteristics. The fat content will be 5 per cent or a trifle less on the average. Yellow in color, Guernsey milk ranks first and for this reason it is often mixed with that of other breeds for the sake of the high color it imparts. Guernsey cream, on account of its color, is in demand for table use, and it often commands a premium on the market.

The color of Guernsey butter is so high, especially when the cows are on fresh pasture, that it is occasionally objected to on the market by those not familiar with it. The fat globules are on the average the largest of all breeds. The Guernseys have the same advantages and disadvantages as the Jerseys as producers of market milk. However, in economy of production of butterfat this breed ranks high on account of the richness of the milk and the large production in proportion to the size of the animal. For this reason the Guernsey breed is most often used where cream is sold either for butter purposes or for table use.

Guernsey Families. The concentration of blood of certain individuals resulting in the formation of well-defined families is not so extensively practiced by Guernsey breeders; but the distinction gained by the descendants of some animals has led to a demand for offspring of similar breeding. Perhaps the most prominent group of this kind is the May Rose family, descended from the cow of that name. Numbered among her descendants are Imp. King of the May, Ne Plus Ultra, and other animals both male and female that have won fame. Imp. Glenwood Girl, through her twelve calves, left a long list of productive descendants. The bulls Governor of the Chene, Sheet Anchor, and Masher may also be listed as founders of families of renown. Governor of the Chene has the distinction of being the first bull of any breed to have one hundred daughters with yearly records.

Advanced Registry Results. No breed has profited more by advanced registry testing. An excellent system of testing for this purpose was adopted by the Guernsey Cattle Club in 1901. The test period at first was for either seven days or a year; but the short-test period was soon discarded and now all tests cover a year. The testing is supervised in the usual manner by the agricultural college or experiment station. The test supervisor weighs and tests the milk of each cow for either one or two days as preferred by the owner.

At present, cows are entered in the Advanced Register in three classes; known as the single letter class, the double letter class, and the triple letter class. The differences in these classifications depend upon age, length of test period, and calving requirements. On March 1, 1938, 669 herds including 6,422 cows were on Advanced Register test.

A Herd Improvement Division was established at the beginning of 1930, the purpose of which is to record records made in Herd Improvement Associations when supervised and certified by officials in charge of Advanced Registry Testing. The same age classes are made and designated by letters as in the other classes with the addition of the letters HI. On March 1, 1938, there were 322 herds including 2,417 cows on regular Herd Improvement Test in the Herd Improvement Division.

TABLE 6. SIX HIGHEST BUTTERFAT PRODUCERS FOR GUERNSEY BREED

Cows	Lbs. Milk	Lbs. Fat
Cathedral Rosalie 334299	23,714	1,213
Noranda's Milk Maid 266975	19,654	1,155
Anesthesia Faith of Hillstead 114354	19,741	1,112
Countess Prue 43785	18,626	1,103
Murne Cowan 19597	24,008	1,098
May Rilma 22761	19,673	1,073

A bull is admitted to advanced registration automatically after two of his daughters have been entered. The appreciation of the value of advanced registry testing is attested by the fact that more than 30,000 records have been accepted by the Guernsey Cattle Club.

The central office of the American Guernsey Cattle Club is at Peterboro, New Hampshire.

CHECK-UP 7

What are some of the differences between Guernseys and other dairy cattle?

A. Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. The Guernsey breed originated in: (a) France; (b) the Channel Islands; (c) Holland; (d) England.
2. The Guernsey is larger than the: (a) Holstein; (b) Jersey.
3. The average butterfat content of Guernsey milk is: (a) three per cent; (b) five per cent; (c) seven per cent; (d) nine per cent.
4. Common colors of the Guernsey are: (a) reddish yellow and white; (b) lemon or orange fawn and white; (c) black and white; (d) all white; (e) purple.

5. In America Guernseys are found chiefly in the: (a) south; (b) Great Lakes region; (c) east; (d) west coast.
6. Guernsey milk differs from the milk of all other breeds in that it is: (a) whitest; (b) most yellow; (c) bluest.
7. The fat globules compared with other breeds are: (a) average; (b) the smallest; (c) the largest.
8. The Guernsey is most often used where the milk is sold: (a) whole; (b) as cream; (c)as butter.

What characteristics of a good Guernsey cow can you recognize?

B. Below are listed a number of traits in dairy cattle. Place the letter Y (yes) in the parenthesis in front of each item for which good Guernseys are noted or the letter N (no) if the characteristic is not typical of good Guernseys.

1. ( ) Reddish yellow, lemon or orange fawn color with white markings.
2. ( ) Beef and veal production.
3. ( ) Early maturity.
4. ( ) Average size.
5. ( ) High total milk production in proportion to size.
6. ( ) Yellow milk.
7. ( ) Nervous, irritable temperament.
8. ( ) Weak constitution.
9. ( ) Stylish appearance.

CHAPTER VII

AYRSHIRES

Origin and Distribution in Europe. The native home of this breed is the county or shire of Ayr in southwest Scotland. It is a comparatively new breed, but has made wonderful advancement in a short time. The origin of this breed is obscure, but traces back to the latter part of the eighteenth century. The cattle of this district were described in 1750 as being small, ill-fed, ill-shaped, and producing but little milk. In color they were black and white. This foundation stock was probably descended from or kin to the original wild white cattle described in early historic records.

During the latter half of the eighteenth century a widespread movement for better cattle spread over Great Britain, and resulted in an immense improvement being made in the cattle of Ayrshire as elsewhere. The improvement was brought about by more careful selection and breeding, and especially by the introduction of blood from several other regions.

Influence of Other Breeds. Cattle imported from Holland furnished one of the most important crosses made. Another important cross was made with cattle of the Durham or Teeswater breed, which afterwards in the improved form became known as the Shorthorns. It is reasonably certain that Channel Island blood was also introduced quite generously. It is also probable that Holderness blood was introduced to some extent at an early date.

In Ayrshire some attention has always been given to the beef-making capacity of the breed, especially in the early period of their development. During the early part of the nineteenth century, the hind quarters especially were improved and the udder brought to its present symmetrical proportions.

The Ayrshires are the leading dairy cattle in Scotland, and are common in some parts of England. They are one of the few British breeds that has spread to any extent on the Continent of Europe. They are quite numerous in Finland, Sweden, and Norway, while in New Zealand they are one of the important dairy breeds.

Conditions in Ayrshire. Ayrshire is situated on the southwest coast of Scotland. The land rises from the level of the ocean on the west to mountains about 2,000 feet high on the east. The soil is a heavy clay of moderate fertility spread over a hilly surface. The temperature ranges from 25 to 65° F. during the year and is not subject to great extremes, although occasionally swept by fierce storms. The moist air and abundant rainfall result in good

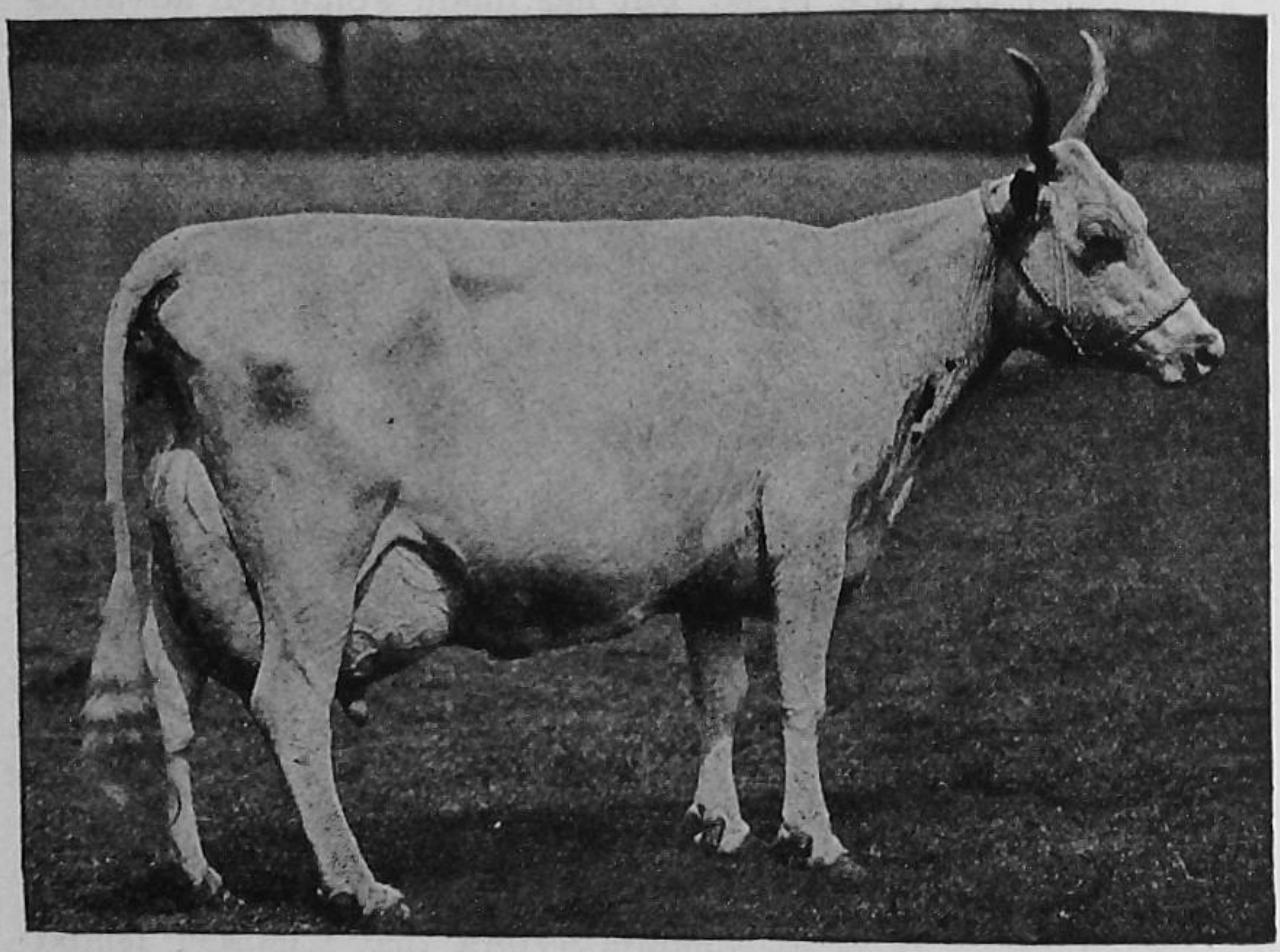


FIG. 20. Ayrshire cow, Garclaugh May Mischief. For many years holder of the milk record for the breed: Milk 25,325 pounds, fat 895 pounds.

pastures. The milk is used mostly for cheese making. The herds in Scotland are usually quite large and well handled. The breeding stock is found largely in the hands of a small number of noted breeders.

Importation and Distribution in America. Ayrshires were brought to Canada by Scotch settlers in the early part of the nineteenth century. More recently the importation of breeding stock into Canada has been extensive. The first importation into the United States was probably in 1837, when several were brought to Massachusetts by the Society for the Promotion of Agriculture, although it is claimed that some were taken to Connecticut as early as 1822. These importations continued at intervals for

twenty to thirty years, then gradually ceased, largely because of the serious objection raised to the short teats of the imported animals.

American Type Ayrshires. Descendants of these importations were bred and developed in the Eastern states and when importations from Scotland again became numerous within the last twenty years, it was found that the New England Ayrshires were considerably different animals from the breed as it has been developed in Scotland. The type as developed in the Eastern states came to be known as the American type in contrast to the imported animals known as the Scotch type.

In recent years the importations of Ayrshires both to Canada and the United States have been numerous, and the imported type has practically superseded the type formerly common.

The Ayrshire breed has never been boomed and, until recently, has not even been well advertised in the United States. Their increase in popularity has been due, therefore, entirely to their merits. The first herd book of the breed was established in the United States in 1863 and the publication of the Scotch Herdbook began in 1878, and of the Canadian in 1870.

A total of 48,236 pure-bred Ayrshires are reported by the U. S. census of 1930. In 1937 there were 14,103 animals registered. The leading states in order of numbers are New York, Pennsylvania, Massachusetts, Vermont, and Ohio. The breed is also common in sections of eastern Canada, where in some localities it is the predominating breed.

Breed Characteristics. In size the Ayrshires rank between the Jersey and Holstein breeds. The average cow weighs about 1,000 pounds at maturity, while some exceed this figure considerably. The bulls range from 1,400 to 2,000 pounds. The tendency in America has been to favor a rather larger type than that considered most desirable in Scotland.

The common color is spotted red or brown and white, in varying proportions. In the old American type the red or brownish-red usually predominated, with only a small amount of white; while in the modern or Scotch type, the white generally predominates. The two colors are distinct, and do not blend to form a roan. The horns are rather long, and as a rule curve outwards and upwards and in some cases slightly backwards. The bulls have very heavy horns.

Dairy Temperament. In disposition they stand rather between the Jersey and Holstein. They are more active and alert than the Holstein but, like them, are less affected by unusual surroundings than are some other breeds. In form the Ayrshires do not show the extreme angular dairy type exhibited by high-class Jerseys or Holsteins. They are smoother over the shoulders, back, and hips, and have fuller rear quarters. At the same time, the barrel is large, showing great capacity, and the udder development the most perfect of any breed. For many years the Scotch breeders have

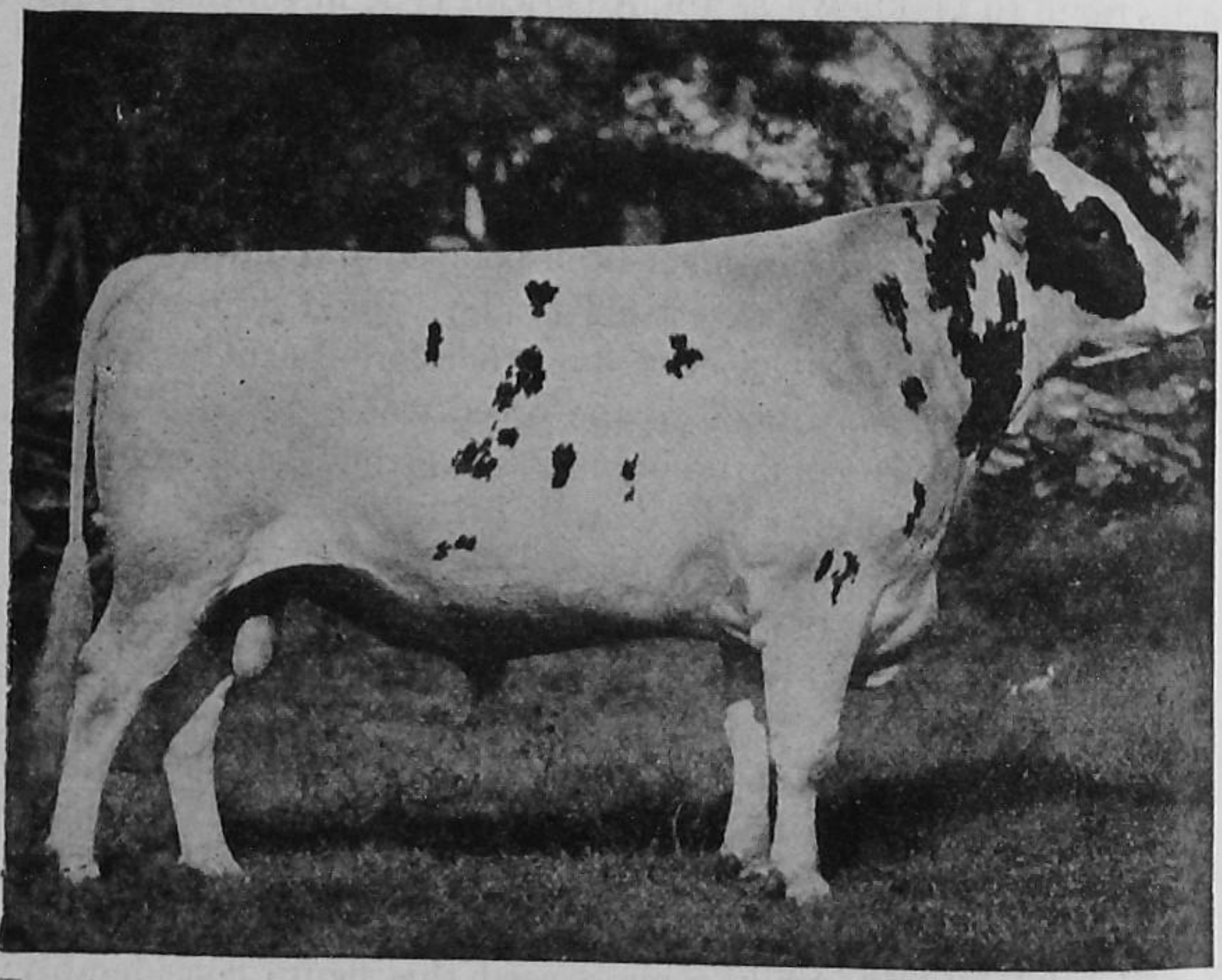


FIG. 21. Ayrshire bull, Morton Mains Lord Barrylyndon, Grand Champion, National Dairy Show, 1920. A noted show bull.

bred especially for large, symmetrical udders, and have attained this end with remarkable success. The udder is attached high behind, and extends far forward, with a flat, even, lower surface. The teats are placed regularly on the udder, and are of uniform size. Ayrshires are regular and sure breeders, the probable result of the favorable conditions under which the breed has been developed, and of the avoidance of in-breeding.

The chief criticism of the imported Ayrshires and their descendants is the short teats, which are often altogether too small for

convenience in milking. This objection, which seems to be given more weight in America than in their native home, is receiving the attention of American breeders and will soon be a thing of the past.

Cows of this breed also show a tendency in many cases to lack persistency in milking. This is especially noticeable with the short-bodied, blocky type of cows which are quite common in herds of Scotch breeding.

The Ayrshire is not so early a maturing breed as the Jersey, ranking about with the Holstein in this respect. At 24 months of age the Ayrshire cow, on the average, has attained 94 per cent of her mature height, while the Jersey has reached 97 per cent at this age. The Ayrshire reaches full weight at the age of approximately 6 years. Cows of this breed are sufficiently mature to come into milk between 26 and 30 months of age. It is claimed that representatives of this breed retain their breeding powers and remain profitable producers to a greater age than is common with other breeds.

Grazing Efficiency. One of the strong points of the breed is its excellent grazing qualities. Ayshires will thrive and keep in excellent condition on pastures where animals of the larger breeds, especially the Holstein, will find it difficult to maintain themselves. This has been observed in a striking manner when a group consisting of pure-bred Holsteins, Jerseys, Shorthorns, and Ayrshire heifers were in the same pasture during a season of poor pasturage. The Ayrshire made excellent gains and kept in good flesh, while it was necessary to feed considerable grain to the Holsteins to keep them in even a fair condition of flesh. The others were given no grain, and remained in fair condition — but uniformly below the Ayrshires.

Calves of the Ayrshire breed weigh 60 to 75 pounds at birth and are usually strong and vigorous although not equal to the Holsteins in this respect. The breed ranks high in beef production for a dairy breed. When dry, the cows fatten readily and furnish a good grade of beef.

Dairy Characteristics. As a breed, the Ayrshires are noted for a good, uniform production of milk. While some very large milk and fat records have been made in official tests, Ayrshires have not so far equalled the Holsteins, Guernseys, and Jerseys in this respect.

Under good farm conditions with reasonable attention to culling

out the inferior animals the average production should be from 6,500 to 7,000 pounds of milk containing approximately 4 per cent of fat. An average production of 8,500 pounds of milk for the year would be considered excellent and would indicate a combination of well-bred animals and expert care. A production of less than 6,000 pounds a year calls for careful consideration as to the methods of selection, breeding, and feeding practiced.

Butterfat Characteristics. The fat globules are small and the milk and butter do not show much yellow color, ranking in this characteristic with the Holsteins. The Ayrshire cow is well adapted for the production of market milk on account of the large yield of milk of average composition. The lack of a more pronounced yellow color is some disadvantage in this connection, while the small fat globules resulting in less trouble from churning in transit is something of an advantage.

The milk of this breed is also well adapted for cheese making on account of the small fat globules and relatively high per cent of casein (a white protein substance), and is generally used for this purpose in their native land.

In economy of fat production the Jersey and the Guernsey breed slightly excel the Ayrshire. In regard to milk production the reverse is generally true.

Advanced Registration. A system of Advanced Registration based upon official tests was established by the breed association in 1902.

In this system, called the Roll of Honor, cows are entered that meet certain production requirements in 305 days and give birth to a calf within a specified time.

The testing is conducted in the usual manner under the supervision of the agricultural college or experiment station in the state where the particular herd is located. The minimum requirements for entry are 6,400 pounds of milk and 256 pounds of fat by a cow calving at two years of age with an increase with age until 400 pounds is reached for the five-year-old animal. An important part of the requirements for admission is the birth of a living calf within 400 days from the date of beginning the test.

The Ayrshire breed took the lead in establishing in 1925 what is called the Herd Test. The object of this type of testing is to bring about more rapid improvement by having all members of the herd under test rather than a few of the outstanding animals, as was

the tendency under the older plan of conducting Advanced Registry records. At the end of the year certificates are issued for each herd, giving the production of the individual cows and the herd. A yearly average for 4,366 cows of all ages in the Herd Test was 8,731 pounds of milk and 352 pounds of fat. The Ayrshire breed in 1937 had 128 cows which had lifetime records of 100,000 pounds of milk and 4,000 pounds of fat.

TABLE 7. SIX HIGHEST BUTTERFAT PRODUCERS FOR AYRSHIRE BREED

Cows	Lbs. Milk	Lbs. Fat
Ardgowan Valda	31,156	1,356
Nellie Osborne of Elmshade 16th	27,198	1,257
Lily of Willowmoor	22,596	955
Vi's Bountiful Lassie	24,556	923
Auchenbrain Brown Kate 4th	23,022	917
Garclough May Mischief	25,329	894

The central office of the Ayrshire Breeders' Association is at Brandon, Vermont.

CHECK-UP 8

What are the main facts about Ayrshires?

A. If the statement is true circle the letter T. Circle the letter F if it is false.

1. T F The native home of the Ayrshire is southwest Scotland.
2. T F Ayrshires are quite numerous in northern Europe.
3. T F In America Ayrshires are most numerous in the northeast.
4. T F Ayrshires thrive better on pasture than Holsteins or Jerseys or Guernseys.
5. T F Ayrshires are good breeders.
6. T F Ayrshires have long teats.
7. T F You are likely to see Ayrshires in New Zealand.
8. T F There are more Ayrshires than Guernseys in Pennsylvania.
9. T F Good Ayrshires show the extreme angular dairy form.
10. T F Among dairy breeds Ayrshires rank high as beef producers.
11. T F Four per cent fat is unusually low for Ayrshire milk.
12. T F Average annual milk production of a good Ayrshire under good farm conditions should be from 6500 to 7000 lbs.

The Ayrshires are not so well known a breed as those described in the preceding chapters, but they are gaining in popularity. What Ayrshire characteristics do you know?

B. Below are listed a number of traits in dairy cattle. Place the letter Y (yes) in the parenthesis in front of each item for which good Ayrshires are noted, or the letter N (no) if the trait is not characteristic of good Ayrshires.

1. ( ) Large size
2. ( ) Fairly long outwardly curved horns
3. ( ) Spotted red or brown or white color
4. ( ) Very angular conformation
5. ( ) Udder development
6. ( ) Ready breeder
7. ( ) Early maturity
8. ( ) Beef and veal production
9. ( ) Yellow milk
10. ( ) Long teats

CHAPTER VIII

BROWN SWISS

Origin. There are two distinct and leading breeds of cattle in Switzerland, and several minor ones closely related to them. In the western portion, including the region around Berne, the Simmerthaler is the common breed. This is a large-boned, spotted red-and-white breed used for milk and beef as well as for work. They have not been imported into this country. The other Swiss breed, known in Switzerland as the Braunvieh or Schwyz and in America as the Brown Swiss, is found in the northeast part in the cantons of Zurich, St. Galen, Luzern, and Schwyz.

Oldest Domesticated Breed. This breed is probably one of the oldest in existence and is supposed to be descended from the cattle which have been used in this locality since before historic records began. This breed represents the *Bos sondaicus*, the smaller of the two types of wild cattle supposed to have been domesticated. Bones found in the ruins of the Swiss Lake Dwellers, which date back to the Bronze Age, show a type of cattle which are apparently closely related to the present Swiss cattle. It is not believed that any considerable infusion of foreign blood has ever been introduced. The Brown Swiss is one of the few breeds originated on the continent of Europe that is used outside of its native locality. This breed has spread over about one-half of Switzerland and largely into the noted dairy district of Algau in Bavaria. The foreign demand for the breed shows its merits. Buyers from Germany, Hungary, and other parts of Europe take the surplus cows at figures considerably above the current market prices for dairy cows in their home localities.

Conditions in Switzerland. The total area of Switzerland amounts to 15,976 square miles, of which about 71 per cent is said to be productive. The total number of dairy cows is approximately three-quarters of a million. From these are produced milk and dairy products sufficient for a population of three and a half million and to manufacture around 70,000,000 pounds of cheese and a considerable quantity of condensed milk for export use.

The Brown Swiss cattle are found from the shores of Lake

Constantine, at an elevation of 1,400 feet above the sea, to near the line of perpetual snow in the Alps. During the winter season the cattle are kept in the valleys and stabled closely in rather warm but dark, poorly ventilated barns — and in not especially sanitary conditions. During this season they are fed almost entirely upon hay grown in the meadows in the valleys, which is handled with the greatest care and is of exceptional quality. In addition they are fed turnips, potatoes, and a small quantity of grain, usually oil cake, but never more than three or four pounds per day. As spring opens they are taken to the edge of the valleys and lower Alps, up to an elevation of about 3,000 feet, where they are pastured on an average of about 116 days. As the summer advances, the herds are moved upwards to the Middle Alps, which are at an elevation of from 3,000 to 6,500 feet, where they are pastured on an average of 92 days. In July and August they are taken on to higher pastures, which are called the High Alps, at an elevation of from 6,000 to 8,500 feet. As winter approaches the cattle are taken to the lower levels. During the summer season they are out of doors practically all the time, being sheltered at night during the cold weather and in case of storms in the temporary shelter sheds which are built on the mountains. The herds are accompanied by the herders who remain with them and who take the milk to the cheese makers. During the summer the milk is used almost exclusively for cheese making, but during the winter it is used in part for butter making. The calves are usually born in the spring in the herds that pasture in the mountains; but in the herds that remain in the valleys, the cows often freshen in the fall.

Importation and Distribution in America. The first cattle of this breed to be imported to the United States were brought by H. M. Clark of Belmont, Massachusetts, in 1869. In 1882 an importation was made by Scott and Harris of Massachusetts. In all, less than 200 head have been imported. This limited number as compared with other breeds is largely accounted for by the prevalence of foot and mouth disease on the continent of Europe — as a result of which the importation of cattle from continental Europe during the past forty years has been possible only for short periods, when the quarantine was relaxed.

Up to 1938 approximately 110,000 have been recorded. The census of 1930 enumerated 25,734 head of pure-bred animals of

this breed. They are found at the present time in almost every state, but nowhere in large numbers. Wisconsin, Michigan, Illinois, and New York rank in the order given at present in the development and use of this breed. The increase in numbers and popularity of this breed has been based entirely upon its merits. The Brown Swiss is the fastest growing breed at the present time even though little advertising has been done by either the breed association or by the breeders.

Breed Characteristics. In appearance, animals of this breed are plain, substantial, and well proportioned — although rather

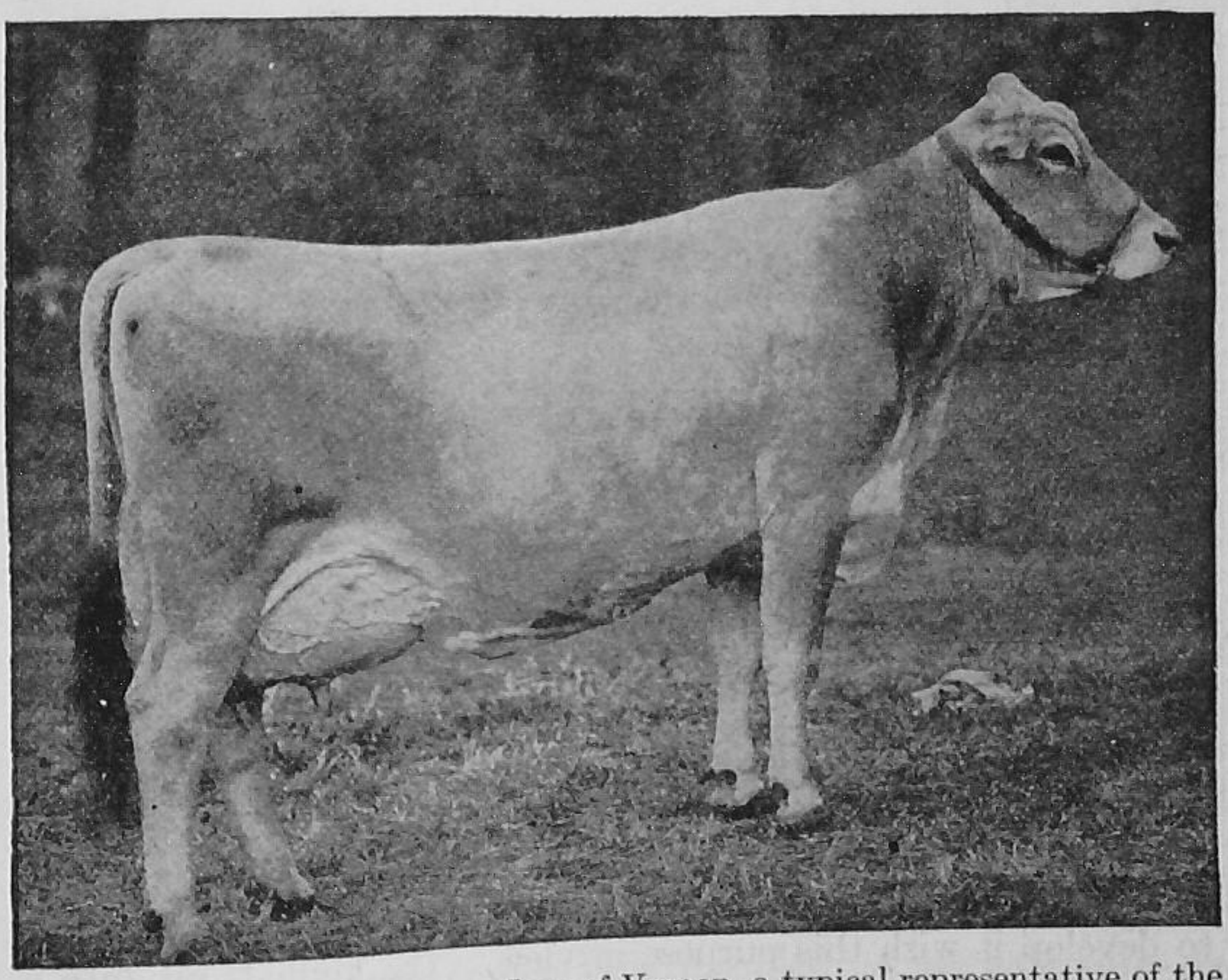


FIG. 22. Brown Swiss cow, Jane of Vernon, a typical representative of the breed. Record 23,569 pounds milk, 1,075 pounds fat. Grand Champion, National Dairy Show, 1936.

fleshy — and give the impression of being somewhat coarse in the bone and in general make-up. The head and neck especially are large, as contrasted with the English breeds of cattle, and seem rather plain and coarse. The back is well developed and the hair abundant and soft. As a rule the skin is of unusually fine quality. The hind quarters are full, round, and inclined to be distinctly beefy. The cows have large, fairly well-shaped udders with teats

of sufficient size to be milked conveniently. Milk veins and milk wells are of medium development. In size, the cows reach an average weight of about 1,200 pounds and the bulls from 1,600 to 2,000 pounds. The color varies considerably in shade. It is called brown, but more of a mouse color is prevalent. The brown varies from a silvery gray or light brown to a dark brown or almost black. The nose, switch, tongue, and horn tips are always black. The mouth is surrounded by a mealy ring, and a light stripe is usually found along the backbone. Small patches of white on the under line near the udder are not objectionable, but white on other parts of the body is not desirable. The uniformity in color markings adds to the attractiveness. The head, neck, and legs may be almost black.

In disposition this breed is especially good, being quiet and docile and easily handled.

Slow Maturity. The Brown Swiss breed is not an early maturing one — ranking about with the Holstein breed, or perhaps a little behind in this respect. In Switzerland the cows usually come into milk at about three years of age. While they are rather slow to mature, they are noted for continuing to be sure breeders until they reach an advanced age. Their excellent breeding characteristics, which are one of the strong features of this breed, come from the favorable conditions and the sensible management under which they have been kept.

In its native home this breed is considered a dual-purpose breed (useful for the production of milk and also of beef), and it was formerly so classed in the United States. However, the Brown Swiss breeders in America have decided that their stock shall be classed as a dairy breed, and they have indicated their intention to develop it with this purpose in view. The animals produce a fair quality of beef, grow rapidly, and reach a good size at an early age; but they are not received very well on the market on account of the large bones, and probably, in part, from prejudice on account of their similarity in color to the Jerseys. For production of veal they rank high, as the calves are large at birth and grow rapidly.

Dairy Characteristics. The records of the milk and butterfat production available for this breed are not extensive, but they indicate a very satisfactory average yield. The United States Consul at Zurich reported some years ago that 6,000 cows supply-

ing the Anglo-Swiss Condensed Milk Company averaged 5,115 pounds of milk yearly with an average fat content of 3.68 per cent. A herd of fifty cows owned by the Agricultural School at Plantahof for five years averaged 5,990 pounds of milk for each cow in milk. The highest fat yield was 513 pounds, while 23 were above 400 pounds. It should be kept in mind that these figures represent the production of cows receiving little if any grain in accordance with the common feeding practice of Europe. One of the leading herds

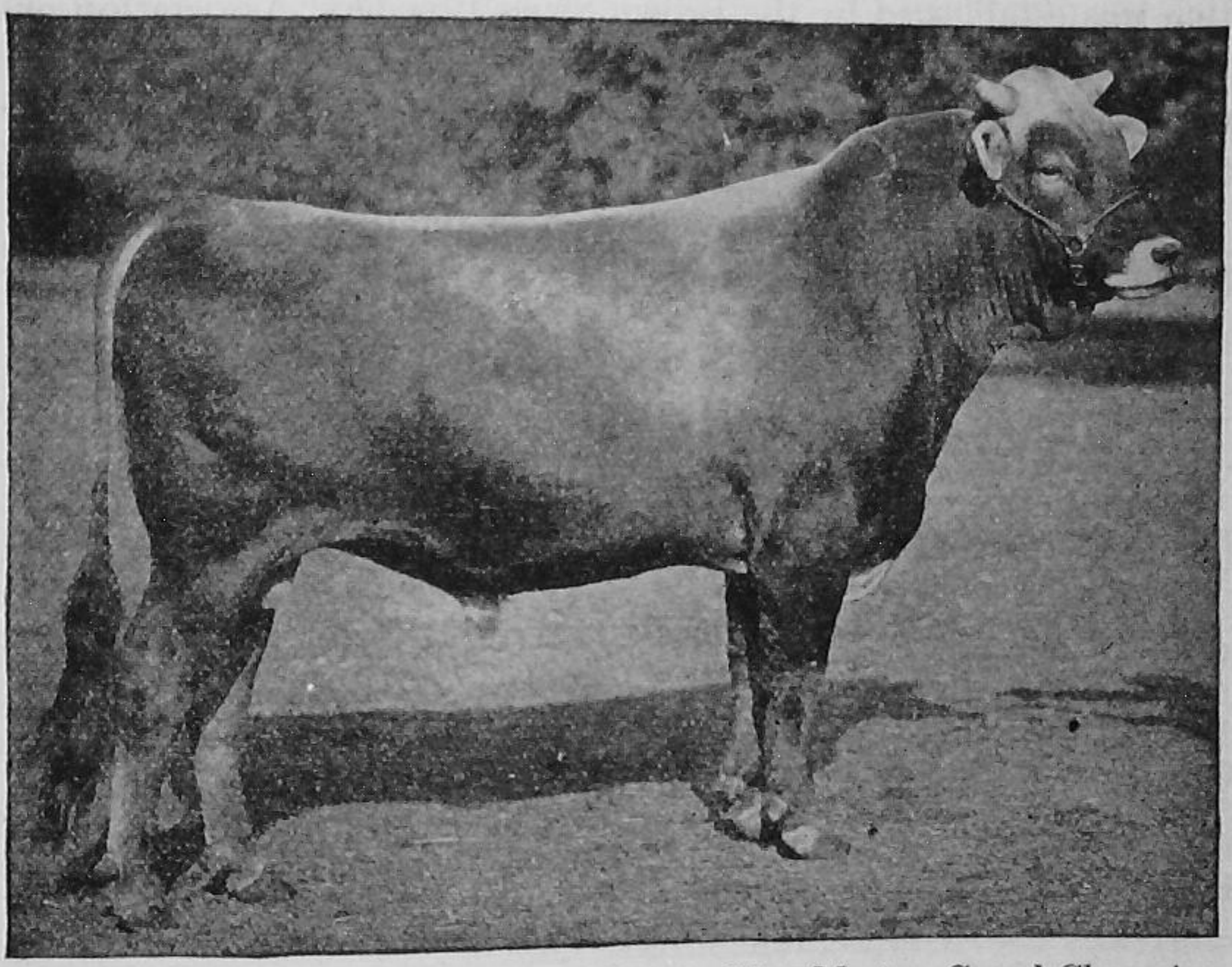


FIG. 23. Brown Swiss bull, Golden Beauty Ring Master, Grand Champion, National Dairy Show, 1937.

in the United States at one time included 33 animals with an average record of 9,000 pounds of milk in a year. Nine of these had exceeded 11,000 pounds. Under good farm conditions with reasonable care in culling the inferior animals, a herd of Brown Swiss should be expected to average from 6,000 to 7,000 pounds of milk yearly with a fat content of about 4 per cent. In composition the milk of this breed is well adapted for market milk purposes.

Advanced Registration. In Switzerland the interests of the breed are looked after very carefully by a cooperative association which is subsidized by the government. The animals used for breeding purposes are approved by representatives of this associa-

tion which also holds fairs at intervals which serve as means for marketing surplus animals. The breeding herds are well controlled by this association and their interests promoted so skillfully that the surplus stock is readily disposed of at good prices to meet the demand of other parts of Europe. Authenticated records of milk production are kept of the best cows and the bulls from these cows offered for sale for breeding purposes.

A system of advanced registry known as the Register of Production was established by the Brown Swiss Breeders' Association of the United States in 1911. The tests are supervised in the usual manner by the agricultural college or experiment station and cover two days each month.

The highest record up to 1938 is held by Illini Nellie with a production of 29,569 milk and 1,200.4 pounds of fat in a year.

TABLE 8. TEN HIGHEST YEARLY BROWN SWISS RECORDS (1938)

Cows	Lbs. Milk	Lbs. Fat
Illini Nellie 26578	29,569.5	1,200.4
Mary's Nell 36395	29,487.2	1,109.7
Swiss Valley Girl 10th 7887	27,513.6	1,106.3
Jane of Vernon 29496	23,569.0	1,075.5
June's College Girl 11427	24,571.6	1.062.3
June's College Girl 11427	24,167.4	1,043.0
Greenwood Valley Lass 18823	21,924.9	1,037.1
Swiss Girl F.C. 13853	23,235.8	1,003.7
Believe 4245	25,847.8	1,002.6
Forest Girl of Lake View 11998	23,556.2	971.3

In 1938 there were 61 herds including 1,150 cows in Herd Improvement Registry testing and a total of 155 cows on Register of Production test.

The central office of the Brown Swiss Breeders' Association is at Beloit, Wisconsin.

CHECK-UP 9

What have you found out about the Brown Swiss?

A. Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. Among domesticated cattle the Brown Swiss breed is probably the:
   (a) oldest; (b) average; (c) newest.

2. In appearance the Brown Swiss: (a) has typical dairy conformation; (b) is coarse in the bone and beefy; (c) is unusually small.

3. You are likely to see Brown Swiss cattle in: (a) Germany; (b) Hungary; (c) Switzerland.

4. In America the Brown Swiss breed is growing: (a) slowly; (b) hardly at all; (c) faster than any other breed.

5. The fat content of Brown Swiss milk compared with Holstein is: (a) about the same; (b) lower; (c) higher.

6. In color the Brown Swiss is most similar to: (a) the Jersey; (b) the Guernsey; (c) the Holstein.

7. The milk yield and fat content of the average good Brown Swiss is similar to that of the average good: (a) Jersey; (b) Guernsey; (c) Ayrshire.

8. Brown Swiss cattle are found in greatest numbers in: (a) the south; (b) east; (c) Great Lakes States; (d) corn belt.

What characteristics has the rapidly growing Brown Swiss breed?

B. Below are listed a number of characteristics of good dairy cattle. If the characteristic is typical of a good Brown Swiss circle the letter Y (yes). If it is not a definite trait of the Brown Swiss circle the letter N (no).

1. Y N Brownish color varying from light brown to a near black.

2. Y N Large size.

3. Y N Angular.

4. Y N Beef and veal production.

5. Y N Quiet disposition.

6. Y N Early maturity.

7. Y N Ready breeders.

8. Y N Yellow milk.

Can you sum up what you have learned about the characteristics of the major breeds of dairy cows?

C. Place a check in the square below the name of the breed if the indicated characteristic is strong in good cows of the breed.

Characteristics	Holsteins	Jerseys	Guernseys	Ayrshires	Brown Swiss
a. Large size					
b. Small size					
c. Medium size					

Characteristics	Holsteins	Jerseys	Guernseys	Ayrshires	Brown Swiss
d. Quiet adaptable disposition					
e. Comparatively shy, nervous temperament					
f. Good beef and veal production					
g. Yellow milk					
h. Persistency of milking					
i. Comparatively high rate of milk production					
j. Ready breeders					
k. Early maturity					
l. Pronounced udder development					
m. Large barrel					
n. Long teats					
o. Good grazers					
p. High butterfat content of milk					

CORRESPONDENCE OR CLASS ASSIGNMENT 3

1. Name and describe the qualities of the breed of dairy cattle most common in your home community and give reasons why you should or should not select this same breed if you go into dairy farming in your home community.

2. Discuss the relative merits of three popular dairy breeds as to: (a) size; (b) appearance; (c) milk yield; (d) and butterfat test.

3. Discuss procedure to be followed in grading up a herd of grade cows touching upon: (a) use of records; (b) use of a pure-bred bull.

CHAPTER IX

MINOR BREEDS

DUTCH-BELTED

Origin. This oddly colored breed originated in North Holland and has been bred for over 200 years to produce a perfect belt of pure white in the center of a coal black body. Very little is known of its history; it is probably descended from the cattle of Holland, the ancestors of the breed known in America as Holstein.

The Dutch-Belted breed first attracted attention about 1750; but the selection and breeding for the white belt probably began long before this, possibly as far back as the sixteenth century. According to the early records, these cattle were bred by the nobility of North Holland on account of their peculiar markings. Hogs and poultry were also bred with a somewhat similar white body line. The development of these animals with this distinct belt of white between coal black ends of the body is a striking illustration of the possibilities of breeding and selection.

In size, the Dutch-Belted cattle rank about equally with the Ayrshires. Their general form and conformation is more like that of the Holstein, however. The cows weigh from 900 to 1,300 pounds; the bulls from 1,600 to 2,000 pounds. The dairy type is highly developed, being of a highly nervous temperament and a very quiet disposition. Their most distinctive characteristic is the presence of the white belt around the center of the body. This belt should extend around the body from just behind the shoulders to just in front of the hips. Otherwise, the body is coal black.

Importation and Distribution in America. The first importation of Dutch-Belted cattle into America of which we have any record was made in 1838. A second importation was made in 1848. The animals from these two importations were scattered throughout Orange County, New York, where their descendants are to be found at the present time. A large herd was also imported and placed on an estate at Cornwall, Pennsylvania. The cattle of this breed in America today are nearly all descendants of these

two herds. In 1840 P. T. Barnum imported a number of Dutch-Belted cattle for show purposes, but he soon sent the cattle to his farm in Orange County, New York. In 1906 one heifer was imported, but prior to this date none was imported for a period of over 50 years, chiefly on account of the scarcity of the animals in their native land. Within recent years, animals of the breed have been exported into Canada, Cuba, Mexico, Brazil and the Argentine.

In the United States, Dutch-Belted cattle are most numerous in the Eastern states, especially New York, New Jersey, Pennsylvania, Ohio, and the New England states; a few are found in the South, and several small herds are to be found on the Pacific coast. There are about 6,000 head in the United States at the present time, with numbers steadily decreasing.

Dairy Characteristics. The cattle of this breed are fair milkers. A few cows hold records of over 400 pounds of butter per year. At the Pan-American Exposition at Buffalo in 1901, five Dutch-Belted cows were entered in the cow test in competition with the same number of cows of nine other breeds, and while the five cows of this breed came out last in the test, they made a very creditable showing. The average production per cow for this breed was 4,978 pounds of milk and 169.4 pounds of butterfat during the six months' trial. The average per cent of fat was 3.4. One breeder in New York, after keeping yearly records for eight years, reports that twenty-five cows and heifers averaged 9,000 pounds of milk for one year. A New Hampshire breeder reports eleven cows in his herd which made an average of 8,579 pounds of milk in one year. One cow in this herd produced 12,672 pounds of milk in one year and 60,297 pounds in a period of six years, with an average butter production during the same length of time of 596 pounds.

Registration and Advanced Registry. The Dutch-Belted Association which was organized in America in 1886 has registered between 3,000 and 4,000 animals. In Holland the cattle of this breed are registered in the Netherland General *Staurbuck*, published at The Hague.

FRENCH-CANADIAN

Origin. The French-Canadian breed is descended from the native cattle of the provinces of Normandy and Brittany, France,

and on this account is very closely related to the Guernsey and Jersey breeds.

The French settlers who came from these French provinces and settled in Quebec, Canada, brought their cattle with them and have bred and improved them under the existing conditions and environment for more than 250 years. The cattle have become adapted to severe climates and are noted for their vigor and ability to withstand the cold winters of the North.

Characteristics. In size and conformation they are very much like the Jerseys and Guernseys. They are active and well adapted to hilly and rough pastures. In color, they are black, or black with a fawn or orange-colored stripe down the back and around the muzzle. In quantity of milk they compare with the Jersey, and the fat content averages between 4 and 5 per cent.

The French-Canadian Herd Book was established in Canada in 1886. Cattle of this breed are found mostly in the Province of Quebec, but also in small numbers in other parts of Canada and in limited numbers in New York and the New England States.

KERRY CATTLE

Origin. The Kerry, the smallest of all dairy breeds except the Dexter, originated in southern Ireland, where it has been bred for centuries. Very little is known of the history of this breed prior to the middle of the eighteenth century.

The breed has been developed by the small farmers in Kerry County — tenants, in the main. The Kerry is of a distinctly dairy type. The color is a solid black, although a small amount of white appears on the underline of some cows. The upstanding horns are rather long and slender, with black tips.

Characteristics. The Kerry cow weighs not over 900 pounds, and the bull about 1,000 pounds. As a breed they are slow to mature, but they are vigorous and well adapted to severe weather conditions and are usually good grazers on scanty pastures.

Kerry cows in Ireland are said to produce from 5,000 to 6,000 pounds of milk yearly, while records of 10,000 pounds have been made. In tests supervised by government authorities in Ireland several records of between 7,000 and 8,000 pounds of milk in a year have been made. The fat content averages about 4 per cent. Few animals of this breed have been brought to America and bred here, and these not primarily for commercial milk production.

DEXTER CATTLE

Origin. Dexter cattle are native to the same locality in Ireland as the Kerry, from which they are an offshoot, and are so closely related to the Kerry cattle that only in recent years have the two been kept distinct.

Characteristics. The characteristics of the Dexter are similar to those of the Kerry except that the type is more like that of the dual-purpose animal. The legs are very short, the body well rounded, and the head plain, with horns similar to the Kerry. The color is solid black.

In size the Dexters are about a hundred pounds below the Kerrys, the cows averaging 600 to 700 pounds. Under government supervision cows of this breed in Ireland have produced up to 8,000 pounds of milk in a year with a fat content of about 4 per cent.

DEVONS

Origin. The Devons are commonly classed as dual-purpose cattle. They are one of the oldest breeds that originated in Great Britain. Very little is known of their early history, but it is generally believed that they are related to the Hereford and Sussex breeds. Some writers believe that the latter breeds descended from the Devons. The Devons were bred and developed in Devonshire, England, and they are divided into the North and South Devons. The North Devons represent more nearly the original and true type of the breed. The Quartly family of North Devon was largely responsible for the development and improvement made with the Devons. While members of this breed are classed as dual-purpose animals today, they were bred originally for milk, beef, and draft purposes in their native country. The cows average about 1,000 pounds in live weight, and are hardy, strong, and active. In color they are deep red. White markings may appear on the belly and on the udder. The horns are long, and turn upwards and backwards.

The Devons were first introduced into America in 1817 and a number of importations were made at later dates. They were at one time popular in the Eastern states, where classes for them are still maintained at certain livestock exhibitions. In recent years other breeds have come into public favor more strongly, and the Devon breed has lost ground.

Characteristics. The dairy characteristics of the breed have never been very highly developed; like other dual-purpose animals, they give a large quantity of milk at the beginning of their lactation period, but are not persistent milkers. In a report made by the New York Experiment Station the average butterfat test for 72 head of cattle was 4.15 per cent. Yields of 5,000 pounds of milk per year have been reported. No official milk and butter records have been reported.

The interest of the Devon breed are looked after in America by the American Devon Herd Book Association.

CHECK-UP 10

From where do the breeds come?

A. Match the following items in the right-hand column with the proper choices in the left-hand column. To do this insert the number or numbers of choices in the parentheses in front of the proper item or items. There may be items that cannot be matched. There may be others that can be matched with more than one choice.

Choices	Items
1. Ireland	a. ( ) Dutch-Belted
2. Holland	b. ( ) French-Canadian
3. England	c. ( ) Kerry
4. Canada	d. ( ) Dexter
5. Scotland	e. ( ) Devons
6. Switzerland	f. ( ) Ayrshire
7. Channel Islands	g. ( ) Holstein
8. France	h. ( ) Brown Swiss
9. Germany	i. ( ) Jersey
10. Belgium	j. ( ) Guernsey

The minor breeds of dairy cattle are not important in American dairy farming and their importance is decreasing. The editor included them here for one of the following reasons. Which one?

B. Underscore the reason in the list below:

1. They are beautiful.
2. They are freaks.
3. You may likely see one or more of them in Holland, England, Ireland, or France.
4. They are good buys.

CHAPTER X

DUAL-PURPOSE CATTLE

GENERAL DISCUSSION

Definition of the Term. The term "dual-purpose" is used to describe those breeds of cattle which are bred for both milk and beef production in contrast with those called special-purpose, which are bred primarily for either milk or beef. However, the question of beef production in connection with that of milk is largely one of degree since practically all dairy cattle are used for beef when their usefulness as milk producers is at an end.

Much of the discussion regarding the question of dual-purpose as compared with special-purpose cattle comes from erroneous ideas of what constitutes a dual-purpose animal. The man who is interested primarily in milk production is inclined to call every cow that does not produce milk profitably — especially if she shows a tendency toward beefiness — a dual-purpose cow. The cow in question might more often be correctly classed as a no-purpose cow. Other dairymen go to the other extreme, and call such cows as the Holstein dual-purpose because they have some value for beef production.

The breeder of pure-bred Shorthorns often calls any cow showing a good-sized udder when fresh a dual-purpose cow. He is inclined to minimize the dairy part of the dual-purpose, as a rule, but at the same time points to large records which have been made by animals of the breed as proof that the breed has dairy qualities.

Standards for Dual-purpose Type. The true dual-purpose type stands about midway between the extremes of the dairy type, or large milk producers, and the beef type with little tendency toward milk production. A dual-purpose cow is one that produces a medium quantity of milk for a dairy cow, and that will fatten readily and sell at a fair price for a beef animal. A dual-purpose breed is one in which these characteristics are so fixed that they are transmitted with reasonable certainty. There is occasionally a dual-purpose Angus or Hereford cow; but these instances are sporadic and these breeds cannot be so classed, for the reason that

they do not transmit this characteristic. Again, we find cows in the dual-purpose breeds that are such remarkable milkers and that show such inferior beef-making characteristics that they should be classed individually as special dairy animals, and not as dual-purpose. There is such a thing as a dual-purpose cow, if we correctly define the limitations of the term. It must not be expected that a cow of this type will compare as a dairy animal with good individuals of the special dairy breeds, or that her calves will be able to compete in beef production with those of the special beef breeds. A dual-purpose cow should be expected to produce about 200 pounds of butterfat per year against about 300 pounds for an equally good specimen of the dairy breed; and her calves should make fair beef animals.

Adaptation of the Dual-purpose Cow. The question of whether the farmer should breed special-purpose dairy cattle or dual-purpose when dairy products are sold from the farm is one that has called forth endless discussion. The view represented by one extreme is that if a cow is to be milked at all, she must be of a special dairy breed, and that no such thing can exist as a profitable milk and beef producer combined. The other extreme holds to the view that the average farmer, who produces the bulk of the dairy products of the country, can make the best use of a cow that will produce a fair amount of milk and at the same time raise a calf which will be salable for beef purposes.

The question can best be considered by eliminating the points upon which there is practically no difference of opinion and by concentrating attention upon the points where there is a chance for difference of opinion.

(1) It is generally admitted by all that cows of the special dairy breeds will, on the average, produce more milk and butter, and produce it cheaper, than those of dual-purpose type; and that the special beef breeds excel the dual-purpose in beef production.

(2) The man who intends to make dairying his chief business, with everything else of secondary order, should make use of the special dairy cow, and the man who produces beef animals and does not milk the cows should make use of the special beef breeds.

(3) The highest development of both milk and beef production cannot be combined in the same animal.

Dual-purpose for General Farm. This leaves the general farmer for whom the dual-purpose cow is adapted, if it is adapted

for anybody. This large class of farmers, especially in the Central states, are often not close to fluid milk markets, and change their farming operations from year to year to meet the changing price levels. They do not specialize in any particular thing and sell a number of things from the farm, among which milk or cream occupies a more or less important position.

The main question regarding the dual-purpose cow is whether this type is better adapted than the special dairy breed for such a farmer. If this general farmer, who is using dual-purpose cattle, is asked why he does not use special-purpose dairy cattle in preference to the dual-purpose, he will give one or all of the following reasons:

(1) The calves from the dairy breeds are not salable for beef purposes.

(2) The cows of the dairy breeds are not salable for beef when they are no longer useful for milk production.

(3) The cows of the dairy breeds are delicate and require better care and attention than he can give them.

There is some ground for these statements. The calves of the dairy breeds, as a rule, cannot be raised for beef with profit, and it is often unprofitable even to raise the males for veal.

It is also true that cows of the dairy breeds bring a low figure in relation to the current market price when sold for beef, and when herds are properly weeded out it is necessary to dispose of a considerable number of cows every year. On the other hand, profitable dairy cows, once secured, are usually kept at a profit for a comparatively long time, and the difference in return for the milk produced by a cow of the dairy breed and of the dual-purpose breed more than makes up for the difference in beef value. It is also true that cows of the dairy breed need good attention, or they will not be kept at a profit, but it cannot be said that they are especially delicate, although they will be of little value if allowed to go without proper shelter and food. The dual-purpose cow that produces milk for a few months during the summer only is better adapted than the highly developed dairy cow for the farmer who will not provide the proper conditions. It requires good, intelligent care to make use of so highly developed an animal as the modern dairy cow; farmers who are not able to meet these requirements might as well let her alone.

Regional Preference for Dual-purpose. There is more to recommend the dual-purpose cow in the corn belt than elsewhere, and

here the type is the most numerous. The typical farmer of this region finds it impractical to secure sufficient labor to carry on a herd of dairy cows large enough to utilize the feed — especially the roughage — grown on the farm. The raising of a number of beef cattle allows surplus roughage, which cannot be sold to advantage, to be utilized with small additional labor.

The dual-purpose cow also serves a useful purpose in many cases as an intermediate step in changing from a system of beef production to milk production when conditions make such change necessary. That is, when the farmer who has been engaged in beef production begins to sell dairy products, he usually milks the cows he has for a time, then gradually changes toward a dairy type by using dairy-bred sires. In this way he gains experience in handling dairy cattle gradually as the herd is developed.

Difficulties in Fixing Dual-purpose Type. Fully as many difficulties are experienced in breeding dual-purpose cattle as in-breeding special-purpose dairy cattle. One of the tendencies observed is for individual breeders to emphasize either the beef or the milk production side, instead of keeping the two of about equal importance. This practice results in dual-purpose breeds varying much in type as bred by different breeders. The judging of dual-purpose cattle in the show ring is often unsatisfactory because of the lack of a definite standard for such types. The tendency of many judges is to minimize either the beef- or milk-producing characteristics.

THE SHORTHORN BREED

Origin and Development. This breed takes its name from its characteristic short horns. It is also known in some localities as the Durham, from one of the counties in which it originated. The original home of the breed is in northeastern England, in the counties of Durham, Yorkshire, and Northumberland, especially in the valley of the River Tees. In this region the breed was improved and developed, and from here it has spread over almost the entire civilized world.

The exact origin is obscure. The Romans, Saxons, Danes, and Normans in succession brought their cattle to England and mixed them with the native stock. After the invasion of the Normans there was little interchange of cattle for several centuries, during which time the animals in the rich valley of the Tees probably

increased in size, owing to the favorable conditions of climate and food and the superior skill of the herders in that section in selecting and mating their herds.

Noted Early Breeders. The beginning of the improvement which resulted in the modern Shorthorn began about 1780, when Robert and Charles Colling, English cattle breeders, began their breeding operations, which lasted until 1818. These men are often spoken of as founders of the modern Shorthorn breed. Shorthorns as bred by the Colling brothers were generally good milkers, and this quality was considered by them as an important characteristic of the breed, to be retained as far as possible. At the same time, they were more interested in developing the general symmetry and beef-making characteristics. They followed the methods of Robert Bakewell closely, practicing in-and-in-breeding constantly.

Toward the latter part of the eighteenth century, Thomas Bates, another English breeder, began breeding Shorthorns. He aimed constantly to develop a superior combination dairy and beef animal, and he succeeded to a marked extent. Most of the best milkers among the Shorthorns at present are descended from animals of this breeding.

The Booth family began to breed Shorthorns about 1790. They emphasized beef production, and paid little or no attention to the dairy qualities.

Amos Cruickshank, who began breeding in 1837, developed the so-called Scotch type of Shorthorns, which are characterized by superior beef qualities and decidedly inferior dairy qualities.

The original Shorthorns were counted good dairy animals. Some very creditable reports are given regarding daily or weekly production of certain cows in the time of the Collings. It would appear, however, that even then the breed had the characteristics of the Shorthorn of today: milking well for a short time, but lacking persistency, that is, milking over a long period such as ten consecutive months.

Influence of Early American Development. The Shorthorn cows brought to America during the early importations were usually at least fair, and some were exceptional, milkers. Because of the general use of this breed for exclusive beef production in America, the dairy qualities were generally neglected, and most breeders aimed only at the best beef animal. This condition was

further strengthened by the importations of the Scotch type. As a result, the typical pure-bred Shorthorn as found today in America as a rule has no claim whatever to be called a dairy animal. In a few localities the original dairy qualities have been preserved, and it is still possible to find first-class dairy animals in this breed. Within recent years there has been a revival of interest in the milking qualities of this breed, and a considerable number of herds of pure-bred Shorthorns are now to be found where all cows are milked and records of individual production kept.

Breed Characteristics. The Shorthorns vary in type from the extreme beef conformation to the dual-purpose, with a few of real dairy form. The latter are exceptional, and not typical of the breed in America. Shorthorn cows of the milking types weigh usually between 1,200 and 1,350 pounds when mature. A typical cow of this type loses considerable flesh when in milk; when dry she fattens rapidly, and shows much more of the beef characteristics. Red, white, and roan are the typical Shorthorn colors, and the disposition is quiet and gentle. Reproductive ability is only fair. More difficulty is experienced with failure to breed than with certain other breeds, and the calves at birth are only medium in vigor. At birth, calves range between 70 and 80 pounds in weight and represent about 6 per cent of the weight of their dams.

Dairy Characteristics. While the Shorthorn breed is not counted among the dairy breeds, still enormous numbers of grade cows of this breed are milked, especially in the butter-producing states of the Mississippi valley. As in the case of other breeds, it is difficult to get satisfactory data concerning the production of Shorthorn cows under practical farm conditions. A compilation of records published by experiment stations shows an average of 6,017 pounds of milk and 218 pounds of fat in a year for thirty-seven animals represented. The average per cent of fat for these animals is 3.63. These figures are about typical of results in herds in which careful attention has been paid to selection of the individual animal, and in which good conditions of feeding and management are maintained. Such an average is considerably higher than that realized on the ordinary farm. From the data available it is safe to say that a herd of dairy Shorthorns should be expected to average between 5,000 and 5,500 pounds of milk and from 200 to 225 pounds of fat. A high figure for a herd

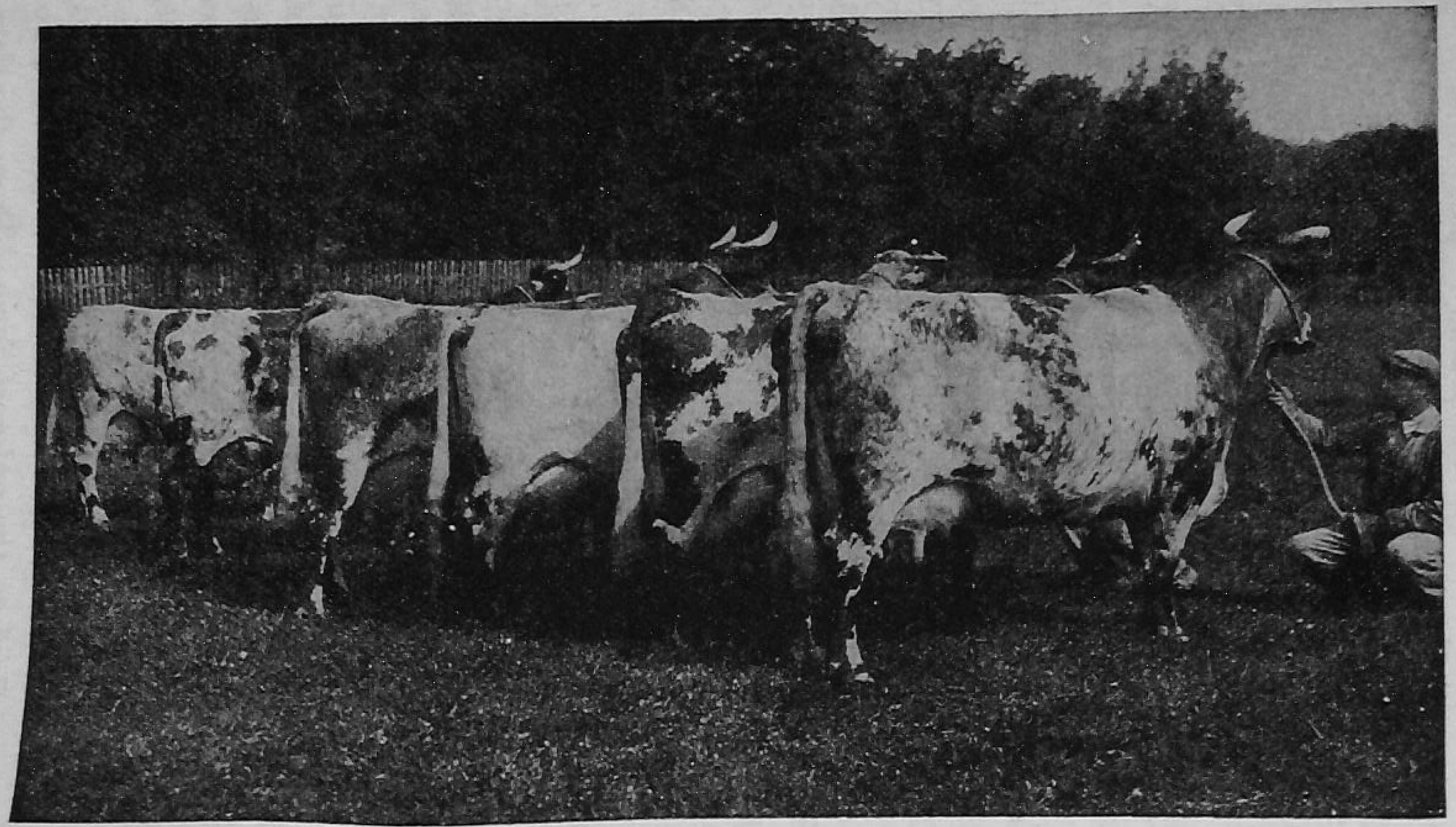


FIG. 24. A group of milking Shorthorns. The cows in this remarkable group have milk records from 8,752 to 17,241 pounds. The second one from the right, Doris Clay, for some time held the highest fat record for the breed. Note that some of them show more dairy than beef type.

average would be 6,500 pounds of milk or more, while less than 5,000 pounds as an average indicates lack of care in selection of individuals or improper conditions of feeding and management. The fat content will vary as a rule between 3.50 and 4.25 per cent with an average of not far from 3.8 per cent.

Persistency in Production. The Shorthorn cow, like others of dual-purpose breeds, generally lacks persistency in milk production. It is not uncommon, for example, that a Shorthorn cow produces 40 to 50 pounds of milk a day when fresh, but declines so rapidly after four or five months that her total product for the year may be not over 4,000 pounds and in seven or eight months she may be dry. There are notable exceptions to this by certain individuals of the breed which show all the persistency in milk production of the more highly developed dairy breeds. Perhaps the most marked difference between herds that show a low to a medium production and those that under the same conditions show a high production is a difference in persistency of milk flow. In color of milk and in size of fat globules, Shorthorn milk ranks between that from the Channel Island breeds and the Holstein breed.

Shorthorns in England. The dairy Shorthorn is the principal dairy cow of England today and the typical Shorthorn cow of England, as well. The milking qualities of the English Shorthorn are shown in a remarkable way by the results of the milk and butter tests made at the London Dairy Show. During the past twenty years, first place in both milk and butter production has been won in a majority of cases by either a registered or a non-pedigreed Shorthorn. Two hundred and thirty-six pedigreed Shorthorns in these tests averaged 48 pounds of milk and 1.82 pounds of fat a day. One hundred and twenty-six non-pedigreed Shorthorns averaged 51.8 pounds of milk and 1.95 pounds of fat a day.

Breed Organizations. The registration of pure-bred animals of this breed is in the hands of the American Shorthorn Breeders' Association, whose headquarters are in Chicago.

Advanced Registration. Some years ago the Shorthorn Breeders' Association established an advanced register planned somewhat along the same lines as those in use by the special dairy breeds. At present three classes or divisions are used. Of these Class A is for authenticated records made under the same rules as official testing in other breeds. Class B is for records made in Herd Improvement Associations, and Class C for private records

which have been subjected to a limited amount of inspection. The average of 7,298 records accepted up to 1936 is 8,418 pounds of milk, fat test 3.94 percentage, and 333.5 pounds of fat.

The highest production for the breed is credited to Melba 15th of Darbolora owned in New South Wales, Australia. This record is 32,522 pounds of milk and 1,614 pounds of fat in a year. A number of other excellent records have been made in the same herd. In recent years several Dairy Shorthorns in England have exceeded 20,000 pounds of milk in a year.

SOME LEADING MILKING SHORTHORN RECORDS

Cows	Lbs. Milk	Lbs. Fat
Ruth B. 568209	21,641	956.7
Mountain Princess 1635668	21,023	853.5
Bonnie Rose Meade 1284440	20,429	785.5
Butter Girl 655609	20,325	698.2
White Molly 1415398	18,346	806.0

RED POLLS

Origin and Development. This breed originated in Norfolk and Suffolk — adjoining counties in the eastern part of England. These counties are low and flat, with some marsh land. The soil is naturally rather poor, but it has been brought to a high state of fertility by good management. About 80 per cent of the area is tillable. The climate is generally typical of England, although the rainfall, of twenty-six inches per year, is less than the average for England.

The origin of this breed is uncertain. It seems that Red Polls have been developed from the cattle native to these two counties. Improvement began in the latter part of the eighteenth century, as part of the widespread movement of that time for improved livestock.

One opinion is that the original cattle of this type were brought to England by the Danes who settled in this part of England in the fifth century. There can be no doubt as to the similarity of characteristics of the cattle found in the southern provinces of Denmark and the red cattle of England.

Development of Polled Character. In 1804 Young wrote an account of the agricultural conditions in Norfolk and Suffolk, in

which he described the cattle of Norfolk as a small, red class of cattle, partly polled (without horns) and partly horned. At this time they were bred more for beef than for milk, and made a poor impression on that writer. Later, the horns were bred out by using, probably, either Suffolk or Galloway bulls for the purpose. The beef qualities were considerably developed, according to some authorities, by introducing Devon blood. In 1818 the cattle of Norfolk began to be known as Norfolk Polled.

The cattle of Suffolk from the earliest records were considered exceptional milkers. They were rather small in size, red, brindled, dun or mouse colored, and always polled. Yields of five gallons of milk per day were not uncommon for entire herds while on pasture. The breed had the reputation of being the heaviest milkers in England for their size, and of being especially adapted for poor pastures and unfavorable surroundings. The Suffolk cattle were always bred mostly for milk. The cattle of this country became known as Suffolk Polled. The colors other than red were bred out during the early part of the nineteenth century.

The cattle of Suffolk and Norfolk were developed along the same lines, and about 1846 it was generally recognized that the two types were so close that they were practically the same. In 1882 the name was shortened to the present name of Red Polled.

At the present time the breed is found largely in the two counties where it originated and to some extent in Australia and New Zealand. They are not found on the continent of Europe. They are used in England as dual-purpose cattle, and in that class rank about the same as the non-pedigreed Shorthorns.

Importation and Distribution in America. Cattle from the home of the Red Polled breed were undoubtedly brought to America during the colonial days, but they were not kept pure. These early importations are probably responsible for the muley red native cows often seen, particularly in the Eastern states, some years ago. The first importation of the improved type was brought to America in 1873. Several importations were made between 1880 and 1890, and from these mentioned are descended most of the cattle of this Red Poll breed now in America.

They are now found in all, or nearly all, the states of the Union, but they are most numerous in Ohio, Illinois, Michigan, Iowa, Wisconsin, and Kansas. The English Red Polled Herd Book was

first issued in 1874. The Red Polled Cattle Club of America, organized in 1883, registers the breed for America.

They have won their way entirely upon their merits, and are increasing rapidly in those states where dual-purpose cattle are in demand. They are the most typical and most popular of the real dual-purpose breeds.

Breed Characteristics. In size, the Red Polls rank below the Shorthorn and other heavy beef breeds. The cows weigh between 1,200 and 1,300 pounds as a rule, but occasionally one reaches 1,500 pounds or more. The bulls range from 1,800 to 2,200 pounds, and occasionally individuals reach 2,500 pounds at maturity.

In color, the Red Polls are a deep cherry red. White may appear on the tip of the tail, the udder may be white, and a few small white markings are allowed on the belly. White on any other part of the body disqualifies the animal, as does a black nose or even abortive horns.

In form, the Red Polls are typical dual-purpose cattle. In general, the conformation is about midway between the dairy and beef types as typical of the dual-purpose breeds. The general form is parallelogramic. The head and neck are lean and of dairy type, with the characteristic poll. The hindquarters are of moderately good beef form. The udder is often somewhat pendulous, and the forequarters frequently deficient and irregular in shape. The udder is seldom meaty in character, but usually elastic and mellow. The milk veins and milk wells are usually fairly prominent. The teats are inclined to be irregular in shape, and often large, even to the extent of being somewhat objectionable at times.

There is considerable variation in type between different herds of this breed, depending upon the purpose for which they have been bred. In some cases they are bred for beef production alone, and the cows are then not milked. In other herds the dairy qualities are given first place. Such practice results in wide variations in form and capacity for milk production in different herds. The judging of Red Polls in the show ring has usually been done mainly from the beef standpoint which tends to develop the beef qualities at the expense of the milking qualities. The Red Polled Cattle Club has formulated a scale of points to assist in establishing a more definite type.

Red Polls are fair breeders, ranking about equally with the Shorthorns in this respect. In regard to early maturing qualities they probably rank rather lower than the Shorthorns.

Beef Production. The Red Polls are a real dual-purpose breed, according to the definition given, since they are quite uniform in their ability to produce a fair amount of milk and are salable for beef at a creditable price.

As compared with the typical Shorthorns found in America the Red Polls are on the average, superior milkers, while as regarding beef production the conditions are reversed. The breed ranks well as beef producers, but does not win highest honors in competition as beef animals. The steers are satisfactory feeders; they gain rapidly and bring a creditable price. The steers are not so blocky and compact as those of the strictly beef breeds, and usually they are longer legged. The cows fatten rapidly when they are not producing milk.

Milk Production. Red Polls rank high in milk production for a dual-purpose breed. Few records have been published of cows owned by experiment stations, but those available show a yearly average of 5,900 pounds of milk having a fat test of 4 per cent, equivalent to a fat yield of 236 pounds. Under good farm conditions a herd of Red Polled cows should average yearly from 5,000 to 5,500 pounds of milk and from 200 to 225 pounds of fat. Good specimens should be expected to produce up to 10,000 pounds of milk in a year. In yield of milk this breed is excelled by the Holstein and Ayrshire, and in England by the Dairy Shorthorns.

Milk of the Red Polled breed has about the proper composition to make it most suitable for market purposes or cheese-making. In color of milk and butter it ranks about equally with the Shorthorn, below the Jersey and Guernsey, and above the Holstein and Ayrshire.

Advanced Registry. A plan for making official records was adopted by the Red Polled Cattle Club in 1908. The tests are conducted, as in the case of the other breeds, under the supervision of a representative of the Agricultural College in the state where the herd is located. The supervision covers two days of each month, the owner keeping the milk record between the test periods. The number of cows tested for advanced registration has not been large as compared with the numbers from the dairy breeds, but the records made have been very creditable and have

exerted a marked effect upon the popularity of the breed. Among the leading cows of the breed in milk production is Jean Du Luth Beauty, with a production within a year of 20,280 pounds of milk containing 891 pounds of fat. This cow weighed 1,750 pounds at completion of the test. Thirty animals in the same herd as the record cow had official records averaging 460 pounds of fat a year.

CHECK-UP 11

A. Underscore the phrase or expression that best completes each of the following statements.

1. The term "dual-purpose" describes cattle that are: (a) of two colors; (b) bred for both milk and beef production; (c) bred for milk production and draft purposes.
2. If the dual-purpose cow is adapted for anybody, it is for: (a) the man who makes dairying his chief business; (b) the man who raises cattle for beef; (c) the farmer who does not specialize but tries to sell what seems to be in demand at the moment.
3. Dual-purpose cattle are preferred in the corn belt above other farming regions because: (a) it is hard to get enough labor for large dairy herds; (b) raising some beef cattle helps utilize the roughage on a corn belt farm; (c) corn belt farmers do not know how to handle the dairy breeds.

George Morgan is a general farmer. His farm is in an isolated part of northeastern Iowa where labor is scarce. Morgan wants cows that will provide milk and that he can sell readily for beef. What sort of cows would you advise Morgan to select?

B. Morgan should select cows that have the following combinations of characteristics. Draw a line through each group of characteristics if there are *any* characteristics indicated in the group that would not meet Morgan's needs.

1. Large size; ready breeders; beefy appearance; persistency in milk.
2. High roughage consumption; shy breeder; persistency in milk; early maturity.
3. Good grazers; adaptable temperament; yellow milk; medium size.
4. Extreme angular form; marked barrel development; marked udder and milk-vein development; vigorous physical condition.
5. Average milk producer; high roughage consumption; average size; fattens readily; vigor of calves.

C. Underline the breeds that are likely to have most of the characteristics you did not cross out in the above groups and which are best suited to Morgan's needs: (1) Shorthorns; (2) Jerseys; (3) Brown Swiss; (4) Dual-purpose; (5) Ayrshire; (6) Holstein; (7) Red Polls.

CHAPTER XI

GENERAL CONSIDERATIONS IN SELECTING A BREED

The Choice of a Breed. The first question which arises in starting a herd is the choice of the breed. There is a tendency to attach too much importance to this decision. It is the capacity and ability of the dairyman and not the breed which largely determines success with cattle. The important thing is to decide upon the breed after weighing all the facts available, and then to continue with the one chosen unless some unusual condition arises which justifies a change. Minimizing the importance of breed selection should not be interpreted as signifying that breeds as such are unimportant. Quite the reverse is true. It has been pointed out in a previous paragraph that breeds represent the efforts towards improvement by generations of breeders and that the use of a well-established breed makes it possible to take advantage of all that has been done in the past and to start on a par with those at present engaged in this work. Warning is also given elsewhere against the crossing of breeds, as it is a practice which leads to deterioration of the herd rather than to improvement.

The leading dairy breeds, however, do not differ much in real efficiency, as shown in a later paragraph. If one farmer has not made a success with dairy cattle and another has made a marked success, the difference in outcome is seldom to be attributed to the choice of breeds. The man who is a failure with one breed ordinarily will meet a similar fate with another. The success or failure of a dairy-farming enterprise is seldom to be attributed to the breed chosen but usually to other causes, such as failing to cull out unprofitable cows, and improper methods of feeding and management.

Factors Determining Breed Selection. There are certain considerations which may be taken into account in choosing a breed and the most important may be listed as follows:

1. Breed of cattle most common in the community.
2. Form in which product is to be marketed.
3. Average production of milk and fat.

4. Original cost and probable demand for surplus animals.
5. Climate, food supply, and topography of farm.
6. Economy of production of milk and fat.
7. Breeding qualities of the cows.
8. Vigor of calves.
9. Beef value of discarded cows and adaptability of calves for veal.
10. Preference of the breeder.

Most of these points have been discussed in connection with the descriptive matter concerning the breeds.

The advantages to the farmer of using the same kind of stock as his neighbors should be considered of far greater prominence than his own preference or any small points of difference between the breeds.

Markets a Factor in Breed Selection. If the farmer expects to sell milk on the wholesale market, his choice would hardly fall upon the Jersey or Guernsey unless the market is one that will pay enough more for rich milk to justify its production. For milk production the Holstein, Brown Swiss, or Ayrshire would come into strong consideration because of their large and economical milk production. If the location is such that cream will be sold, the Channel Island breeds should receive careful consideration on account of their well-known economical use of feed for the production of butterfat. Under these conditions the probable value of skim milk for pigs and calf feeding is still another consideration and might cause the choice to fall upon the Holstein on account of the large production of this valuable by-product. When selling butterfat or cream the total quantity of fat and not the percentage of fat in the milk is the important factor. For cheese-making and for market milk the total solids as well as fat are wanted.

It is impossible to give figures that are satisfactory regarding the relative production of the breeds under practical farm conditions. The results from official testing are available but represent conditions far removed from those existing among the herds where the great mass of the market product is produced. It may safely be said that, among the breeds, the variation in average production is not great, and it is far less than that between the good and the inferior animal within the breed.

The original cost should receive some consideration but can be easily overemphasized since the herd is ordinarily maintained by raising young animals, and the expense for the foundation animals

has to be met but once. The probable demand for surplus animals is difficult to estimate in advance. It does suggest, however, the desirability of using a breed well known to the public and one popular in the region where the herd is located.

Adaptation to Region. Facts concerning the relation of the breeds to abundant pasturage, hilly pastures, and warm climates have been given in connection with the individual breeds. The economy of milk and fat production is closely related to the form in which the product is to be marketed and should be considered in that connection. It is well to keep in mind that the breeds having the largest average production are the cheapest producers as well. The breeding qualities of the cows and the vigor of the calves are important and should receive due consideration. The beef qualities of discarded cows and the adaptability of the calves for veal are of minor importance in a herd representing a special dairy breed. A difference of even $25 in the beef value of a discarded animal is a small consideration, if in order to get this additional return an inferior cow has been kept four or five years with possibly a greater loss in milk production each year than her additional beef value when discarded.

The individual preference of the man who is about to start a herd should not weigh too heavily in making a choice, since a person who is a born stockman will soon prefer the breed with which he is working, and his preference will change quickly, as a rule, if a breed is selected which was not his first choice.

The Relative Efficiency of the Breeds. In presenting the merits of a breed, its adherents often make claims of special efficiency in the matter of fat production or milk production as the case may be. The idea is often held that one breed or another in some way makes better use of its food than others. It is a simple matter to analyze the situation and to show how much truth lies in such claims and to give an explanation of such of these statements as can be substantiated. In order to understand the questions involved it is necessary, however, to have certain fundamental facts clearly in mind.

Between high and low producers. It is well known that there is a wide contrast between a heavy producing and a low producing cow in the amount of food required to produce a pound of milk or fat. An animal that produces 300 pounds of fat in a year does so at a lower feed cost per pound of fat than does an animal of the

same size and breed producing 150 pounds. The heavier producer uses more feed but less in proportion to her production. The explanation is that the feed used to maintain the animals — that is, keep up the body — is the same for both. The heavier producer has a great capacity for work and after supplying her own maintenance uses more feed for making milk than does the small one.

Fig. 25 will assist in conveying these facts. This graph illustrates the division of the ration between maintenance and milk

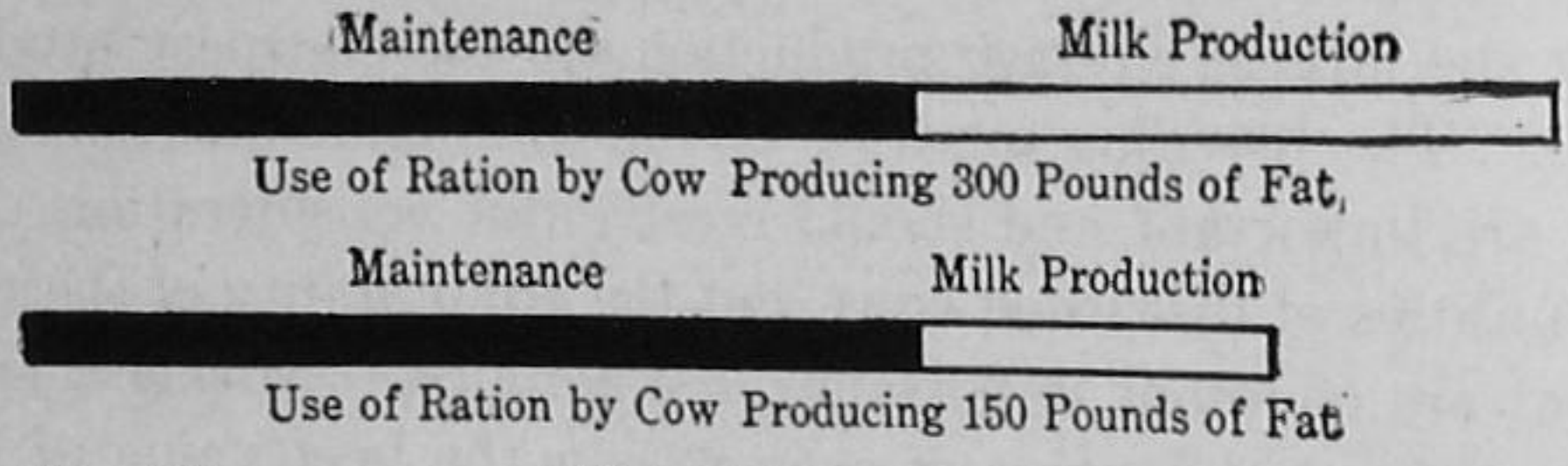


FIG. 25. The economy of high fat production. The cow producing 300 pounds of fat uses only about 25 per cent more feed than is required to produce 150 pounds by a cow of the same size.

production for two Holstein cows, one producing 300 pounds of fat annually, the other 150 pounds in a year. It will be noted that the additional feed used by the heavier producer all goes to milk production and while she uses a greater quantity of feed the amount to the pound of fat is evidently decidedly less.

Maintenance requirement in proportion to size. It is well established that the feed necessary to maintain a dairy cow — that is to preserve a uniform weight when no milk is produced — varies with the size of the animal. From this point of view a cow weighing 900 pounds will require three-fourths as much feed for maintenance as will one weighing 1,200 pounds.

Breed differences in digestion of feed. The evidence available shows that the breed of the animal has no relation to its ability to digest food. In an experiment by the author a digestion trial was made with cows representing four breeds and receiving exactly the same ration. The results were as follows:

	Per Cent Digested
Holstein	65.34
Ayrshire	64.31
Jersey	66.27
Dairy Shorthorn	65.52

It is surprising how close all came to the same figure. These results are, in fact, all within the limit of error, and the variations are too small to receive any attention.

Breed variation in cost of fat production. In the discussion of the Jersey and Guernsey breeds, it is pointed out that, on the average, cows of these breeds can produce a pound of butterfat at a slightly lower feed cost than can a Holstein or Brown Swiss. There are two reasons for this: (1) the most important is that the Jersey and Guernsey are smaller animals and the amount of feed required to maintain the cow is less than for a Holstein or Brown Swiss. (2) These breeds produce richer milk; in other words, they produce less milk along with the fat.

The author fed cows of different breeds for an entire lactation (milking) period upon uniform rations. From these data figures for individual cows are selected which illustrate in a typical manner the case as between the Jersey and the Holstein breeds:

	Lbs. Weight	Lbs. Milk	Lbs. Fat	Lbs. Digestible Nutrients per Lb. Fat
Holstein . . .	1,219	11,986	407	16.1
Jersey	950	6,033	367	14.1

These data show that the Jersey used less feed to the pound of fat produced than the Holstein. The principal reason for this was that the Holstein, weighing 1,219 pounds, because of her greater size required more feed for maintenance than the Jersey, which weighed only 950 pounds.

This is illustrated by Fig. 26 in which the black is the portion of the ration used for maintenance and the unshaded that used for milk production.

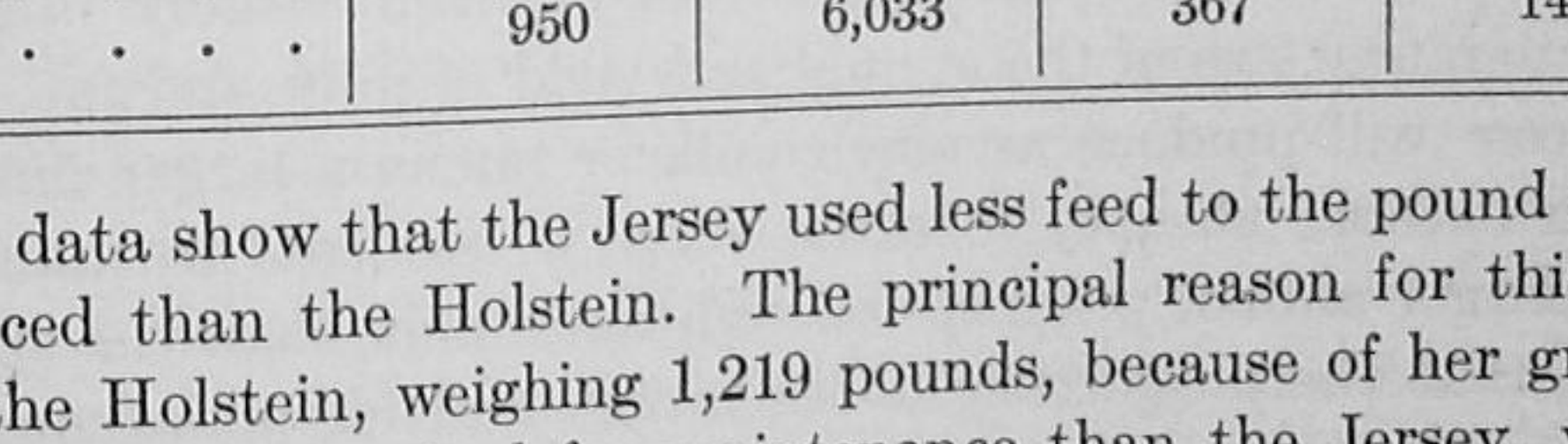


Fig. 26. Graphic illustration of the influence of the size of the animal as a factor in economy of production. If two cows produce the same amount of fat, the smaller cow will use less feed per pound of fat because of the smaller maintenance requirement.

The difference between the 16.1 pounds of digestible nutrients used by the Holstein per pound of fat produced and the 14.1 used by the Jersey is thus to be attributed to a combination of a lower maintenance for the Jersey and less skim milk produced in proportion to the fat.

Breed difference in feed for milk produced. It is generally recognized that the Holstein breed is first in economy of milk production, although, as in the case of the cheaper fat production by the Channel Island breeds, the importance of this fact is often overestimated.

Feed is required for the production of the solids — which may be thought of as skim milk in this connection — as well as for the fat. Since the Holstein produced more skim milk in proportion to her fat, the feed cost of the milk — if all is charged against the fat — will tend to be higher for the Holstein. In this case it is clear there are two reasons for the cheaper production per 100 pounds of milk by the Holstein. These are the larger production and the lower per cent of fat.

General considerations. When all the facts are considered, it will be found that the question of efficiency of breeds from the standpoint of feed requirements resolves itself largely into one of comparative size of the animal and yield of milk and fat. If a small cow will produce as much milk or fat as a larger one, she will do it more cheaply, because there is less cow to maintain. If the larger animal produces enough more milk than the smaller cow so that the proportion of her ration used for maintenance is no larger than with the smaller, the feed cost per pound of fat will be just as low. In the case of two animals of the same size which produce milk of the same quality, the larger production, although it calls for more feed, is bound to be the cheaper.

The main difference in the efficiency of cows as milk and fat producers is the difference between the low producer and the high producer, and bears no relation to breed. There is no known difference in the efficiency of breeds so far as digesting feed is concerned or in the use of feed as a whole if everything is taken into account. Individual differences will be found within the breed which are equal or greater than any breed differences which may be cited. Some animals require more for maintenance because of their greater size; others, by producing milk low in fat, use more feed for production of solids not fat.

The Channel Island breeds are cheap producers of fat; first, because of their smaller size in proportion to the amount of fat produced; second, because of the smaller amount of skim milk, or other solids, produced along with the fat.

The Holstein breed produces milk at the least feed cost per 100 pounds; first, because of the larger milk yield which overbalances the higher maintenance costs; second, because of the lower fat percentage — that is, the smaller amount of fat in proportion to the total milk produced.

Breed differences in the use of roughage. The statement is often made that a marked difference exists in the utilization of roughage by different breeds. Superiority in this respect is generally claimed for the Holsteins by partisans of this breed. Clearly there is no advantage in the consumption of large quantities of roughage unless the need for concentrates is correspondingly less. The real question therefore is the possibility of one breed having the ability to utilize roughage to the extent of securing a larger proportion of their nutrients from this source.

Conclusions. The Holstein cow, in common with other large breeds, is a liberal consumer of roughage, exceeding the smaller breeds in total consumed, but this greater use of coarse feed is to be attributed to her greater size. An average sized Holstein weighs 40 per cent more than the other extreme of the common dairy breeds, the Jersey, and it is not surprising, therefore, that her total roughage consumption is greater. According to the feeding practice of both experiment stations and practical breeders, cows of this breed when fed for liberal milk production do not receive any greater proportion of their nutrients in the form of roughage than do the other breeds. If there is such a thing as a breed characteristic, regarding the use of roughage, it is limited to the growing heifer and to the cow in milk when the ration is practically all in the form of roughage and the production, therefore, very limited.

Community Breeding. While progress has been made in the development of dairy cattle in the United States, the improvement is disappointingly slow. While the best herds are fully equal in production to the choicest representatives of the breeds in their native homes, the average production of all breeds, however, is below that of the same breeds in the localities in Europe in which they originated. Possibly several causes contribute to this end

and among these the intermingling of breeds in almost every locality in America. Although Europe has a large number of breeds — over forty being described on the continent alone and twelve for Great Britain — the common condition is to find but one breed in a locality. This is a decided contrast to conditions in America, where three or four breeds of cattle may be found within the limits of a small neighborhood. Within recent years the conviction has been growing in this country that one reason for the much higher average production of dairy cattle in Europe is a better development made possible by this grouping of breeds into localities.

Out of this growing conviction has come a definite policy on the part of those in a position to guide to some extent the development of the dairy industry in this country to encourage the development of dairy cattle breeding communities. When a community takes up such an enterprise in a more or less organized manner, it is spoken of as community breeding. Outside of organized community breeding activities there is clearly a tendency for such a grouping of breeds by localities as the result of several factors, but this movement advances slowly unless organized.

Community preference as a basis for breed selection. As pointed out in connection with the discussion of breed selection, the first consideration in the selection of a breed by the beginner should be the breed most generally used in the locality. Instead of selecting a breed because it is not well represented in the community, as is sometimes done under the impression that the demand for surplus stock will be better, it is much wiser to develop a herd of the same breed that already predominates in the locality.

If the dairy cattle development has not reached the point where any community preference has become manifest, the choice will necessarily be made on other grounds. It is possible that the judgment of an entire community will be wrong in this matter, but a beginner should not take this position without very good reasons.

Where a community preference has not been developed, it is often possible for a group of no more than five or six, who will work together for the purpose, to turn the attention of an entire locality to the breeding of one breed of livestock to the great benefit of all concerned.

Community organizations. The first organization for the express purpose of developing a community as a breeding center was the Waukesha Guernsey Breeders' Association, organized in 1906 by less than a dozen men of that county in Wisconsin. The possibilities of such an organization were so quickly recognized that others followed rapidly. By 1910, thirty similar organizations were in operation in Wisconsin, and by 1920 the number had increased to 160. By this time ten sales pavilions had been built and twelve more were under way. This type of community organization has spread to other states, particularly Minnesota; but Wisconsin still retains the leadership in this activity. Experience has shown these organizations to be successful to the extent that individual members are willing to subordinate their own interests in part to those of the community. In the successful communities the spirit of cooperation among the members is striking.

Activities of a community organization. The primary purpose of such an organization is to promote the welfare of the community by the improvement and development of a certain breed of livestock and the establishment of cooperation and cordial relations between its members that will insure the most successful economic results. As a means to this end an association of this kind will be interested in most of the activities listed:

1. Increase in number of breeders of the particular breed in the locality
2. Extension of the use of pure-bred sires.
3. Organization of calf clubs among boys and girls.
4. Holding public sales for its members.
5. Eradication of disease from the locality.
6. Establishment of cow testing association and the stimulation of official testing.
7. Use of proved sires.

During the early stages of a community organization the objective is securing a large number of breeders of the same class of cattle in the locality and developing the spirit of community cooperation. As the quality of the livestock improves, the reputation of the community for high-class animals may be established by suitable advertising in the agricultural press, and by the holding of shows, sales, and other means.

Sale of surplus stock. One object of a community organization is to facilitate the sale of surplus stock whether it be grade or

pure-bred. When one community has a large number of animals of the same breed for sale, it soon becomes widely known and a good market for that class of animals is established. Buyers are always attracted by the possibility of buying a number of cattle in one neighborhood, and surplus stock can be disposed of much more readily than where animals are widely sca tered. As a result of community breeding certain localities become known as Holstein centers, others as Jersey or Guernsey localities and buyers from a distance visit these localities knowing they will be able to find what they want among the large number available.

It is believed that the average price received for surplus animals is fully 20 per cent higher in communities having a reputation which attracts buyers. When the stock in the community is well developed it may be advisable to inaugurate public sales held at regular intervals. However, experience has shown that it is a mistake to hold a sale until sufficient numbers of high-class animals are available. A sale of culls is a detriment to the future development of the community. Likewise the continued unwise sale of the best foundation animals of the community will lead to disaster.

Stimulation for improvement. One of the most important advantages experienced when a community takes up the development of a certain breed is the more rapid advancement made in everything that pertains to cattle breeding and management. This is largely the result of the stimulation as well as the information the individual breeder receives from his association with others interested in the same subjects. Regardless of how much ability or education a person may have, he needs the constant help and counsel of others interested in the same line. When a man is the only breeder of a certain class of livestock in the locality he seldom makes much progress either in knowledge of his business, or in building up a reputation which will bring buyers for his surplus. He has no one at hand with whom he can talk over his problems or with whom he can compare results. Often he loses ground and finally gives up the struggle.

On the other hand, a number of breeders in the same community, especially where a community organization functions, exchange ideas, compare results, and learn from each other's successes and failures.

Exchange of breeding stock. Another of the decided advantages of community breeding is the opportunity it affords to make

better use of high-class breeding animals. One of the deplorable facts concerning present practices in breeding cattle is the limited use made of pure-bred sires. One reason for this is the feeling on the part of the farmer that he cannot afford to pay a good price for a bull when the herd is small and as a rule the bull has to be sold for beef at the end of two or three years. When there are a large number of breeders of the same breed in a locality it is possible to exchange bulls and by this means to make a more extensive use of high-class animals than would be possible otherwise. This also increases the possibility of finding bulls of great transmitting ability before it is too late to make use of them. The possibilities offered by the recent development in artificial insemination are just now being recognized. One community in New Jersey has been organized with more than one thousand cows of the same breed to be bred by artificial insemination from noted proved sires.

Testing and disease eradication. The conduct of official testing has become a necessary part of the business of raising pure-bred dairy cattle for sale. It is generally easier to get official testing done when there is a group in the same locality, especially when these are members of an association. If it is desirable to organize a cow testing association to test grade cows, a group accustomed to work together are in a position to go ahead to the best advantage. The control and eradication of tuberculosis and abortion can also be handled much better where local associations are in existence.

CHECK-UP 12

What are some important considerations in selection of breeds?

If the statement is true circle the letter T. Circle the letter F if it is false.

1. T F The ability of the dairyman is more important than the choice of breed.
2. T F There is considerable difference in efficiency among the leading dairy breeds.
3. T F The kind of dairy product sold, or whether a farmer sells milk or cream, should influence his choice of breed.
4. T F The beef and veal values of the breed are of major importance.
5. T F Personal preference concerning breeds should not weigh too heavily in selecting a breed.

6. T F The feed necessary to maintain a cow varies with her size.
7. T F Some breeds of cows digest their feed better than others.
8. T F The Jersey or Guernsey produces butterfat at a lower cost than Holsteins, Brown Swiss, or Ayrshires.
9. T F The Holstein breed stands first in economy of milk production.
10. T F Larger milk production from an individual cow means lower cost of production even though more feed is required.
11. T F The first consideration in the selection of a breed by the beginner should be the breed most generally used in the locality.
12. T F Community organizations of cattle breeders are not worth much to a farmer who is educated.

Starting the Herd. The successful dairy herd, in common with the successful business enterprise of other kinds, usually is started on a small scale and increased as the owner adds to his capital and experience. The plan to be followed will depend upon conditions, such as purpose in view, knowledge of the business, and capital available. It is seldom advisable for a beginner to take up the breeding of pure-bred cattle without first having some experience with grades.

Assuming that a beginner has already decided what breed he wants, what is the best course to pursue? Should he undertake by using good bulls to build up from common cows, some of which may contain more or less blood of beef breeds, or should he buy well-bred animals of the breed he has selected, and if so, how should these animals be selected?

A numerous class is represented by a farmer who lives in the corn belt, or the south, or any part of the country where dairying is not as yet well developed. This farmer does not expect to become a dairyman in the sense of making that his exclusive business. He expects to operate a general farm and milk as many cows as one man can handle. He is not certain just how far he will care to go into the business. Probably he has a very limited amount of capital available and there are few well-developed dairy herds near him. He has some cows on hand of mixed breeding with more or less beef blood. A man in this situation should begin milking all cows on hand as they freshen, taking care to have them in good flesh at calving time and making certain that a good ration is fed after freshening. This is giving the cows a chance to make good. The keeping of milk records should begin with

each cow as she freshens. Probably half or more of the cows will prove to be such low producers, even when given a chance, that they will not return a profit. These should be sold as soon as conditions are favorable. The keeping of milk and fat records of each cow in the herd should be continued regularly from year to year.

A pure-bred bull from a family of heavy milking cows should be purchased or rented as soon as it is decided to develop a dairy herd. The heifers by this bull and only from the best cows should be raised to replace the older cows that are discarded. If the herd has not been tuberculin tested, it should be tested and started on the way towards an accredited (free from tuberculosis) herd.

Herd Building through Purchase. A somewhat modified plan for a person under the conditions outlined would be to dispose of the stock on hand, if they are not what is wanted, and buy bred heifers of the breed chosen. The other details of management remain the same. By starting in this manner with well-bred grade females, the time required for getting a start is reduced three or four years. The element of disease is also largely eliminated if such heifers have been tested for tuberculosis and abortion before being purchased. The investment is greater and the owner has to learn the business of feeding and management more quickly, since he will presumably have some good producing cows to deal with almost at once.

Another factor which may decide the practicability of this plan is the possibility of getting readily in the locality the animals wanted. If animals of the breed chosen are numerous locally, making purchase easy, the plan of starting with good grade heifers is to be recommended. On the other hand, if no cows of the breed wanted are available locally, it is generally impracticable for the farmer to purchase the animals needed from a distance. Under these conditions it is comparatively easy to buy and ship a bull, and for this reason the plan of improvement would be mainly one of using pure-bred bulls and culling out the unprofitable cows.

As a rule it is wise to purchase as few animals as possible and depend mainly upon raising those needed. Not only is there a constant danger of disease when animals are purchased; but when an inexperienced man goes to a distant locality to buy stock he often comes home with animals that are anything but desirable.

As a rule the cows offered for sale are the culls, and if really good animals are offered the prices are proportionately high. To get together a herd of good milkers by purchase is possible but difficult and expensive. Generally where all cows are purchased and none bred the average for the herd is decidedly lower and shows no indication of improvement from year to year.

When buying foundation animals for a grade herd the best buy usually is bred heifers. With animals of this age the type or appearance offers but a limited basis for judging their probable value. About all that can be done is to observe that the animals in question show by their breed characteristics an indication of having a liberal amount of improved blood and that they are well developed for their age and in a good thrifty condition. Possibly the most important point to take into account is the quality of the herd from which they come and especially their sire.

Often a beginner starts out with the idea of buying only cows with milk records. He soon finds it is impracticable to follow this plan, as it is difficult to locate such animals for sale, and when they are found the price is high. It is just as well to take the same amount of capital and buy more bred heifers. Some of them will prove unsatisfactory and it will be necessary to cull them out, but some extra good ones may also be found.

In the districts where whole milk is sold to cheese factories or condenseries, the raising of calves is expensive. Many of the heifer calves are shipped at the age of about two weeks and are generally guaranteed by the selling agent to be sired by pure-bred bulls. Farmers needing to add to their herds for the future, especially in cream selling districts where skim milk is available, find it profitable to buy calves under these conditions. It has been demonstrated that some danger of infection with tuberculosis exists even when calves leave an infected farm by the age of two weeks.

Guarding against Disease. The problem of keeping a herd free from diseases such as tuberculosis, infectious abortion, and mastitis is always a difficult problem. To the beginner it is a particularly important problem since these diseases, once introduced, are difficult to eradicate. If a herd is started with clean (disease-free) animals, and additions to the herd by purchase are kept to the minimum, it may be possible to maintain a healthy herd for years. Once a herd is free from disease, it is wise practically to

limit the purchase of animals to the necessary bulls. Many breeders have learned by bitter experience that if the practice of adding to the herd from time to time by purchase is followed, sooner or later disease will gain a foothold, even though every possible precaution has been taken.

Tuberculosis. Tuberculosis does not develop spontaneously. It spreads only through transmission by an infected animal. An animal may have a bad case without showing any outward symptoms whatever. The placing of such an animal in a healthy herd may result in the greater part of the herd contracting the disease within a few months. When animals are bought, especially for starting a herd, every animal should be given the tuberculin test by a competent veterinarian.

When purchasing cattle, the important thing is to buy only from accredited herds or from herds which have been tested and will sell subject to a retest. In recent years a condition of many sales, both public and private, is one allowing a retest in 60 or 90 days. Meanwhile the animal is to be kept isolated on the premises of the purchaser until the retest is made.

A cow in the advanced stages of the disease, and acting as a spreader of the disease, sometimes shows by her physical condition that something is wrong. While it should be understood that all spreaders do not show what they are by their physical condition — nor are all unthrifty animals infected with tuberculosis — still it is wise to be on the safe side and to reject from the herd any animal that becomes emaciated or shows a decidedly unthrifty appearance.

Abortion or Bang's disease. This disease ranks next to tuberculosis in importance to the dairy cattle industry. In fact, from a purely financial standpoint the loss is even greater. This disease is especially widespread in sections where there has been considerable buying and selling of cattle. In some sections infection runs as high as 25 to 30 per cent in the larger dairy herds. Fortunately considerable advance has been made in developing a reliable blood test for infectious abortion. The present testing methods compare very favorably with the reliability of the tuberculin test, and are less costly.

It is a well-known characteristic of the disease to go in waves in a herd. For a period, usually a few months, it is very active, at times half the cows losing their calves; then it gradually

recedes until for from two to four years the herd may seem practically free from abortion. While in this stage the owner often ascribes to accidents the few cases which occur. However, a cow very seldom aborts from an accident, and so long as any cases of abortion occur the presence of the disease is probable. After a dormant period the disease flares up again as before — to be followed again in a few months by a dormant period. The importance of understanding these facts is to avoid overconfidence in assuming that because very few or no abortions have occurred for a number of months that the disease is gone. If it was once dormant, it is probably merely dormant again, only to break out later with increased virulence.

The indications are that the open (unbred) heifer seldom carries the infection. If her first calf is aborted she probably became infected during the gestation period. This suggests that the danger of introducing the germ of the disease with purchased animals is reduced if heifer calves or unbred heifers are introduced rather than older animals. Animals once infected seldom later become negative although such statements are frequently made by those who oppose the test. Constant and consistent blood testing coupled with stringent isolation at calving and disposal of all reactors (infected cows) have proven the most successful methods in controlling this disease.

Mastitis. This disease is more commonly known as caked udder or garget. It is caused by a variety of conditions. Among them may be mentioned bruises to the udder, exposure to cold, irregular milking, and most common, the infection of specific organisms into the udder tissues. The disease is very prevalent in all dairy sections of the country. It is a costly disease because of the loss of milk in infected cows; the loss of one or more quarters of the udder, and the final loss to the herd of diseased cows. It is one of the most common causes of the removal of milking cows from dairy herds.

CHECK-UP 13

What are some general points to keep in mind in selecting a breed?

A. Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. A good way to improve a herd at low cost is: (a) by buying better cows; (b) by the use of a pure-bred bull; (c) by buying good bred heifers.

2. As a rule it is wise to purchase as few animals as possible and depend mainly upon raising those needed because: (a) there is constant danger of disease when animals are purchased; (b) good cows are seldom offered for sale at reasonable prices; (c) there is less chance of improving the herd where replacements are purchased instead of raised.

3. Diseases that are likely to get into a herd through purchase of animals are; (a) foot and mouth disease; (b) tuberculosis; (c) infectious abortion; (d) mastitis.

4. A blood test is a reliable indicator of: (a) tuberculosis; (b) infectious abortion; (c) mastitis.

If you are going into the business of dairy farming you will want to have your own herd.

B. Below are groups of associated items that you would consider in establishing your herd. Indicate the order of consideration of the items within each group by placing the letters a, b, c, etc., in the parentheses in front of the proper items in each group. The 4 groups are set up already in the proper order for group consideration. Indicate the proper order *within* each of these groups.

Example: (c) *supper*
(a) *breakfast*
(*b*) *dinner*

1. Herd consideration

( ) What is the most prominent breed in the locality?
( ) What kind of milk is wanted by available wholesale market?
( ) Is the cow a ready breeder and are the calves vigorous?

2. ( ) Is there a market for sale of surplus stock?
( ) Is there a community breed association?
( ) Are pure-bred sires available?

3. ( ) When would you purchase or rent a pure-bred sire descended from a line of good milkers?
( ) When would you start culling out poor producers?
( ) When would you purchase a relatively small number of fairly high grades instead of pure-breds?
or

4. ( ) When would you test bred heifers for abortion and tuberculosis?
( ) When would you select a breed well established locally?
( ) When would you purchase bred heifers of the desired breed subject to retesting from a high-producing accredited herd?

CORRESPONDENCE OR CLASS ASSIGNMENT 4

1. Discuss the selection of dairy cattle touching upon: (a) relative merits of pure-breds and good grades; (b) improvement of the herd by means of a pure-bred sire.

2. Mention five factors to be considered in making selection of a breed of dairy cattle. Discuss three of these factors in some detail illustrating the application of each to practical situations.

REVIEW CHECK-UP 1

Each statement below is either true or false and each contains a word or phrase in italics. If a statement is true, circle the T and do nothing else with it. If a statement is false circle the F. Then correct it by crossing out the portion in italics and writing the correct word or phrase in the blank space at the end of the statement.

1. T F Proteins in milk are *different* from proteins in grains and vegetables. _____

2. T F Proteins in milk supply *better* than any other animal proteins the things that plant proteins lack. _____

3. T F Consumption of milk and dairy products is at a *high* level and is *certain* to go lower. _____

4. T F *Pigs* return more human food from a given amount of feed than any other domestic animal. _____

5. T F In civilized nations the *first* type of farming to be developed is usually dairying. _____

6. T F Dairying *helps* maintain soil fertility and is therefore a *permanent* kind of agriculture. _____

7. T F The special value of the cow lies in her ability to convert large quantities of *grain* into milk and meat. _____

8. T F Dairy cattle furnish *nearly half* the beef supply of the United States. _____

9. T F Dairying is a *seasonal* job. _____

10. T F Holstein cattle are *native* to America. _____

11. T F Difference in *origin* is the greatest factor in causing the differences between the Holstein and Jersey. _____

12. T F Robert Bakewell pioneered the art of breeding in *Holland*. _____

13. T F We will probably have *fewer* breeds in the future. _____

14. T F The longer a characteristic has existed in a breed the more *certain* it is to be transmitted. _____

15. T F The conformation of a good dairy cow *is* smooth and round like that of a good beef cow. _____

16. T F Conformation of the animal *is indicative* of its milk-producing ability. _____

17. T F It is *unnatural* for a cow to fatten when she is dry. _____

18. T F A *good* time to judge a cow is when she is dry. _____

19. T F Milk veins are a *reliable* indication of dairy capacity. _____

20. T F In judging a dry cow the size of the milk well is of *greater* importance than the size of the milk vein. _____

21. T F A *good* udder is one that is nearly as large after milking as before. _____

22. T F The Holstein is one of the *newest* of the dairy breeds. _____

23. T F Holstein cattle are *common* throughout northern Europe. _____

24. T F The Holstein in Holland shows somewhat *more* beef type than the Holstein in America. _____

25. T F Holstein colors are *always* sharply defined and *never* blended. _____

26. T F Holsteins are *less* disturbed by changes than other breeds. _____

27. T F Holstein calves make *poor* veal. _____

28. T F The average fat content of Holstein milk is *6.0* per cent. _____

29. T F An annual production of *7500* pounds of milk is a satisfactory average for a Holstein cow. _____

30. T F *Jersey* cattle are supposed to be descendants of the cattle of Normandy and Brittany in France. _____

31. T F The Jersey breed is numerous in England but *not* in Europe. _____

32. T F In America the Jersey is more popular in the *north* and *west* than is the Holstein. _____

33. T F Jerseys have been *inbred* freely and continuously. _____

34. T F Jerseys are *good* meat producers. _____

35. T F Jersey milk has the *highest* percentage of fat of the common dairy breeds. _____

36. T F Guernseys and Jerseys have a *common* ancestry. _____

37. T F Guernseys are of *little* importance in England or Europe. _____

38. T F Most Guernsey breeders prefer a *black* muzzle. _____

39. T F Ayrshires are quite *numerous* in the Scandinavian countries. _____

40. T F The Ayrshire is the *same* size as the Guernsey. _____

41. T F The Ayrshire has *short* horns. _____

42. T F The Ayrshire *is noted* for persistency of production. _____

43. T F The Brown Swiss is *seldom* seen outside of Switzerland. _____

44. T F The fat content of Brown Swiss milk is about *4* per cent. _____

45. T F The Shorthorn is *more widely* distributed over the world than any other breed. _____

46. T F The Shorthorn is *the principal* dairy cow in England. _____

47. T F The Shorthorn is the most popular *dairy* breed in the United States. _____

48. T F Red Polls are typical *dual-purpose* cattle. _____

49. T F The leading dairy breeds *do not differ much* in real efficiency. _____

50. T F The kind of dairy product you can sell in your neighborhood *should influence* your choice of breed. _____

51. T F The main difference in efficiency in cows *is among individuals* and not among breeds. _____

52. T F *The Holstein* produces milk at low feed cost. _____

53. T F Jerseys and Guernseys produce fat *at low* cost. _____

54. T F The use of a pure-bred bull is *absolutely essential* to herd improvement. _____

Now compare your answers with those in the key at the back of the book. Alongside the answers are numbers in parentheses. These numbers refer to the pages on which the information is given which supports the answers. If you did not know the correct answer, it would be well to turn back to the page referred to and study the reasons for the answer. Don't just take the editor's word. Find out why. He is human. You may be right. He may be wrong. But you'll have to show him.

CHAPTER XII

SELECTION OF THE INDIVIDUAL COW

Necessity for Selection. Breeds are of great value as a means of preserving and transmitting qualities which have already been developed, and it is important to select a breed adapted to the purpose for which it is to be used. However, the selection of the individual cow within the breed is of more importance as this affects the economical production of milk.

The highly developed dairy cow of today is, to a large extent, abnormal. It is safe to assume that the wild cow produced only milk enough to support the calf for a few weeks until it could subsist on other food. There was probably little difference in the amount of milk produced by different individuals at this time, and the milking characteristic was undoubtedly transmitted quite uniformly.

After cattle were in a state of domestication and the milk became an important article of human food, some attention began to be paid to developing the milking functions. Through natural variations, certain animals showed more highly developed milk-producing functions than others, and by using these animals for breeding purposes and stimulating the mammary glands by better feed and regular milking, a change was gradually made in the amount of milk secreted, and probably to some extent in the quality as well. While the wild cow possibly produced from one to two thousand pounds of milk in a year, a good dairy cow of today may produce more than this in a single month.

Acquired Characteristics. It is a well-known fact, and one easy to understand, that when any characteristic or function has been developed to a higher degree in a breed of animals than existed originally, the acquired characteristic may not be transmitted uniformly. There is a constant tendency for the characteristic of some of the ancestors to appear. This is called reversion to type. The more highly developed the animal is the more difficult, as a rule, is the retention of the acquired characteristics. This explains why there is such a wide variation in the capacity of individual cows to produce milk. Although wild cows presumably varied

but little in the milk produced, it is not uncommon under present conditions for one cow to produce four or five or more times as much as another individual of the same breed kept under similar conditions in the same herd. These individual variations must be expected, and the higher the development of the dairy cow is carried the more difficult will it be to maintain this high production.

Significance of Individual Variation. It is only within recent years that the full significance of individual variation has been understood by those who are engaged in dairy farming. One of the weakest points in the system of dairy farming as carried on at the present time is the failure on the part of a large number of farmers to appreciate the importance of this factor of individual selection, or, if it is appreciated, a failure to give this subject the attention and time which its importance justifies. Even when cows are milked regularly and the selling of dairy products is a regular business, the yearly butter production seldom exceeds 250 pounds per cow except in the hands of the unusual dairyman; and even among those who are making the sale of dairy products their principal source of income, the average production is comparatively low.

Variation in Production by Individuals. Credit for first calling attention to the great importance of the selection of the individual cow is due the Illinois Experiment Station. Beginning in 1902, eighteen herds numbering 221 cows were tested through complete milking periods. A summary of the results is given in Table 9. The average milk production was 5,617 pounds and the fat production 227 pounds. The best herd averaged 350 pounds, the poorest 142 pounds, of butterfat per cow. The best ten cows averaged 389 pounds, the poorest ten 142 pounds, of butterfat per cow for the year. Herds which had been graded up by the use of a pure-bred sire produced 85 pounds of butterfat more per cow than did those in which no grading had been done. These herds were in the hands of men who were making the production of milk their principal business. As a result of the investigation it was concluded that at least one-third of the cows in ordinary herds which were being used for milk production in that state were unprofitable, and that on nearly every dairy farm a few cows were kept at an excellent profit, some at a small profit and some at an actual loss.

A large amount of data which corroborate these early conclusions has been accumulated largely from the records of cow-testing associations since the pioneer work reported in Table 9 was published by the Illinois Experiment Station. An especially

TABLE 9. PRODUCTION OF AVERAGE, BEST, AND POOREST COW, IN TWENTY-FOUR ILLINOIS HERDS

HERD	NO. COWS IN HERD	LBS. MILK			PER CENT FAT LBS.			BUTTERFAT		
		AVERAGE	BEST	POOREST	AVERAGE	BEST	POOREST	AVERAGE	BEST	POOREST
1	11	5,753	6,099	4,391	4.54	5.17	3.91	262	315	172
2	8	7,376	8,739	4,928	3.19	3.81	3.92	268	333	193
3	5	8,057	9,454	6,719	3.42	3.40	3.27	276	324	221
4	11	6,220	7,445	4,091	3.89	4.82	3.83	242	359	157
6	20	7,873	9,067	5,796	3.62	4.41	3.65	285	399	212
7	10	4,525	5,507	3,412	3.76	4.70	3.78	170	264	129
8	10	4,486	6,647	2,691	4.29	3.09	3.61	193	263	97
10	13	5,431	7,291	3,847	4.18	4.31	4.38	227	315	168
11	9	5,969	6,531	5,552	3.43	3.78	3.01	205	247	168
12	13	4,504	6,429	2,090	3.89	3.80	4.83	175	248	101
15	12	5,128	6,289	3,491	4.03	4.74	3.01	207	299	135
16	9	4,608	5,293	3,752	3.98	4.49	3.99	184	238	150
17	7	4,355	6,115	3,710	3.96	3.31	3.33	173	203	124
19	19	5,410	6,413	4,530	4.11	4.57	3.49	243	293	158
20	15	6,106	7,530	2,980	3.84	3.93	4.56	235	296	136
21	15	5,971	8,882	4,025	4.06	3.75	3.55	243	333	143
23	25	3,314	4,337	1,846	4.28	4.96	4.24	142	216	78
24	9	5,921	6,911	3,478	5.91	6.91	4.64	350	477	161
	221	5,616	6,994	3,962	4.03	4.55	3.83	226	301	150

valuable study of the question made in the Southern states is reported in Table 10. These data show the same wide variation in the cost of production by individual cows as that found in the investigations previously noted. In this case the best cow produced butter at a cost of 13.4 cents per pound as compared with 37.1 for the least profitable. The best cow consumed feed worth $3 for each $1 expended for the poorest, but at the same time she gave a return of $8.30 for each $1 by the inferior animal.

This table shows that the best thirty cows produced about three and one-half times as much as the poorest thirty cows. The former gave a return of $2.25 for each dollar invested in feed to

$1.18 for the latter. The best individual produced nearly eight times as much as the poorest.

TABLE 10. RESULTS OF TWELVE MONTHS' RECORD FOR 719 COWS IN THE SOUTHERN STATES

ITEMS	AVERAGE OF 719 COWS	BEST COW	POOREST COW	AVERAGE OF BEST 10 COWS	AVERAGE OF POOREST 10 COWS	AVERAGE OF BEST 30 COWS	AVERAGE OF POOREST 30 COWS
Milk produced, pounds . . .	4,299.40	8,325.50	1,125.00	8,681.90	1,577.60	7,326.00	2,099.60
Butterfat produced, pounds . . .	216.84	538.79	64.12	459.00	77.21	391.75	100.70
Value fat at 28 cents	$60.71	$150.86	$17.95	$128.52	$21.62	$109.69	$28.20
Value skim milk at 20 cents a hundred weight . . .	8.17	15.57	2.12	16.45	3.00	13.87	4.00
Total value of products	68.88	166.43	20.07	144.97	24.62	123.56	32.20
Cost of feed per cow	36.27	72.03	23.80	65.73	24.63	54.83	27.36
Profit per cow . .	32.61	94.40	—3.73	79.24	—0.01	68.73	4.84
Cost of producing a lb. butterfat, in cents	16.70	13.40	37.10	14.30	31.90	14.00	27.20
Returns for each $1 invested in feed .	$1.90	$2.31	$0.84	$2.20	$1.00	$2.25	$1.18
Profit on each $1 invested in feed .	0.90	1.31	—0.16	1.20	0.00	1.25	0.18

The following figures are taken from a report of a cow-test association in Utah:

	TEN HIGHEST	TEN LOWEST
Average lbs. milk yield . . .	8,779	4,584
Average per cent fat	3.98	3.77
Average lbs. fat yield	338	176

In this case the best ten cows produced almost as much as twenty cows like the poorest ten.

Vast quantities of data could be assembled, all showing the same facts. The extremes in production indicated by the data given are not confined to any breed or geographical location. While in pure-bred or highly developed grade herds the proportion of inferior producers is less than in herds of more common breeding, still a certain proportion of unprofitable cows may be expected

even in herds of this kind. It is no reflection upon a breeder to have such animals appear occasionally, but it is a reflection upon his judgment if he retains them in his herd.

The Economy of High Production. The amount of milk and fat produced bears a direct relation to the economy of production. This fact can be shown by any amount of data. Those given in Table 10 are typical. The best thirty cows consumed feed worth $27.47 in excess of the poorest thirty animals, but produced 291 pounds more fat each.

The most abundant evidence on this point is furnished by the records of 120 cooperative cow-testing associations. The cows are grouped in classes according to the amount of fat produced in a year, and the gain shown for each group is the average net gain over cost of feed per cow. Groups with insignificant numbers have been omitted from this table.

TABLE 11. RELATION OF FAT PRODUCTION TO INCOME OVER COST OF FEED
A SUMMARY OF COW TEST ASSOCIATION RECORDS

NUMBER COWS	BUTTERFAT PRODUCED POUNDS	AVERAGE BUTTERFAT POUNDS	SELLING PRICE PER POUND	GAIN
43	26 to 76	58	$0.41	$13.88*
600	76 to 125	109	.44	12.48
2,305	126 to 175	154	.44	27.90
4,310	176 to 225	202	.44	42.45
4,748	226 to 275	251	.44	57.82
3,385	276 to 325	298	.44	73.34
1,635	326 to 375	347	.44	89.67
652	376 to 425	396	.44	105.07
214	426 to 475	446	.45	124.85
79	476 to 525	493	.43	135.30
27	526 to 575	543	.40	134.80

* Loss.

It will be seen that 600 cows averaging 109 pounds of fat in a year earned only $12.48 each over the cost of feed; whereas 3,385 cows producing close to 300 pounds of fat showed earnings six times as large, and 214 which produced close to 450 pounds of fat each earned ten times as much as the first group.

Table 12 shows the results of a survey of the cost of milk production in Jefferson County, New York. This survey included 53 herds numbering 834 cows, the average production being

TABLE 12. RELATION OF MILK PRODUCTION TO INCOME ABOVE FEED
Jefferson County, New York

AVERAGE LBS. YEARLY MILK PRODUCTION	NUMBER COWS	PROFIT PER COW OVER FEED COSTS
5,000 or less	159	$ 6.04
5,001 to 7,000	360	16.69
7,001 to 9,000	214	27.21
9,001 to 11,000	84	39.39
Over 11,000	17	75.53

6,621 pounds milk and 241 pounds fat; 19 per cent of them caused their owners a loss of $11.18 each.

Relation of Individual Production to Costs. A careful study of the cost of producing milk in four dairy farms located in Wisconsin, Michigan, Pennsylvania, and North Carolina brought out the same truth regarding the relation of the individual cow to the cost of production. Table 13 gives the results.

TABLE 13. RELATION OF PRODUCTION TO FEED COST AND INCOME. RESULTS FROM WISCONSIN, MICHIGAN, PENNSYLVANIA, AND NORTH CAROLINA

PRODUCTION OF MILK PER COW LBS.	NO. COWS	AVERAGE PRODUCTION LBS.	AVERAGE PER COW PER YEAR			AVERAGE PER 100 LBS. MILK	
			Feed Cost	Other Cost	Total Cost	Feed Cost	Total Cost
3,000 and under	16	2,349	$43.93	$39.97	$83.90	$1.87	$3.57
3,001 to 4,000	33	3,648	49.47	45.01	94.48	1.36	2.50
4,001 to 5,000	78	4,596	55.00	50.04	105.04	1.20	2.29
5,001 to 6,000	111	5,450	59.91	54.51	114.42	1.10	2.10
6,001 to 7,000	109	6,445	62.85	57.18	120.03	.93	1.86
7,001 to 8,000	60	7,513	70.38	64.04	134.42	.94	1.79
8,001 and over	36	9,049	80.45	73.20	153.65	.89	1.70

It will be noticed that as milk yield increases there is also an increase in the feed cost and in other cost items, but not in the same proportion. The decrease in cost of producing one hundred pounds of milk is much greater between the very poor cow and cow of medium quality than it is between the medium cow and the good cow. Because of this fact the most rapid herd improvement will follow the elimination of the poorest cows.

A study of the yearly records of 18,014 cows kept by cow test associations is summed up as follows: "As butterfat production increased from 100 to 400 pounds there was a regular increase of about $16 in income over cost of feed per cow for each 50 pounds of increase in production of butterfat.

"Cows having high average production of milk and butterfat averaged high in income above feed regardless of breed, age, weight, date of freshening, or geographical location. Cows having an average milk production of 3,250 pounds had an average income of $32.50 over cost of feed, while those having an average milk production of 13,250 pounds had an average income of $218.19 over cost of feed. The average production per cow in the latter group was about four times as great and the average income over cost of feed was nearly seven times as great as in the other group."

The general conclusion can be drawn from the data given that it costs from $5 to $30 more per year to feed a cow, depending upon the price of feeds, that will produce 300 to 400 pounds of fat, than it does to feed a cow producing from 100 to 200 pounds of fat.

Herd Numbers and Herd Profit. The farmer too often makes the mistake of thinking that a certain number of cows should give a certain amount of product, and that the sum received from his herd should be comparable with that received from another herd of the same size. The point is overlooked that it is not quantity, either of milk produced or number of animals kept, that determines the profit, but the income in excess of the cost of production. In any herd of 15 to 20 cows that has not been carefully culled, a greater total profit will be realized by retaining from one-half to two-thirds of the herd and disposing of the inferior ones. This is especially true of herds composed of common grade and dual-purpose animals.

One cow producing 300 pounds of fat in a year makes vastly more profit than do two cows producing 150 pounds each, although the total production is the same in each case. The reason can be easily understood when we consider the use which the animal makes of its feed. The first use to which the cow puts the feed given her, as is the case with any animal, is to maintain the body, which in this case is keeping up the machinery for milk production. The feed necessary for this purpose is called the ration of maintenance. With an ordinary cow producing 200 pounds of fat in a year, the

ration of maintenance represents from 50 to 60 per cent of the feed she consumes; in the case of a better producing cow about 40 to 50 per cent of her ration; while an extraordinary producing cow may not use over 35 per cent of her ration for this purpose. This may be looked upon as a fixed charge which has to be made in the case of every animal, and since in any, except especially good producing herds, at least half of the feed will be used for this purpose, it is clear that keeping two cows to do the work of one

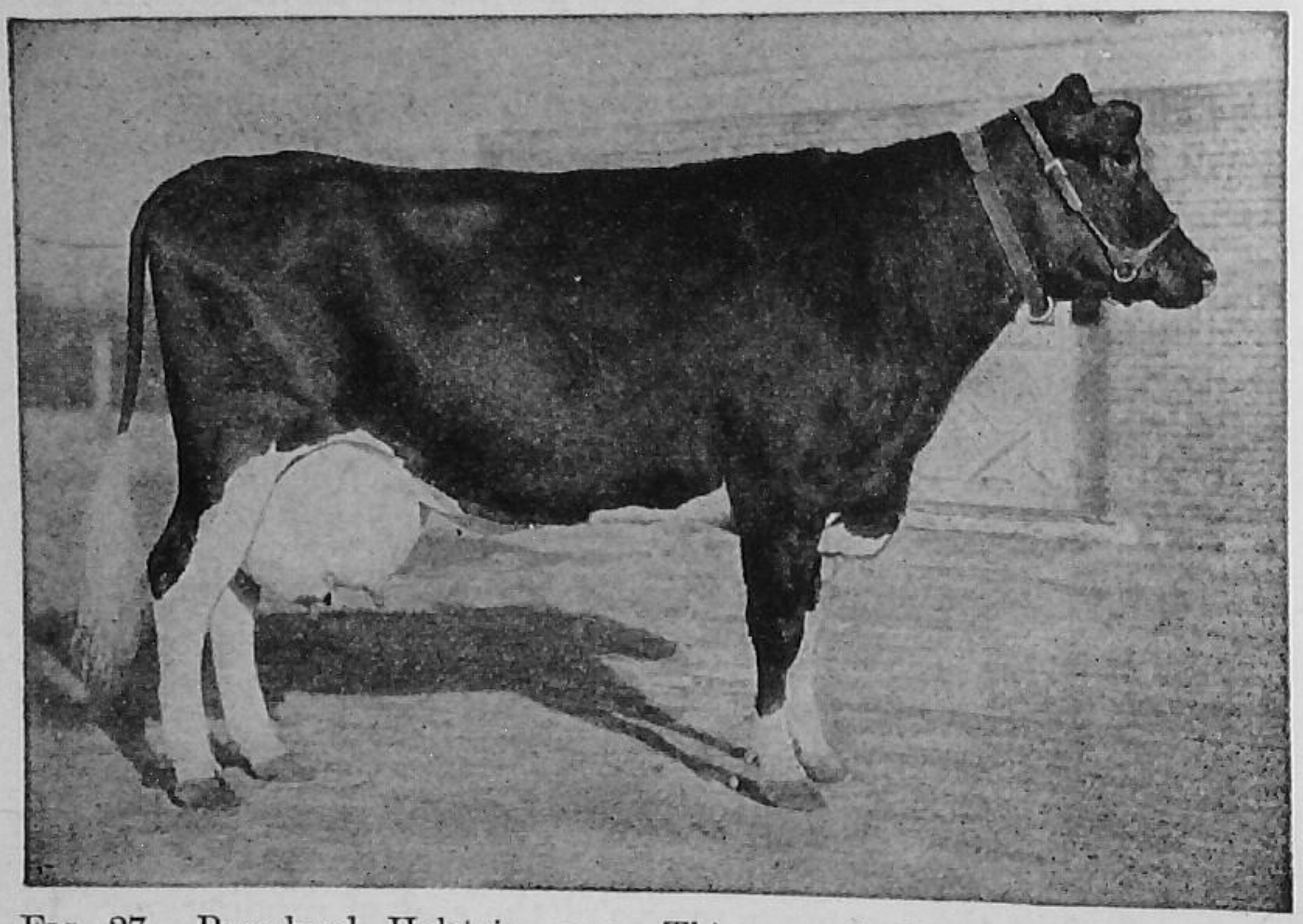


FIG. 27. Pure-bred Holstein cow. This cow had good ancestors, was healthy but lacked the inherited stimulation for satisfactory production.

is increasing the total amount of feed used by something like 25 per cent.

Cause of Individual Variation. It has been the purpose of this chapter to emphasize the selection of the cow from the standpoint of her milk-producing capacity. The assumption has been in this discussion that the low production figures are due to a limited capacity of the cow to produce milk; in other words, that all have had a fair chance. As a matter of fact, low production under farm conditions is the result of poor feeding as frequently as of inferior animals. The figures used, however, in most cases are not comparisons between herds but within herds, and by this means the result of variation in feeding is largely eliminated.

Limiting the discussion from this point on to the cause of the variation in capacity of the cow to produce leads to a consideration of milk secretion.

Inherited Variation in Milk Secretion. The cow that is a superior milk producer for her breed has received something by inheritance differing in degree from that inherited by the inferior milk producer. Without this internal factor, this stimulation

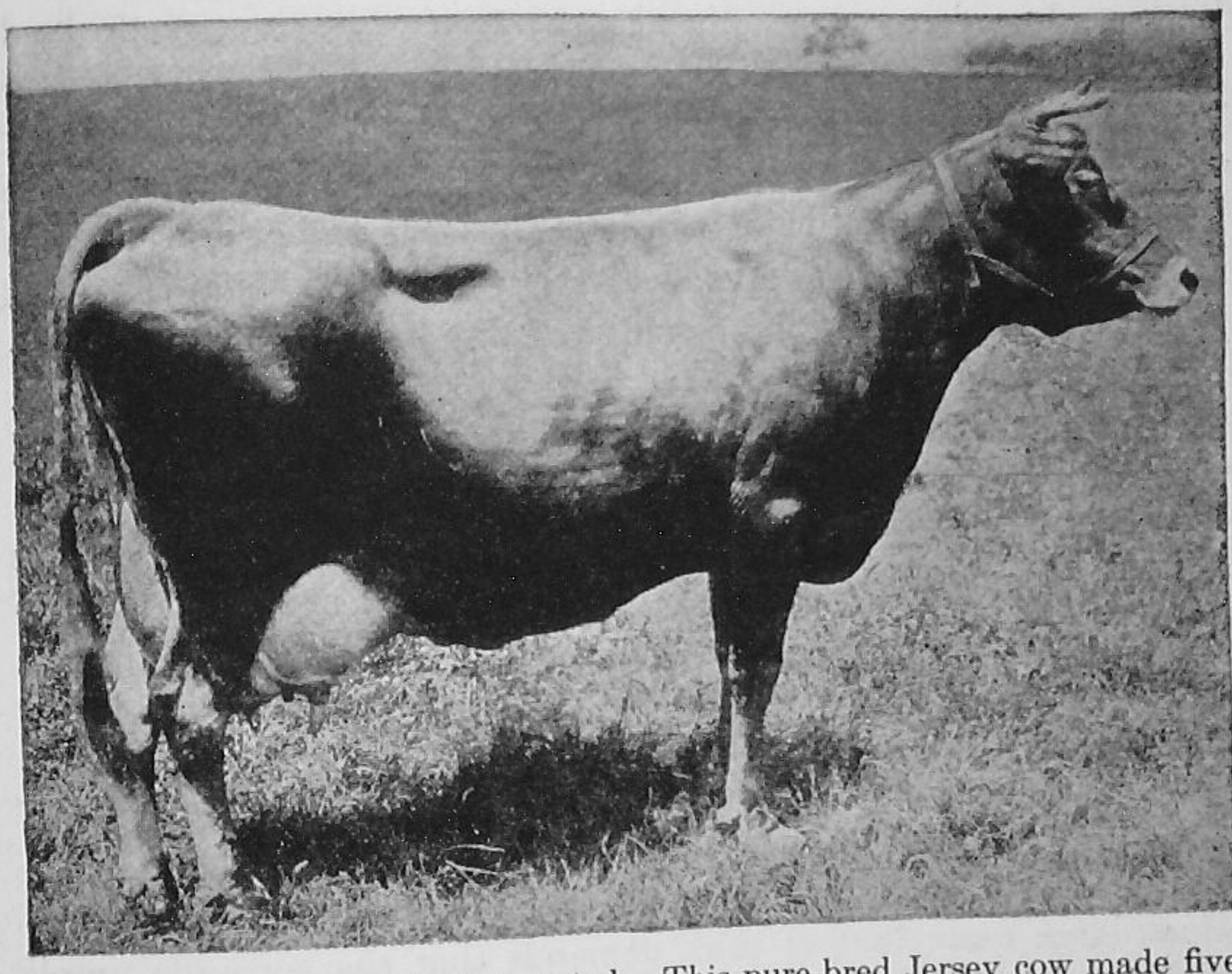


FIG. 28. Duke's Rachel Interested. This pure-bred Jersey cow made five remarkable yearly records. Inherited characters for high production made this production possible.

from the inside, the best of feed and care will not yield results. Just what this internal factor may be is a physiological question too involved to be discussed here except in a brief statement. According to physiologists, the udder glands which secrete milk are stimulated into activity as the result of the secretion of other glands, belonging to that group known as ductless glands. The stimulating substance is secreted by the anterior lobe of the pituitary and is carried through the blood. This substance, the hormone known as prolactin, stimulates the udder gland to produce milk. The amount of this substance that a certain animal

secretes depends upon the development and vigor of the gland by which it is manufactured. A good dairy cow is one that has inherited the power to form a large amount of this substance, while an inferior animal is one with a weak stimulation to produce milk. From this viewpoint the selection of the cow is choosing the one that has a strong inherited stimulation to produce milk.

Inherited Stimulation May Be Strong. An experiment made by the author illustrates how strong this stimulation may be. A mature Jersey cow was fed a liberal ration while dry; she calved in more than moderate flesh. Her ration was then adjusted to supply only nutrients sufficient to support the body, leaving nothing for producing milk. She was compelled either to cease producing milk or to make it from the reserve on her body. This was continued for 30 days. At the end of this time she was producing only one pound of milk per day less than in the beginning, but was so weak she could hardly get up without assistance. During this time she lost 115 pounds in body weight and produced over 90 pounds of solids in the milk from her own body.

According to the view expressed, the high-producing cow secretes milk because of the strong stimulation she has in her body. To replace these nutrients she has a keen appetite and consumes a large amount of food. The point is this, she consumes the heavy ration because she produces a large amount of milk. The consumption of the heavy ration is the result and not the cause of the heavy milk production, and likewise the form or shape of the animal is influenced to a degree. Her inherited stimulus to produce large quantities of milk demands that she consume ample feed, which tends to develop the organs of digestion. Similarly, the generous secretion of milk develops the mammary system. The result is the close approach to the ideal dairy form.

Reason for Economy of High Production. It seems entirely reasonable that a cow producing a large quantity of milk should be a more economical producer than one with a small capacity. However, careful thought is required to understand properly the reason. The assumption is often made that the good dairy cow in some way is able to get more out of feed than an inferior cow, but digestion trials do not bear out this view. The portion of a given ration that is digested and used is practically the same for all individuals, regardless of milk-producing ability, age, or breed. It should be kept in mind that the feed cost is approximately half

the total expense of milk production. Table 13 supplies data on this point. The other expenses include labor, barn expense, taxes, depreciation in value, bull service, and veterinary fees and possibly others of a minor nature. These overhead expenses, like those of feed, increase somewhat as the level of production is raised but not at all in proportion. In Table 13 it will be noted that the other costs for cows producing 3,000 to 4,000 pounds yearly was $45.01 a year or $1.28 a hundred for the milk. For cows producing 7,000 to 8,000 the costs other than feed were $64.04 a year or 85 cents a hundred. The high-producing cow, as pointed out, uses more feed than the cow producing at a lower level; and the same is true for the overhead expenses other than feed. But the important point is that this increase is not in proportion to the increase in milk produced and the great economy of high production results from a combination of this saving in feed and in general overhead expenses.

CHECK-UP 14

After having read this chapter thoughtfully you should be able to reach some general conclusions about milk production in terms of the individual cow.

A. Below are thirteen statements. Cross out each one that is not a safe conclusion to make or that is not related directly to economical milk production.

1. Selection of a pure-bred dairy type assures a high rate of milk production.
2. Acquired characteristics of pure-bred cattle are not always transmitted at a uniform rate because some animals may revert to type.
3. Retention of acquired characteristics becomes more difficult as the breed is developed, consequently great variation in milk production may be found among stock of the same breed and environment.
4. Grading up herds by use of a pure-bred sire can raise butterfat production per cow.
5. In highly developed herds the proportion of inferior producers tends to be greater than in herds of common breeding.
6. The profit from increased milk yield of higher-producing cows more than offsets the increased feeding and other costs of maintenance.
7. It costs more in the long run to maintain a herd of medium and poor producers than to maintain a herd of medium and good producers

because poor producers cost about the same to maintain as do medium and good producers.

8. A given number of cows should produce a certain amount of milk and butterfat.
9. In dairy farming profits come from income in excess of production costs.
10. Low production under farm conditions is as often caused by poor feeding as by selection of inferior stock.
11. Good milkers have an inherited ability to produce more prolactin which stimulates the udder glands than do medium or poor milkers.
12. Poor and medium milkers can often be developed into better milk producers by increasing their food consumption.
13. Feed cost is about equal to half of the total cost of milk production.

Important factors concerning milk production.

B. In the groups below place an x in the parenthesis before each item that is definite reason for the statement made.

1. A high rate of milk production is not necessarily assured by selection of a pure-bred dairy type.

   a ( ) Highly developed dairy cows are actually abnormal.

   b ( ) It becomes more difficult to retain acquired characteristics as breeds are improved.

   c ( ) Care must be taken to choose the individual cow.

   d ( ) Some cows have an inherited characteristic that enables them to produce more milk than other cows of the same breed and environment.

   e ( ) Increased costs of maintaining a good milker do not rise in proportion to increased yield.

2. It is false to assume that a given number of cows will yield a certain amount of milk and butterfat and therefore a certain profit.

   a ( ) One cow producing 300 pounds of butterfat per year makes greater profits than two cows producing 150 pounds each.

   b ( ) A superior milker may use only 35 per cent of her food ration for maintenance, 65 per cent going into milk production, while other less productive cows may consume 50 or more per cent for maintenance.

   c ( ) Under actual farm conditions, low milk production is caused as often by poor feeding as by inferior stock.

   d ( ) Cows consume large quantities of feed.

3. In general, poor milk producers of good breeding cannot be developed rapidly into average or better producers.

a ( ) It a cow lacks the inherited characteristic which stimulates the milk-producing glands she will never become a high producer.

b ( ) Cows of good breeding sometimes revert to type.

c ( ) A poor milker cannot be made into an average milker by merely ncreasing the feed ration.

d ( ) Herds may be improved gradually by use of a pure-bred sire.

CHAPTER XIII

SELECTION OF THE COW BY RECORDS

Methods of Selection. The selection of the individual cow has to be made either by judging the dairy qualities of the animal from her conformation, or from records of her milk and fat production. There is no doubt that in most cases the high-producing dairy cow shows what is generally recognized as the dairy type. Competent judges can readily select very good cows from inferior ones by observing the extent to which they approach a recognized dairy type. However, dairy type alone cannot be depended upon as a means of selecting the best dairy animals from among a number of good ones. As a rule, it is possible to select cows that are capable of producing from 300 to 350 pounds of fat in a year from those that will produce one-half that amount; but it is practically impossible to select a cow capable of producing 400 to 500 pounds of fat from one producing 300 pounds of fat. Often those persons most familiar with the subject will make decided errors in selecting animals by this means.

Limits of Selection by Type. One of the special difficulties in selecting animals by type is that the conditions under which the selection is made are often unfavorable. In the show ring the cows exhibited in the mature classes are nearly always in milk, and all are well fed and in good physical condition. On the other hand when one farmer is buying from another the conditions are far less favorable for comparing the animals. Some are fresh, others dry or nearly so. Some may be in good condition; others, because of poor feeding, may be thin in flesh and unthrifty. Few judges of dairy cattle would recognize as superior animals many of the great record cows of the various breeds if they were dry and in a herd of any considerable size, the majority of which were in poor condition.

Selection by type, however, has its value, even in dealing with grade cows kept for commercial production alone, since it is generally the only practicable basis for buying such animals. Records of production are available for only a limited number of cows, and those which have demonstrated their worth are not generally for

sale. In case an animal is to be purchased for which no records of production have been kept, the buyer must depend mainly upon the evidences of dairy characteristics as shown by the animal, and it will be well to depend upon these rather than to attempt to select by weighing and testing the milk for a single milking, or even for an entire day. As a rule, in such a case the conformation of the animals should be depended upon as an indication of dairy quality rather than statements regarding the production of the animal, unless such statements are based upon actual weights and tests taken.

Selection by Records. When cows are to be purchased it is generally necessary, as suggested, to depend to some extent upon the indications of dairy qualities as shown by the type of the animal. In the management of a herd the conditions are different, and there is no reason for basing upon their dairy type the selection of the individuals to be retained in the herd. The only satisfactory way to select the profitable from the unprofitable in a herd of dairy cows is by keeping records of the amount of milk produced and then testing for butterfat at regular intervals. There is no excuse for not keeping records.

The records to be taken should include the total milk production based upon the weighing of each milking, and the fat production calculated from the average fat percentage in the milk and the total milk. When the milk is sold by weight alone the producer is interested mainly in the milk yield, but it is wise even under these conditions to keep the fat records as well. In keeping records, or in making use of the records in buying or selling cattle, care must be taken to give proper weight to milk yield and to the fat content. As shown by the next paragraph it is a serious mistake to judge an animal by either of these alone.

Overrating the Importance of Rich Milk. A common mistake in the judging of the value of cows is that of attaching undue importance to the richness of the milk. The cow that gives the richest milk does not necessarily produce the largest quantity and is not necessarily any better than, or even as profitable as the cow yielding milk with a smaller per cent of fat. It is the total fat production rather than the fat percentage that counts. The fallacy of depending upon the per cent of fat in the milk as an index of the value of an animal is especially dangerous when animals of different breeds are involved. The figures given below

are the average of the records of a group of each breed represented, made under the supervision of the author:

	Lbs. Milk	Per Cent Fat	Lbs. Fat
Holstein	10,911	3.5	382
Guernsey	6,971	4.96	346
Jersey	6,749	5.01	338

It is clear from these figures that neither the milk nor the fat yield alone offers a fair basis to judge between the breeds. Judging by the fat percentage alone, the Jersey and Guernsey are far superior; while if the milk yield is made the basis of judgment, the Holstein is far in the lead. The same condition exists within the breed. A herd of any breed should not be culled upon the basis of the test alone, nor should either high or low test be overemphasized when buying or selling without taking the milk yield into account as well.

Breed Variation in Milk Yield and Richness. Within a breed there is no apparent relation between the milk yield and the richness of the milk. This truth is somewhat contrary to popular opinion, which is that a high milk production goes with a low test and low milk production with a high test. Figures in Table 14 on the following page were assembled from records of a herd under the author's supervision.

These figures show that there is little if any relation between the yield of milk and the test. A high milk yield may be accompanied by either a low, a medium, or a high fat test; and the same may be said of a low milk yield. The test of the milk bears little relation to the total fat yield. There is, however, a very close relation within the breed between the milk yield and the fat yield. The striking fact brought out by this table is that the milk yield varies far more widely than does the fat percentage.

In the figures given, one Jersey produced more than five times as much milk as another; and this result is not unusual with any breed. It might be possible to find one cow that would show an average fat content one-half higher than another in the same breed; but even such extremes are exceptional. In a herd where different breeds are represented, the variation in fat percentage may be somewhat wider.

TABLE 14. RELATION OF PER CENT OF FAT TO MILK YIELD AND TO TOTAL FAT PRODUCTION

BREED	HERD NO.	LBS. MILK YIELD PER YEAR	LBS. TOTAL FAT YIELD	AVERAGE PER CENT FAT
Jersey	1	13,895	681	4.90
Jersey	16	12,729	634	4.98
Jersey	124	13,322	625	4.69
Jersey	62	3,188	169	5.31
Jersey	5	2,797	176	6.20
Jersey	45	2,849	126	4.60
Holstein	204	18,405	618	3.41
Holstein	211	17,692	519	2.93
Holstein	214	5,436	212	3.92
Holstein	205	6,387	208	3.20
Guernsey	502	13,878	606	4.37
Guernsey	G—4	3,388	146	4.30
Guernsey	G—6	2,307	134	5.80
Guernsey	517	12,188	622	5.10

The Importance of the Milk Yield. The foregoing discussion shows that the variation between individual cows is from three to five times as great in milk yield as in fat percentage, and that the milk yield bears a very close relation to the total fat production. These facts make it clear that the most important part of records is the weight of the milk. In starting to keep records provision should always be made first for keeping these weights. It is at least three times as important to weigh the milk as to test it, although both should be done. The man who attempts to cull his herd on the basis of a few butterfat tests made from the milk of each cow will certainly do his animals injustice in many cases. In fact, culling on such a basis is worse than useless. The advice often given "to go after your cows with a Babcock test" is not sound. The test is needed, but the first and most important thing is to keep the record of milk produced. This should be accompanied by systematic testing for fat with the Babcock test.

In communities where milk is sold to factories on the butterfat basis, certain herds are often considered the best in the community simply because the per cent of fat from these herds is the highest; but this should not be taken as evidence that they are the most profitable herds.

The Three Factors in Individual Selection. There are three

things that should be known in order that the relative profits may be ascertained from the individual animals. These are: The amount of milk produced, the per cent of fat, and the cost of feed consumed. In regard to recording the feed cost of each animal, the view of the author is that it is not practicable on the farm, because of the time required. It is wise, however, to keep sufficient records to determine if the herd as a whole is profitable. It is well established that within the herd the profits are in direct proportion to the production of the animals.

KEEPING MILK RECORDS

Various plans for keeping records have been tried. One suggested some years ago was to weigh and test the milk of each cow for a period of seven days once each three months. From the figures obtained the yield was calculated for three months, of which the test period was the middle week. This plan was better than none, but it has little to recommend it in comparison with others, and it is seldom followed at present.

Testing at Monthly Intervals. Another plan which is used to a considerable extent consists in weighing the milk for a period of from one to three days, once a month, and testing a sample representing the same interval for butterfat. In carrying out this method, the best arrangement is to weigh the milk from each individual cow for three days about the middle of the month. A composite or average sample of the milk is also taken during the same time, which is tested for per cent of fat. The average milk and fat produced for the three days is taken as the average for that month. This should be carried out regularly each month during the year. The total production of each cow as shown by such tests is close enough to the actual for all practical purposes. One disadvantage of the plan is that the milkers often forget to take samples at the proper time. It is found to be much easier to get the records when each milking is weighed. Another serious disadvantage is that daily milk records are not at hand to serve as guides for feeding and for checking up the efficiency of milkers. Essentially this plan is followed by many members of cow-test associations who depend entirely upon the records taken for one day each month by the tester. Others follow the better plan of weighing the milk of each cow regularly, depending for the fat test upon the sample for one day each month taken by the tester.

The Most Satisfactory Plan. Experience has shown that the most satisfactory plan by all means is to weigh and record every milking of each individual animal. The fat test may be made from a composite sample respresenting three days in the middle of the month. To the dairyman who has never followed such a plan, this appears a time-consuming task. When it is carried out under proper arrangements, however, the additional time required to weigh and record each milking is found to be less than that usually anticipated; and the testimony of those who follow the practice is that the returns are perhaps greater than for the same amount of time devoted to any other part of the farm activities.

Reasons for Keeping Records. The first reason for keeping records is to know definitely which cows are profitable and to dispose of the inferior animals. Experience has shown that without such records the individual cows in a herd are often greatly misjudged. In many cases the individual which the owner considered the best is found by actual records to be far below others which were not looked upon with any special favor. Without records, certain cows become favorites of the milkers, some because of their disposition, others because they milk easily. These favorites are usually held by the milker to be the best cows but often the records tell a different story. It is conceded by all who have had experience in keeping records that the judgment of the milker concerning the relative production of the cows in the herd is worth very little.

Records Aid Correct Feeding. The second important reason for keeping daily records of milk produced by each animal is that it makes possible the proper feeding of the individual cows. All skilled feeders recognize that cows in milk should be fed grain in proportion to their milk production. Unless there is a record of the daily milk production available no satisfactory basis is at hand by which to regulate the amount of feed supplied. Even when the milker also does the feeding, unless he also keeps daily milk records he will have a very indefinite idea of how much milk the cow is producing and how much grain she should receive. In large herds where the same man does not do the milking and the feeding, the difficulty is even greater in getting the individuals fed as they should be if no records of milk production are available. In a large herd with milk records at hand the person responsible for the herd can, by looking over the milk sheets at intervals of a week,

estimate closely the amount each animal should be fed. A figure placed over the stall serves as directions for the feeder.

Records Detect Sickness. The third advantage in having daily records is the opportunity it affords the herdsman to detect sick-

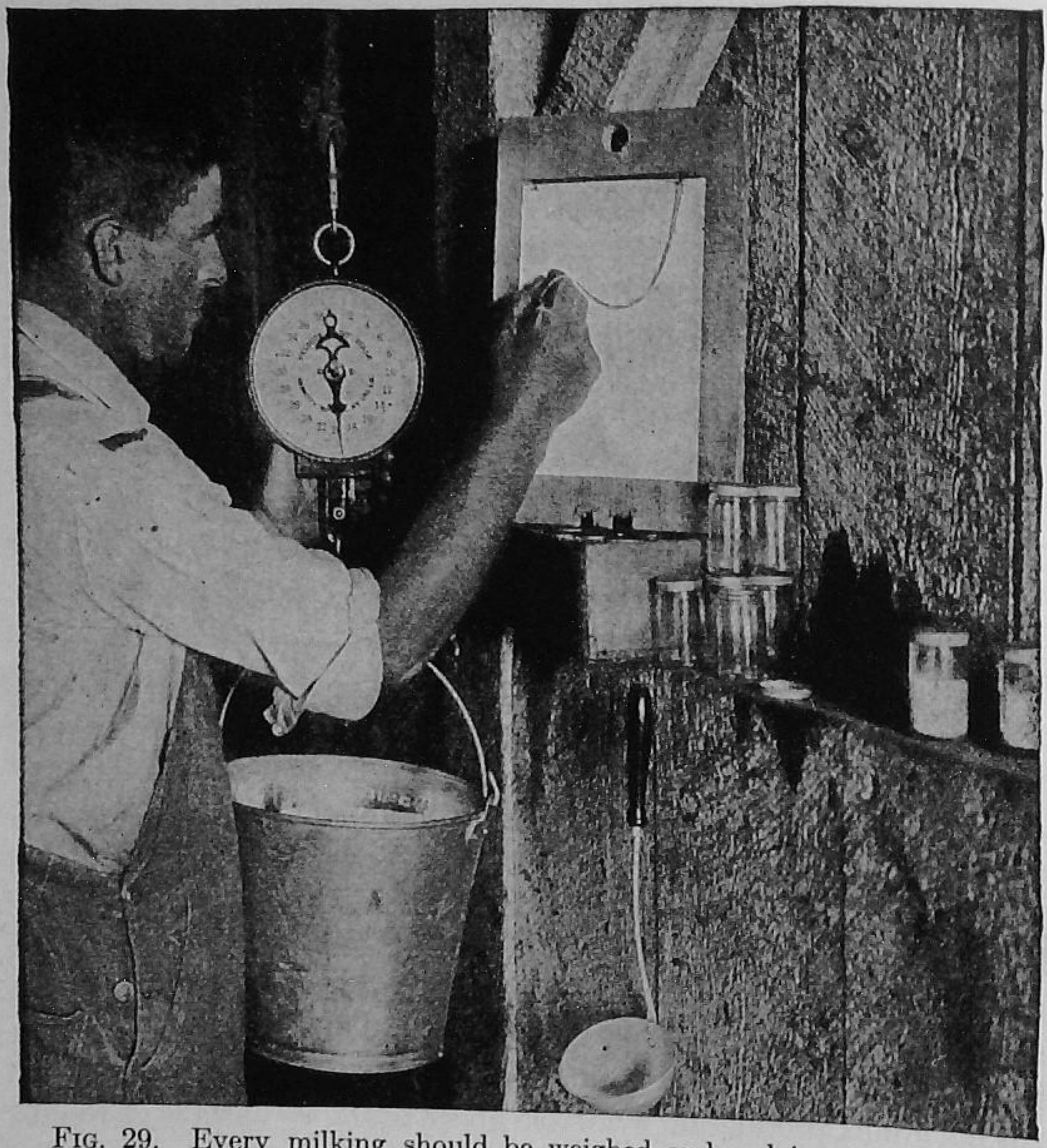


FIG. 29. Every milking should be weighed and a dairy record kept of each cow's production. Scales should be graduated in tenths and be designed for this purpose.

ness in a particular animal before it would otherwise be observed. If there is a noticeable decline in the amount of milk produced, with no apparent cause, it is certain the animal is not in the right condition and will probably show a more marked case of sickness very soon, if not properly treated. When such a sudden decline occurs, the herdsman, by adjusting the ration and giving the cow

some special attention, will be able in many cases to prevent the development of what might otherwise be a serious case of sickness.

A fourth reason for weighing and recording each milking regularly is the chance it gives to judge of the work of different milkers. It is a well-known fact that some milkers are able to secure much more milk from the same cows than are others. The difference may be as much as 25 per cent, or even more. Especially where there are several milkers in the same herd, it is impossible to form a fair estimate of their work unless each man milks the same animals regularly, and each lot of milk is weighed and recorded.

A fifth and very important purpose in keeping records is the interest the practice adds to a task that is at best more or less monotonous. When each milking is recorded, the milkers will observe the variations from day to day and find many things of interest in tracing the cause. A friendly spirit of competition is often developed which also leads to more interest in the work and, consequently, better results.

Method of Taking and Testing Samples. Where many samples for testing are to be taken, the most convenient and accurate method is with a sampling tube, which can be purchased from a dairy supply company. In taking a sample with this apparatus the sampler, which is a brass or copper tube, is lowered in the pail of milk and then closed. The milk remaining in the tube is placed in a pint glass jar bearing the name or number of the cow. These jars must be kept covered tightly to prevent evaporation. If a sampling tube is not at hand, a satisfactory sample may be prepared by taking equal quantities of the milk from each milking with a very small dipper after thoroughly mixing them by pouring from one pail to another. A screw-top jar, properly labeled, should be provided for each cow to be tested. Some preservative is used to prevent the souring of the milk before the time for testing. For this purpose formalin, which may be purchased from any drug store, is one of the best agents. Ten drops of this substance will be sufficient to preserve half a pint of milk for several days. A small amount of corrosive sublimate (bichloride of mercury) serves the same purpose and is at present most commonly used. This substance is a strong poison, and for this reason milk containing it must be handled very carefully. If corrosive sublimate is used it is wise to use it in the form of prepared tablets containing a coloring matter, or to add some common

dye to prevent the milk from being used for food by mistake. The samples when complete are to be tested by the Babcock test.

Calculating the Fat Yield. The reading of the Babcock test is in terms of butterfat percentage or pounds of pure fat per 100 pounds of milk. The total yield of milk multiplied by the per cent of fat gives the total fat yield. If the cream from this milk should be separated and churned into butter, a yield of butter would be obtained in excess of the butterfat. This results from the incorporation of some curd, considerable water, and a small amount of salt with the fat, the mixture being ordinary butter. If proper methods are followed, the yield of butter will exceed that of the fat in the milk by about one-sixth. This excess of butter over butterfat is known as "over run." The over run in a skillfully operated creamery should be 20 to 22 per cent, based upon the fat as found by the Babcock test applied to the cream. The over run is higher in this case because the loss in the skim milk is not included and the skilled creamery operator is able to control the composition of the butter very closely.

Form of Keeping Record. In keeping records of the production of individual animals one of the first essentials is to arrange a system to be followed. In many cases those who have undertaken to keep records of milk and fat production have not carried out their intentions long, for the reason that they started without any carefully prepared plan and with no convenient way to keep their records.

Fig. 30 shows a portion of a sheet to be used in the barn for recording the milkings. Some use sheets with space for seven days only, although the most common plan is to have the sheet arranged to cover an entire month. The milk scales used should be graduated to tenths of a pound rather than in ounces as this saves considerable time in adding the sheets. The scales should be hung at a point convenient for the milkers.

The milk sheet is best placed on the wall beside the scales. Without some means of protection the milk sheet becomes badly soiled before the records are completed and it is ready to be removed. Various forms of holders have been designed for this purpose. Plans for such devices may be obtained in some cases from the state experiment station.

Adding Records. Part of the value of keeping records is realized from day to day but their full value comes only from

DAILY MILK RECORD

Owner of Herd..... Address..... Month of.....193..

Name or Number																															
1	A. M.																														
	P. M.																														
2	A. M.																														
	P. M.																														
3	A. M.																														
	P. M.																														
4	A. M.																														
	P. M.																														
	A. M.																														
	P. M.																														
30	A. M.																														
	P. M.																														
31	A. M.																														
	P. M.																														
Total pounds milk																															
Test (per cent butterfat)																															
Total pounds butterfat																															

FIG. 30. Daily milk sheet. Blank sheets may be purchased for barn use. Those carrying a complete record for the month are usually preferred, especially for average farm herds. (Adapted from chart issued by Michigan State College Dairy Department.)

Name..... Herd No..... Color..... When Dropped..... Registry No.....

SEMI-OFFICIAL AND HERD TEST RECORDS

Age	No. Days	Milk	% Fat	Fat

AGGLUTINATION REACTION FOR CONTAGIOUS ABORTION

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.

PRODUCE

Date of Service	Times Bred	Conceived	Sire	Due to Calve	Date of Calving	Sex	Weight before Calving	Weight of Calf	Weight after Calving	No. Herd	Name and Number of Calf	Disposition

FIG. 31. Form for a permanent herd book record. Suitable blank forms are essential for record keeping. Such a form combined with the reverse of the sheet (Fig. 32) as a loose leaf for a herd book provides all the information necessary to keep for each cow in the pure-bred herd.

MILK AND BUTTERFAT RECORD

Name.....

Disposition.....

Year																				
	Lbs. Milk	% Fat	Lbs. Butterfat	Lbs. Milk	% Fat	Lbs. Butterfat	Lbs. Milk	% Fat	Lbs. Butterfat	Lbs. Milk	% Fat	Lbs. Butterfat	Lbs. Milk	% Fat	Lbs. Butterfat	Lbs. Milk	% Fat	Lbs. Butterfat	Lbs. Milk	% Fat	Lbs. Butterfat
January																				
February																				
March																				
April																				
May																				
June																				
January																				
February																				
March																				
April																				
May																				
June																				
Record 365 Days																				
Complete Period																				
No. Days																				

151

FIG. 32. Form for keeping permanent records. Such a form will serve for a complete record for eight years. It is best to have this as a loose leaf so it may be taken from the herd book and filed away. This is the reverse side of Fig. 31.

having proper totals for each month and, finally, for the year. Adding up the milk sheets is a tedious task if it is done without the aid of a modern adding machine. Some farmers find it possible to make use of adding machines in local banks or to employ some one having the use of such a machine.

A Permanent Record. It is customary to think in terms of calendar months, and in keeping records the best plan to follow is that of using the calendar month as the unit. After the totals by months are available there is seldom occasion to make use of the daily records. It is desirable then to record these totals in a permanent form in a book which will be kept in the office for reference. The form in which these records are kept is very important in determining their value to the cattle owner. Books designed for this purpose are on the market and separate printed sheets can also be purchased from many supply houses. These sheets can be used in connection with pedigree sheets or in loose leaf forms.

A form used for many years by the author, and which meets the requirements exceptionally well, is illustrated in Figs. 31 and 32. This form of record is especially valuable for the pure-bred herd. The illustration shows the sheets printed and perforated for use in a loose-leaf book. The pedigree and record of progeny appear on one side of the sheet and the production record by lactation periods on the reverse side. Two holders are needed when the loose-leaf system is used. In one is kept the leaves bearing the records of the cows in the herd; in the other holder are placed the leaves for the animals which are no longer in the herd.

It will be noted that the months of the year are arranged in order, 24 months being allowed for in each column. In entering a year's record of a cow, the first month's record is entered opposite that month the first time it appears, beginning at the top of the column. It leaves room in every case for at least 13 months' record. Each new lactation period should be begun in a new column.

At the end of the milking period the record is added and the total inserted. In finding the average per cent of fat, the total fat yield should be divided by the total milk yield to give the true average per cent of fat. An average found by adding the monthly tests and dividing by the number made does not give a true average test but usually a figure somewhat too high, since the amount of milk is usually small when the per cent of fat is the highest.

CHECK-UP 15

Having read this chapter you realize that the problem of the selection of a cow does not end once you have bought the cow or have decided to retain her in the herd. You have found out that it is necessary to know at all times whether or not the cow is up to the desired standard. Below are some general considerations that are important in cow selection.

Underscore *the most important factor* to be considered in each of the following statements.

1. The qualities of a good dairy cow can: (a) be estimated by her dairy conformation; (b) not be determined by dairy conformation alone especially among a number of high grade cows; (c) readily be distinguished from those of a medium cow; (d) readily be determined by a good judge.

2. In selecting a cow for which no record has been maintained, it is best to judge her: (a) by testing the milk for an entire day; (b) by dairy conformation and temperament; (c) by records of the entire herd; (d) when she is dry or nearly so.

3. In determining what cows are to be culled from the herd the most reliable guide is the: (a) degree of dairy conformation; (b) richness of milk of the cows in question; (c) individual records of milk production and butterfat content; (d) percentage of fat in the milk.

4. The most important part of the individual cow's record is that which shows: (a) weight of milk yield; (b) results of the Babcock test; (c) total fat yield.

5. Daily records of individual milk yield should be kept because: (a) cows should be fed grain in proportion to individual milk yield; (b) there is no other certain way to distinguish between profitable and unprofitable cows; (c) the records reveal the condition of the cows enabling early detection of sickness; (d) the records stimulate interest among the workers and offset the monotony of dairy farming.

6. Records to be taken on a cow should be for: (a) total milk production; (b) fat percentage in the milk; (c) total fat production.

7. A high milk yield may be accompanied by a fat test that is: (a) high; (b) medium; (c) low.

8. In order to know what the profits from an individual cow are it is necessary to know: (a) the amount of milk produced; (b) the percent of fat; (c) the cost of feed consumed.

9. The best way to keep records is by: (a) testing and weighing milk of each cow for seven days every three months; (b) weighing and testing one day every month; (c) weighing every day and testing every month.

10. To obtain the full value from records it is necessary: (a) to keep them every day; (b) to total for each month; (c) to make yearly totals.

11. If an older farmer tells you to "go after your cows with a Babcock test" he means that it is: (a) a good basis for culling cows from the herd; (b) an easy way to make money; (c) a good way to prevent tuberculosis.

12. If the cream from 100 pounds of milk testing 5 per cent fat is separated and churned for butter there will be: (a) 5 lbs. of butter; (b) less than 5 lbs.; (c) more than 5 lbs.

DAIRY HERD IMPROVEMENT ASSOCIATIONS

Limitations of Individual Testing. There are several reasons why testing has been neglected by many dairy farmers who really appreciate the necessity and the value of testing from the stand-

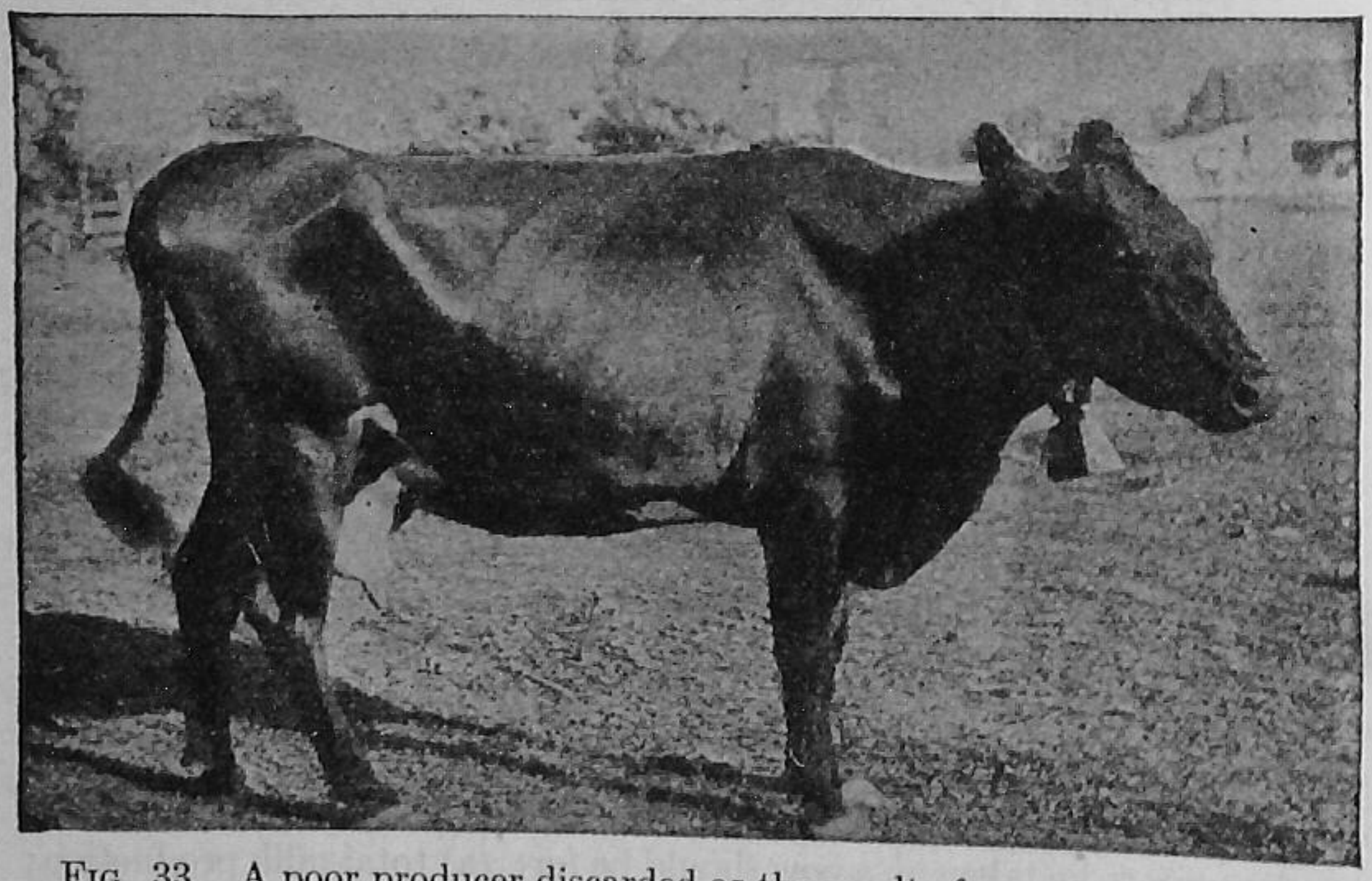


FIG. 33. A poor producer discarded as the result of records kept in a cow-testing association. Under good conditions she failed to produce at a profit. Her owner failed to realize how inferior she was until he started to keep records.

point of herd improvement by culling unprofitable cows. It must be attended to systematically and regularly in order to secure satisfactory results, and on many farms there are seasons when rush of other work will cause the testing to be put aside. Again, the keeping of useful records involves a certain amount of book work and calculating — which is ordinarily put off from time to

time, until the accumulation is so great that no one has the courage to undertake the task of bringing the records up to date in order to determine the year's production of the various cows. Nothing can be accomplished this way and herd improvement is at a standstill.

Origin of Cow-testing Associations. The first cooperative cow-testing association was organized in Denmark in 1895. It became

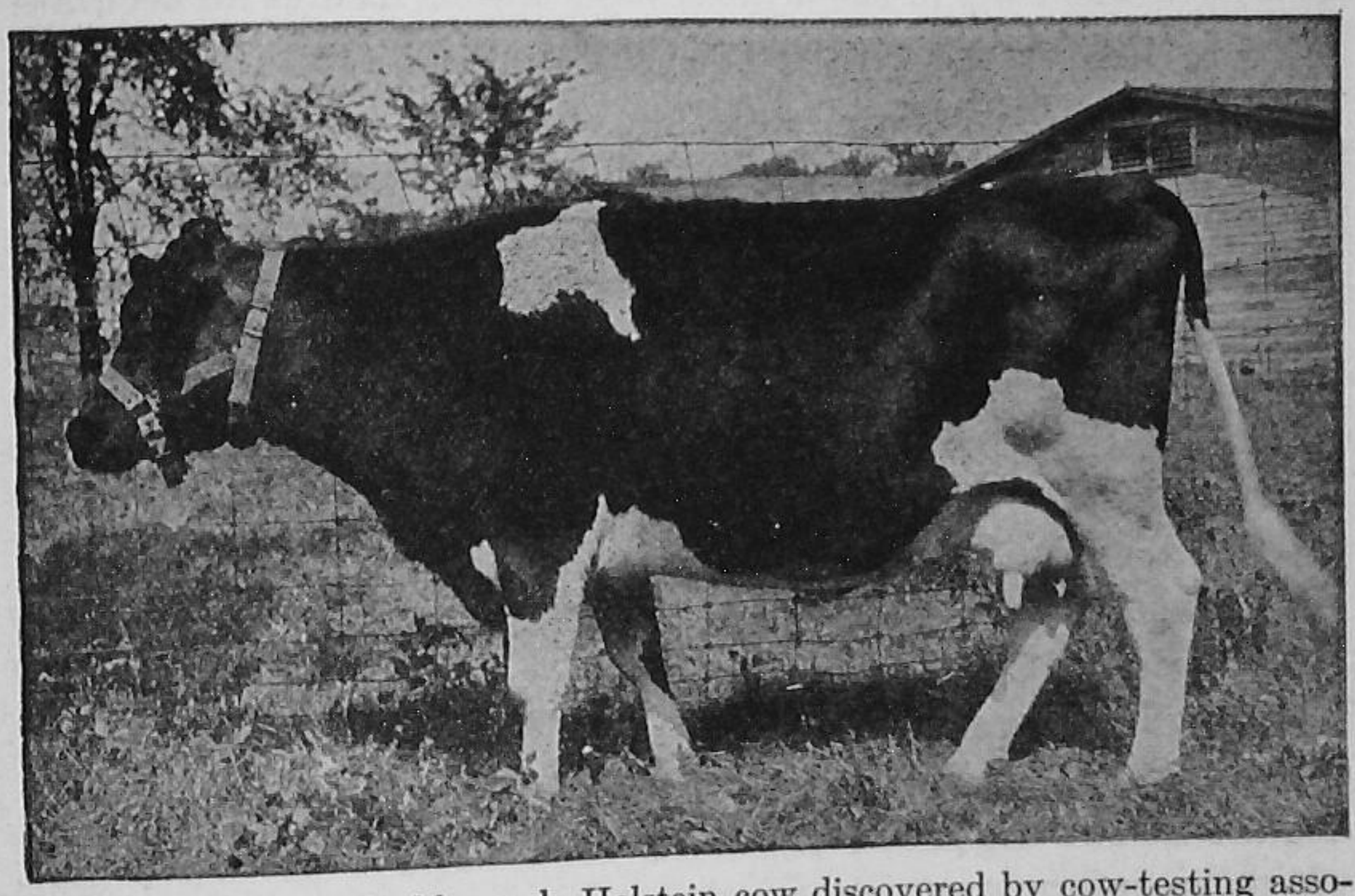


FIG. 34. A profitable grade Holstein cow discovered by cow-testing association records. Her owner knew she was a good cow but did not realize her value until he started to test. She averaged 10,652 pounds of milk and 433 pounds of butterfat for three years.

very popular with the Danish farmers and has since spread to every dairy country of the world. The first association in this country was established in Michigan, in 1905. From that time the movement has been gaining steadily, and in 1938 there were 1,106 such associations scattered throughout the various states. They are now known as Dairy Herd Improvement Associations.

Organization. The plan of organization is simple. Fifteen to twenty-five or more farmers adopt the usual form of constitution, elect officers and agree to put a certain number of cows on test. The cost per cow for one year varies from $1.50 to $2.50, depending on the locality and number of cows pledged. The association then hires a competent tester to do the work, and he visits the farm of each member once a month throughout the year. He

weighs, samples, and tests the milk of each cow individually, and the per cent of fat as determined by this test is used as a basis for calculating the monthly fat yield. The milk should be weighed by the milker for the remainder of the month and entered on the barn sheet. The tester totals the milk sheets, calculates the amount of fat, and also determines the cost of feed consumed by each cow. All of the record work is looked after by the tester, so that membership in one of these associations insures an accurate monthly test on each cow, and a complete summary of production and feed costs at the end of the year.

Other Advantages. There are additional advantages which accrue to the members of cow-test associations. Testers are often able to give valuable advice regarding the feeding of the cows and to suggest beneficial changes in the rations. Testers may also help compile useful information regarding bulls used through dam-daughter comparisons and assist in intelligent sire selection. They come in contact with different dairymen throughout the month, and in the course of their duties they gain much valuable information which they will gladly pass on to other farmers. Joining a test association is usually followed by a renewed interest in the dairy herd and a more careful study of the cows as individuals. Of course, the primary purpose of all this work is to afford a definite line on the producing ability of the cows in the herd; and when this information is secured, proper use should be made of it by removing the unprofitable cows, thus raising the average production. As a concrete example of the results which will follow if this is done, in ten years of cow-test association work the average yield of all cows in the Newaygo County, Michigan, association was increased from 5,354 pounds of milk and 215 pounds of fat to 6,637 pounds of milk and 276 pounds of fat.

To summarize briefly, the rapid extension of cow-testing associations and the appreciation of the value of carefully kept private records are affording more and more information on which to base the purchase of foundation stock for a dairy herd and to improve the production of herds by culling. In the absence of some accurate record of performance, the dairyman is continuing to work in the dark, and the man who buys milk cows must rely on his judgment of their producing ability from external appearances which can never be as good a standard as the milk scale and Babcock tester.

Selection by One-year Record. It is usually safe to select the profitable cow from the unprofitable after one year in milk. If the cow at first freshening is reasonably mature and in good condition and no sickness or accident occurs — in other words if there is no reasonable excuse for low production — it will be safe to judge the cow upon the records of this first year. Perhaps the most practical plan to follow when the cow proves inferior as a two-year-old and is to be sold for beef is to keep her until she freshens the second time. She may then be milked so long as her milk production continues to be profitable, and then she may be sold. By this plan the owner has the calf, and oftentimes the calf from an inferior cow, if sired by a high-class bull, will be a satisfactory producer.

Unless the breeding of the cow is such that the owner desires to be very certain before condemning her, he may go even farther than suggested and decide within a few weeks after the first freshening whether or not the heifer is one to be retained. In this case, special care should be given that all conditions are favorable — in other words, that she has had a fair chance.

CHECK-UP 16

How do cow-test associations help the dairy farmer?

If the statement is true circle the letter T; the letter F if it is false.

1. T F Cooperative cow-testing associations originated in Denmark.
2. T F A cooperative cow-testing association is the same as a dairy herd improvement association.
3. T F Membership in a cow-testing association is an easier and more reliable way of keeping records than attempting it alone.
4. T F A good dairyman can judge a cow by appearance as well as by the milk scale and Babcock tester.
5. T F Under favorable conditions it is safe to judge a cow by the record of her first lactation (milking period).
6. T F Cow-testing associations are an advantage to the young dairyman who wants to get started because they afford more information on which to base the purchase of foundation stock for a dairy herd.

CHAPTER XIV

SELECTION, CARE AND MANAGEMENT OF THE SIRE

General Importance of Selecting the Sire. It has been pointed out in a previous chapter that the question of getting for immediate use a herd that may be kept at a profit is a question of the selection of the individual cow. It is generally conceded that, taking all dairy cattle into account, about one-third of those raised are unsatisfactory and have to be culled out as unprofitable when records are kept. This results in an enormous loss of feed in the aggregate, not only in raising unprofitable animals but in keeping them until their worthlessness is proved. In this connection one of the first questions to arise is whether these inferior animals which must be culled are the result of inheritance or of environment. In other words, is a good or inferior cow born what she is, or is she made what she is by feed and management when young? Experimental results lead to the conclusion that the ability of the cow to produce milk — the dairy temperament, as some term it — is almost entirely a matter of inheritance. The high class or the inferior cow is born that way, and not made so by any special treatment when young. In fact, within the limits of ordinary practice the manner of feeding and management of the growing heifer has little if any relation to the efficiency of the mature cow as a milk producer.

If the difference between a cow having a capacity of 10,000 pounds of milk in a year and another that barely reaches 4,000 is a question of parents, it certainly becomes a matter of no small importance to see that the proper parents are provided. Selection of the individual cows must be depended upon to insure a satisfactory herd for present use. With the same emphasis, it may be said that the problem of getting a better herd for the future is a question of having good young stock coming on, and is a matter of breeding. The question of breeding is primarily that of the selection of the right sire.

Sire One-half the Herd. More than one hundred years ago one of the great English breeders, looking back over the activities of a

lifetime spent in breeding livestock, summed up his experiences in the words, "The sire is half the herd." This statement has ever since been accepted as a fit expression of a most important fact, and has become an axiom of livestock breeders the world over.

Every owner of livestock who gives careful thought to the problem of herd improvement realizes that the main chance for the rapid improvement of a herd lies in the introduction of better blood through the sire. No one would recommend the purchase of a high-class cow and a medium bull as a means of improving a herd. Every animal raised gets half of its inheritance from the sire. From the first cross with a pure-bred bull the offspring of a scrub herd

FIG. 35. The Guernsey bull, Chilmark's May King, with ten of his daughters. The yearly fat production by these daughters was 119 pounds per year of fat above that of their dams. At ordinary prices for butterfat the income from each of these daughters would exceed that of her dam by nearly $60 yearly.

have one-half improved blood. A second cross raises the proportion to three-fourths and a third cross to seven-eighths. When this proportion of improved blood is reached, the animals have essentially the characteristics of the breed represented by the improved sires, and if the inferior animals are culled out the dairy qualities should be practically the same as for pure-bred specimens of the breed. The real objective of breeding operations should be not to raise a few great producers but to raise a high percentage of efficient animals. By proper attention to breeding — and especially to the selection of sires — it should be possible to reduce the proportion of culls gradually, until ultimately it would not be necessary to cull out more than one in ten of the heifers raised.

Results from Using a Pure-bred Bull. One of the most striking demonstrations regarding the value of pure-bred bulls as a means of increasing the productive capacity of a dairy herd is shown by results obtained at the Iowa Experiment Station. A group of typical native cows was brought from an isolated locality in the Ozark region. After reaching the experiment station these cows

received the same treatment as that given the regular dairy herd. The cows were divided into three groups for breeding purposes. The original cows in one group, and their descendants, were bred to Holstein bulls, another group to Guernseys, and the third to Jerseys. The thirteen original cows with a total of 74 lactation periods averaged 3,991 pounds of milk and 187 pounds of fat. Thirteen daughters of these cows by pure-bred bulls representing the three breeds for a total of 40 lactation periods averaged 5,556 pounds of milk and 253 pounds of fat — an increase in milk of

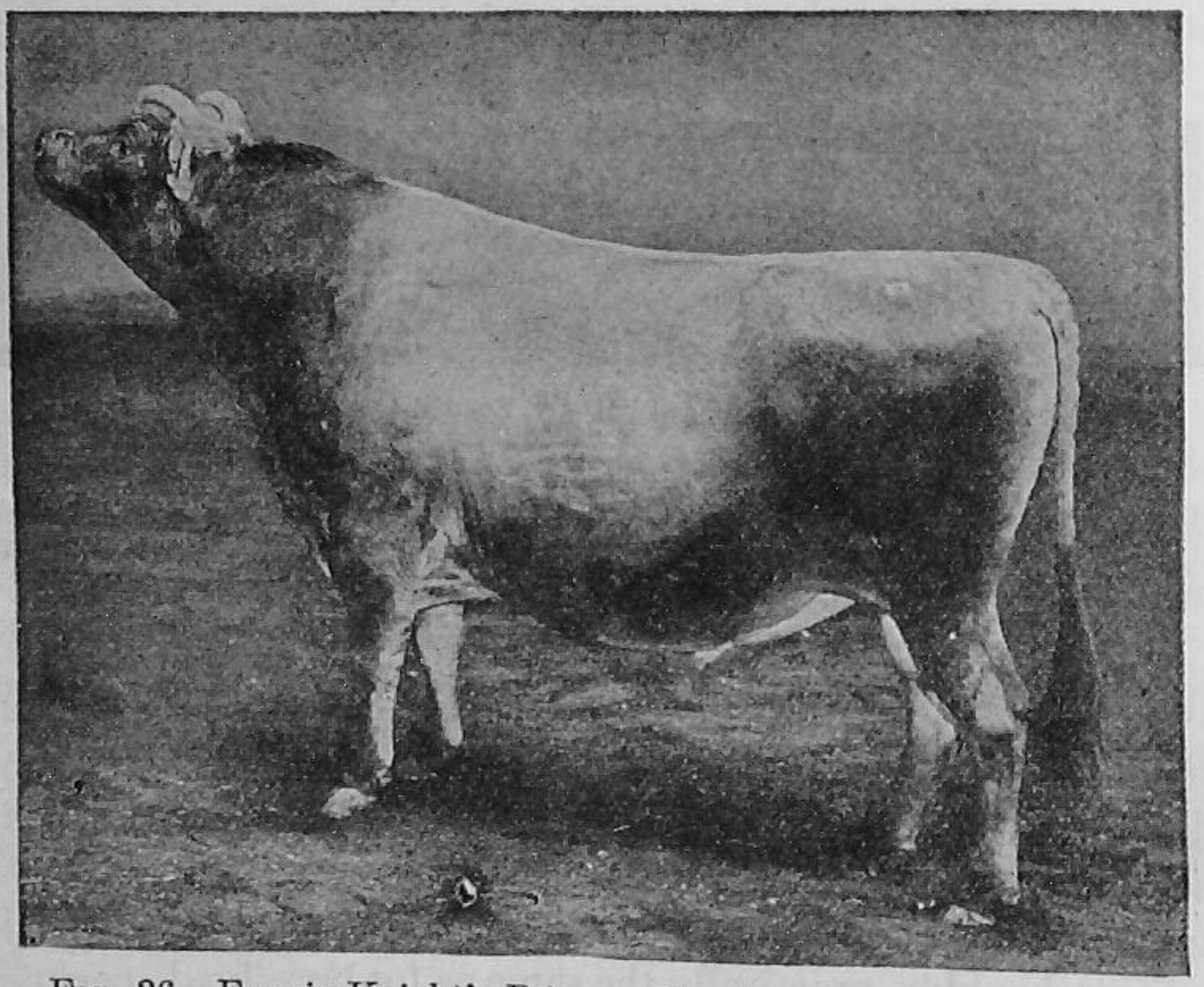


FIG. 36. Fauvic Knight's Prince. Purchased as a proved sire after a study of the records of his first seven daughters. In active service at fourteen years of age.

39 per cent. Records are reported for five cows of the second generation of grades carrying 75 per cent of improved blood. These animals, including a total of six lactation periods, averaged 8,401 pounds of milk and 358 pounds of fat — an increase over the original scrubs of 130 per cent in milk yield and 109 per cent in fat production. It was noted that the improved blood resulted in a decided increase in persistency of milk flow.

Another instructive example of the possibilities in the way of improving the production of a dairy herd by means of a pure-bred

sire is found in the results from the herd owned by the Grand Rapids, Minnesota, Sub-Station. In 1905 a group of cows of native and mixed blood was purchased as the foundation for a herd. The purpose was to demonstrate the possibility, and the methods, of building up a grade herd under practical farm conditions. Complete milk and fat records were kept from the beginning. The average production of the original herd was 196 pounds of fat. Ten years later the average of the herd, numbering 41 animals, was 5,721 pounds of milk and 280 pounds of fat. By further culling the herd to 27 cows, three years later an average production was reached of 7,184 pounds of milk and 358 pounds of fat. A comparison is possible between records of 19 common cows in this herd and of their daughters by a pure-bred dairy sire. These 19 common cows averaged 4,570 pounds of milk and 196 pounds of fat, as compared with 5,028 pounds of milk and 251 pounds of fat from the daughters — an increase of 55 pounds of fat, or about 30 per cent, to be attributed to one cross of improved blood.

A Guernsey bull was exhibited at the National Dairy Show in 1921 with ten of his daughters that exceeded the yearly records of their grade dams by an average of 119 pounds of fat.

By the use of pure-bred bulls the average yearly milk production of a California herd, composed originally of inferior animals of mixed breeding, was increased from 5,818 pounds of milk to almost 10,000 pounds.

The records from a bull association in Maryland give the production of 21 cows in comparison with that of their daughters by a pure-bred bull of a dairy breed. The dams averaged 5,530 pounds of milk and 219 pounds of fat while the daughters by the pure-bred sire averaged 6,523 pounds of milk and 263 pounds of fat. The increase to be credited to better inheritance was 1,414 pounds of milk and 62 pounds of fat yearly for each daughter. Other examples of equal significance could be assembled and thousands of farmers have experienced the same results in their herds without having the full records available to make the facts public.

Economic Value of Pure-bred Sires. Still another striking example of the economic value of the pure-bred sire is shown by a survey made by the County Agricultural Agent of the dairy farms of Lake County, Illinois. The survey included four hundred and

forty-two farms selling milk and using a total of 7,045 cows. The results are shown in Table 15.

TABLE 15. RESULTS OF USING PURE-BRED BULLS
(From a Survey of Lake County, Illinois)

SIRE USED	NO. FARMS	NO. COWS	MILK SALES PER COW FOR YEAR
Pure-bred, females pure-bred .	56	941	$284
Pure-bred 5 yrs. or more . .	95	1,610	267
Pure-bred 2 to 4 years . . .	125	2,098	221
Grade or scrub	214	3,160	173

Note the income per cow on those farms which have used pure-bred bulls for a term of years; it is approximately $100 above that of the herds where grade or scrub sires were in use.

Only the most careful consideration and analysis on the part of the reader will reveal the full significance of these figures. The striking relation between the amount of milk and fat produced and the economy of production has been pointed out in another chapter and an analysis of the causes made. This analysis shows that the overhead expense of keeping the cow — including ration for maintenance, labor, barn room, interest, taxes and risk of death — are practically the same, regardless of the amount of milk produced. The high-producing cow does require more feed than the low producer, but, since maintenance is the same, the additional nutrients are used directly for milk production. It has been pointed out in the discussion of the selection of the cow in a previous chapter that the cow producing 300 pounds of fat a year requires about 25 per cent more feed than one producing 150 pounds.

The Pure-bred Bull in Grade Herds. Let us make an analysis of the figures from the Grand Rapids Sub-Station herd. The original herd averaged 196 pounds of fat and 4,666 pounds of milk. The herd after thirteen years averaged 7,184 pounds of milk and 358 pounds of fat, an increase of 2,518 pounds of milk and 162 pounds of fat. Assuming these cows were milked six years each, the total increase in production per cow for those having the improved blood would be 15,108 pounds of milk and 972 pounds of fat over the average of the original unimproved herd. At $2.50

per hundred pounds for milk, the additional milk would be worth $377.70. If the 972 pounds of fat were sold at 45 cents a pound the increased income would be $437.40. Against this it would be fair to charge the cost for additional feed which would be necessary on account of the greater production. This additional amount would in this case not be over 900 pounds of grain a year and a small increase in roughage. If concentrates are worth $30 a ton, the additional feed would for the six years amount to something like $95 a cow, leaving a net gain of $272.70 if the milk were sold at the figure mentioned, or of $342.40 if the fat were marketed. The use of pure-bred bulls in this herd made possible an annual income of $57.06 more for each cow in the herd than would have been realized from the original stock.

The data from the Iowa Experiment Station show an increase of 66 pounds of fat yearly from the daughters of a pure-bred bull as compared with the scrub dams. At 45 cents a pound for fat, the daughters gave an income of $29.40 a year more than their dams. Assuming that one-half of the offspring were males and of no value, and that the heifer calves were raised and milked six years each, a service (breeding) fee of $88.20 could have been paid for each scrub cow bred to the pure-bred bull. It is clear that given a herd of low-producing cows, and looking forward for a term of years, the axiom, "The sire is half the herd," is really a conservative statement.

Importance of the Sire in the Pure-bred Herd. With the pure-bred herd, even more is at stake in the selection of the herd sire than when the herd is a grade one used only for producing market products. Furthermore, with each progressive stage of development the problem of getting a sire that will result in improvement becomes increasingly difficult. In fact in the highly developed herds it becomes a serious question to select an animal for breeding purposes good enough to hold the advancement that has been made. While almost any pure-bred bull of good inheritance will increase, or at least maintain, the standard of an ordinary grade herd, only an animal of the best inheritance will make it possible to even maintain, to say nothing of improving the production of, a highly developed pure-bred herd. All successful breeders recognize that the whole future of the herd is at stake when the bull is selected.

Breed History Made by Great Sires. A study of the history of

any unusually successful breeder of the past will generally reveal that his success was based largely upon one or more great transmitting sires. The great work of the Colling brothers in establishing the Shorthorn breed in the eighteenth century was based largely upon the bull Favorite. The early popularity of the Jersey breed in America was made possible largely as the result of the great transmitting bull Stoke Pogis 3rd. This bull was the founder of a family that has been bred successfully for forty years. Golden Lad, another great transmitting bull of the same breed, still exerts an important influence, although he has been dead nearly fifty years. The Guernsey bull, May Rose King, and the Holstein, Hengerveld De Kol, made famous the herds where they were owned and left a permanent impress upon their breeds.

Another remarkable bull was Emblagaard Tritomia Homestead, a Holstein owned by the University of Illinois. The yearly production of his first ten daughters as two-year-olds and of their dams at the same age is as follows:

	Dams	Daughters
Lbs. milk	9,594	13,504
Per cent fat	3.21	3.47
Lbs. fat yield	308	469

The average increase in production of the daughters over that of their dams was 3,907 pounds of milk and 161 pounds of fat. On the percentage basis, the increase was 40.7 per cent in milk and 52.2 in fat.

Prepotent Sires Found in All Breeds. A large number of very striking examples could be assembled showing the remarkable transmitting ability of certain well-known bulls in all the dairy breeds. One of the most striking of these examples is that of the Holstein bull Sir Pietertje Ormsby Mercedes. The ability of this animal to transmit milking qualities was phenomenal. Sixty-one daughters of this bull, of which forty-two were not yet mature at the time the record was made, averaged on official test 17,816 pounds of milk and 643 pounds of fat in a year. Of these fourteen exceeded 800 pounds of fat and twenty produced in excess of 20,000 pounds of milk during the year of test. This remarkable bull at the same time was an outstanding animal of the breed in

conformation and transmitted this to his offspring to a high degree as is shown by a long list of prizes won at the leading shows over a term of years. It has been largely through the descendants of this bull that the Ormsby family has become so popular.

Fauvic's Prince, a Jersey sire of recent years, is another outstanding example of a prepotent sire. The first seventeen daughters of this bull freshening at an average of 26 months averaged 558 pounds of fat in a year under official test.

Cause of the Wide Variation in Prepotency of Bulls. It is easy to understand why a pure-bred bull should transmit the characteristics of his breed more uniformly than does a scrub, or even a grade animal. His ancestors have been selected for generations with a certain purpose in view. However, it is not so clear why there should be such extreme variations in the way pure-bred bulls of the dairy breeds transmit milking characteristics. Why should the daughters of one bull be uniformly high-producing animals while those sired by another are medium or even inferior? The variation is undoubtedly to be attributed to a difference in the combination of hereditary factors.

Continued Improvement Difficult. The dairy cow of today has been developed until she is an abnormal animal from the standpoint of nature. There is, of course, no means of knowing the capacity of the original wild cow as a milk-producing animal. It is safe to assume that she produced not over 1,500 to 2,000 pounds of milk in a lactation period of five or six months. The high-class dairy cow of today produces more milk in a month than her wild ancestor did in an entire milking period. Moreover, she will continue to produce milk at least ten months out of each year. Since the production of large quantities of milk is not natural to the species, but acquired, the characteristic is easily lost and many revert to the older type of unprofitable producers that have to be culled from the herd. Unless constant selection of breeding stock is made, not only will no progress be made but the tendency will be actually backward. To retain the milking qualities at a uniform and satisfactory level requires the use of a prepotent bull better bred than are the cows. To improve or even retain the standard in a highly developed herd becomes exceedingly difficult.

The Basis of Sire Selection. The selection of the dairy sire is generally based upon one or more of the following four points:

(1) Breed.
(2) Type and appearance.
(3) Pedigree, including with this all facts regarding ancestry, such as milk records.
(4) Characteristics of offspring.

In most cases more than one of these points are taken into account. For example, the most common basis for selection is by breed, type, and pedigree combined.

The breed. As a rule the question of what breed the sire shall represent is answered at once by the fact that the herd for which the sire is to be purchased is either a grade or a pure-bred herd which is maintained according to a well-defined breeding plan on the part of the owner. An owner of such a herd is not satisfied by selecting a bull by breed alone, however, but he also considers type and pedigree. Many owners of herds buy bulls with little attention to anything other than knowing the animals belong to the breed they are using. There should be no unnecessary crossing of breeds. The bull selected should be pure-bred of the breed to which the cows belong, or, in case grading up from mixed stock is to be begun, of the one selected as best suiting the purpose. Under the latter conditions it may be necessary to use a bull on cows containing more or less blood of other breeds. However, deliberately crossing breeds with the expectation of getting better results by that means is a great mistake.

Type and appearance. There is some difference of opinion as to the importance to be given to type in the selection of a bull. The emphasis to be placed upon type undoubtedly depends mostly upon the objective of the purchaser. If the purpose is to develop a herd for milk production with little attention to show ring type in the cows, less attention is necessary to this point than is desirable when the animal is to be used in a pure-bred herd where beautiful conformation is an asset. The view of the author is that there is little relation between the show type of dairy bull and the milking qualities of his daughters. The beef-bred bull shows in his own bodily conformation the beef qualities for which he is bred and which he may reasonably be expected to transmit to his offspring. Likewise, some conclusions may be drawn from the type of a dairy-bred bull as to the conformation of his daughters. Milk production, however, is the function of a gland, and has little to do with body conformation. For this reason the appearance of the bull

offers far less basis for judgment as to the milking qualities he will transmit than it does for the probable type of his daughters. The type of the bull should not be ignored, since it is important to have cows of good conformation if possible; although for the practical milk producer, animals of milk-producing ability are the first consideration. It is a general observation that cows showing superior dairy conformation are also the better producers. It is always well to insist that the size of the animal selected be from medium to large for the breed he represents and full of vigor and nervous energy. Many men buy bulls, especially those that command only a moderate price, without going farther than knowing that the animal is pure-bred and that he is a good-looking specimen. He should have at least reasonably good type, but it would not be advisable to make the decision as a rule on this point alone.

Selecting by pedigree. A majority of the bulls are selected largely upon their pedigree and the milk records of their ancestors. A careful consideration of the pedigree, with some attention to the individuality of the animal, is the best means of selecting a bull — next to that of judging him by his daughters. The experienced breeder of pure-bred cattle has usually given some attention to the question of pedigrees and knows how to interpret them. The person who has not had opportunity to become familiar with the subject should either do so, or preferably get some one with this knowledge to assist him in making his choice. As a rule, it is best for the inexperienced person to go to a reliable, experienced breeder and rely largely upon him to supply what the buyer needs.

The Value of the Dam. In studying the pedigree, the mother of the animal in question should be given first consideration. Many experienced breeders believe that dairy qualities are inherited more strongly from the sire than through the dam. There is some question concerning this view, but at any rate the mother of the bull chosen should by all means be outstanding and typical of her family. The buyer should make it a point to see the dam, if possible, and satisfy himself as to her qualities. If the purchase is to be made by mail, a photograph of the dam should be insisted upon. In addition to the dam being an animal of proper size and conformation, satisfactory evidence should be available — preferably in the form of an official record — as to her milk-producing ability. Transmitting ability of other sons or daughters is also of great value. Next in importance to the dam is the sire, to be

judged mostly by the dairy qualities of his daughters if they are in milk, by his sisters, and especially by his dam.

Too much attention should not be given to ancestors three to four generations back. Frequently the owner of a pure-bred bull speaks with great pride of ancestors back three to four generations, and at the same time does not know anything concerning the immediate ancestors, even of the dam.

Avoid the Unusual. Another important consideration is to make sure that the dam of the bull under consideration is not an unusual producer in a family of inferior animals. Such a cow is not a good dam for a bull even though she may have an excellent record herself. If a certain cow is a splendid producer, but the remainder of the family are ordinary or inferior in this respect, she is not typical of her inheritance and cannot be counted on to transmit her own good qualities. The chances are that she will transmit characteristics nearer the average of her family. The dam, then, should not only have a good record herself but if possible be one of a large group of high-producing cows. She should represent a family in which it is common, and not exceptional, for the cows to be high producers. The same statements apply to all females in the pedigree, but with less importance to those farther removed from the bull whose pedigree is under consideration. If the dam of the sire comes of a high-producing family of this kind it is also quite significant, and greatly increases the chances that the characteristics desired will be transmitted. If the sire of the bull under consideration has daughters in milk, naturally they should be uniformly good.

It is also well to take into account the opportunity which the animal in question has had to make a showing. It is clear that a bull which has a half-dozen high record daughters is not necessarily a good ancestor for a herd bull if he also had three dozen daughters that could not get into the Advanced Register at all. Again, a record made in a herd where only ordinary care is given to the cow appears to disadvantage compared with records made in herds where every cow is forced to the limit. A bull, then, whose daughters have been owned in a herd where every opportunity is given for maximum results will show to an unfair advantage over the bull whose daughters have received ordinary treatment. Unfortunately, it is usually quite difficult to get the information necessary upon which to pass judgment along these lines.

Evaluation of Records. In studying milk and fat records in pedigrees care should be taken to make certain what the records mean. Are the records given in terms of butterfat or butter? Records of Holstein cows are often given in butter calculated on the 80 per cent fat basis, while the records of other breeds are generally given in terms of butterfat.

Records covering a year should certainly be given more consideration than short time records. This is especially true with reference to the percentage of fat. In fact, an unusually high percentage of fat for seven days is largely a result of the condition of the cow at the time of freshening and the way in which she is handled. A high fat percentage for seven days does not necessarily indicate that a cow will produce milk with a high fat content throughout the year. A farmer who is led to select a bull from a cow with a great seven-day butterfat record made as the result of abnormal per cent of fat must not expect the daughters of this bull to inherit this high per cent of fat.

An unfortunate practice has been in vogue in recent years in the preparation of pedigrees, especially for public-sale catalogues. So much attention has been given to milk and fat records that the attention of the reader is at once attracted to the name of the animal that has no records below. To avoid this situation, records of ancestors or distant relatives are put in the vacant place with an explanatory statement in small type, for example, "By a three-quarters brother to the sire of" followed by the records. The object of such statements is to make the pedigree appear better than it really is, without making any actual misstatements, and to mislead the careless reader.

Pedigree No Guarantee. It must be conceded that at times animals selected with the best of judgment and after careful consideration of the pedigree prove very disappointing. Such experiences unfortunately are only too common.

While a good pedigree cannot always be relied upon to insure a satisfactory transmitting animal, it is the best, and in fact the only, basis for selecting the young and untried animal. It should, however, be emphasized that, while selection by pedigree is at times disappointing, after all, if proper care and judgment is exercised in the majority of cases at least, the results will be reasonably satisfactory.

The Proved Sire. A man who has a dairy herd already highly

developed should, whenever possible, find a bull for a herd sire that has already demonstrated by his daughters his ability to transmit the dairy qualities wanted. Unfortunately the common practice followed by so many of using a bull two years and then selling him to the butcher makes it impossible to judge of the value of most bulls until too late. The movement now under way of forming bull clubs and exchanging bulls offers great possibilities along this line. By the exchange among the groups of members as

FIG. 37. Eight unselected daughters of the proved bull, Fauvic Knight's Prince. Twenty tested daughters average 663 pounds fat, 13,026 pounds of milk.

planned by these clubs it will be possible to retain a bull until he is old enough to show breeding value. In this way, many bulls are being discovered that are wonderful breeders.

A study of the methods of the great breeders of the past will show that they followed this plan of judging a bull by his offspring rather than by his ancestors; and this was unquestionably one of the main reasons for their success. Whenever possible, it is wise to retain a bull until the results of his breeding can be ascertained. Then if his daughters are not satisfactory, the sooner he is sold the better. There always exists the possibility of finding a great bull like Hengerveld De Kol, Golden Lad, or many others of wonderful prepotency (ability to transmit characteristics). To be sure, there are many difficulties to be met in getting an animal of this kind, and it is not always possible, or at least practicable, to do so; also some breeder had to select a calf and stake his judgment on the chance that the bull would later prove worthy.

The bull known to transmit dairy qualities of a high order is appreciated today as never before, and is certain to bring a long

price when his value is known. As a rule, it is only the breeders of pure-bred cattle who can spend the time and money to locate a bull of this class. The smaller breeder, however, should always be on the lookout because occasionally a bull of this class may be located where his value is not appreciated.

Much as it is desirable to use only a proved sire, it is generally very difficult to secure one when needed. Great bulls can seldom be bought. Many bulls are sold for slaughter before their value as breeders is known and when a bull with great transmitting ability is discovered he is not usually for sale. As a partial remedy for this situation it is suggested that breeders of pure-bred herds especially buy a young bull of good breeding and use him to a limited extent, then loan him out until his daughters come into milk. The plan is especially recommended of sending two or three good cows for breeding to a bull recognized as a great transmitting sire. Bull calves from this mating should then be tried out in a limited way as suggested.

Age as a Factor in Selecting the Bull. Sometimes the claim is made that a mature bull is more prepotent than a young one, although there is no evidence to prove such an assertion. According to the modern view of heredity there is no possible way for the transmitting ability of the animal to change as the result of age. An animal of either sex receives a certain combination of hereditary characteristics at the time the ovum from which the animal comes is fertilized. This combination determines the characteristics of the animal and what it in turn will transmit. A young bull is generally preferred, especially by the average dairyman, mainly because a young one is easier to handle and to ship than an older one. Furthermore, as a result of improper care the aged bull is an uncertain breeder. The typical farmer buys a bull calf about a year old, keeps him two years, then sells him to the butcher instead of trading with a neighbor or buying one old enough so that his ability to transmit the desired qualities may be judged. The reluctance of many breeders to handle the mature bull is a serious obstacle to overcome in any program looking toward the improvement of the great mass of dairy cattle. The average dairyman prefers to experiment continually with a young bull rather than make use of a proved bull if one has by chance been kept in his neighborhood long enough to make this possible. There is no reason, however, for choosing an aged bull unless

evidence is at hand that he has the power to transmit what is wanted. If a bull is to be purchased on pedigree alone, let it be a young bull by all means, since he then has all his life before him. Furthermore, the fact that the heifer calves of a bull are attractive at that age and have indications of making satisfactory cows by no means makes him a proved sire so far as the milking qualities of his daughters are concerned. Oftentimes promising calves develop into mediocre cows when mature.

Relation of Dam's Age to Prepotency of Bull. The question also arises at times if a bull which is the first calf of a heifer is as likely to transmit dairy qualities of a high degree as is a son of an older cow which has made large records. On the basis of the discussion in the previous paragraphs, the answer would be that there is no basis for any such conclusion. It is true that the highest prices are generally commanded by bulls from older cows and that the first calf of a heifer is not so much sought after. This results from the fact that in the case of the older cows their merits are known, since they have had opportunities to make official records. The heifer in milk for the first time has her reputation to make as a producer. It is wise not to select the calf from the two-year-old as a future herd sire until the heifer has had opportunity to demonstrate her good qualities.

Feeding during the Growing Period. The bull calf designed for breeding purposes should be well fed during the growing period, in order that he may develop to the full limits of his inheritance. An animal that is poorly fed during the growing period may fail to reach his full size. His progeny will not be smaller on account of the sire's being undersized from the same cause; but it is impossible to judge from the appearance of the animal whether his small size is due to inheritance or to feed. A male breeding animal that is small and undeveloped for his age should always be looked upon unfavorably.

Optimum Growth Desirable. While there is no advantage in getting the bull fat while young, on the other hand there is no special harm done if he appears a little smooth in form at this age since this tendency will disappear later and it is desirable that optimum growth be secured. The bull reaches maturity in size at about the same age as the cow of the same breed. Bulls of the Jersey and Guernsey breeds when well fed reach their full development of skeleton some time between the ages of four and five years.

The animals of all breeds increase in weight for about two years after the skeleton has ceased to grow.

Age for Breeding. Bulls of the early maturing breeds, if well fed, are old enough for light service by the time the age of twelve months is reached. One or two services a week is all that should be allowed from the age of twelve to fifteen months. As the animal becomes older and better developed the amount of service may be increased. A well-fed, mature animal might serve for a herd of two hundred cows if his services were distributed throughout the twelve months. As a rule, the greater proportion of a herd is bred to calve at a certain period of the year, and for this reason ordinarily one bull should not be expected to serve for more than about fifty cows. The breeding powers of the bull are at the best between the ages of two to five years. A bull that has been properly handled when young and sufficiently exercised when mature may retain his breeding ability to the age of twelve or fifteen years, or even occasionally longer. As a rule, however, the bull past eight years old is liable to be a slow and uncertain breeder.

Ringing the Bull. When the bull is about one year of age a ring should be put in his nose as a convenience in handling and as something of a protection in case the bull becomes vicious and attacks the herdsman.

Dehorning the Bull. There is some difference of opinion regarding the advisability of dehorning the bull. The claim has been made by a few breeders that dehorning reduces the prepotency of the bull or that it in some way is detrimental to his breeding powers. There is not the slightest evidence, however, that dehorning has any effect upon the breeding qualities of the animal, but it does undoubtedly injure his chances in the show ring. For this reason the bulls at the head of highly developed herds, where it is important to maintain the best possible appearance of the sires, are seldom dehorned. However, in herds kept primarily for producing market products, and this includes the big majority, the bull is seldom allowed to retain his horns. A bull is dangerous under any circumstances but certainly less so when dehorned. For this reason it is recommended that all bulls, except those at the head of valuable pure-bred herds, be dehorned.

Feeding the Mature Bull. The bull which has reached his growth should be kept in moderate flesh but never allowed to get fat. The animal is in the best breeding condition if fed rather

liberally and sufficiently exercised to prevent him from becoming over-fat.

Housing the Bull. The bull should not be allowed to run loose in the pasture with the herd. In the first place, it is a dangerous practice, as it gives abundant opportunity for the bull to attack a person unawares, or in a place where escape is difficult. Furthermore, a record of the date of breeding of the cows cannot be kept, and no dairy herd can be handled to best advantage without such records. Cows are often served younger or sooner after calving than the owner intends. The bull running with the herd exhausts himself until he becomes an uncertain breeder sooner than should be the case.

Bull Pens. A box stall ten by twelve feet is suitable for such an animal, when he is to be kept in the barn. A strong outside paddock should be provided, with a door from the box stall. In all except severe climates the bull is best housed in a shed built in the paddock. All the protection necessary is a good roof and tight walls to serve as a windbreak. Exposure to any but severe weather is beneficial rather than injurious to the breeding bull. Such open-air treatment, with the precaution that the animal gets plenty of exercise, will keep the bull in the best breeding condition, and he will be almost as sure a breeder at eight or nine years as at two. This open-air treatment causes the animal to look somewhat rough, and for this reason does not find favor with those who make a business of selling breeding stock, since the appearance of the herd bull is of importance in making sales.

FIG. 38. A modern bull pen. A steel pen of heavy construction with a corner manger is the most suitable type of bull pen.

Exercising the Bull. While nearly all successful breeders keep the bull away from the herd, there is great need of an improvement in the way the bull is handled when confined. Too often he is confined in a dark, dirty stall without exercise from the time he is a calf. Such treatment is certain to result in weakening of the

breeding powers, and often the animal becomes entirely impotent while scarcely more than mature. As a result of such treatment, by the time the sire is old enough to have daughters in milk so that his value as a sire may be judged, he is too often valueless for breeding purposes. The main points to be observed in keeping a bull in good condition to retain his breeding powers are to avoid excessive use when young and to give plenty of exercise and a moderate ration when mature.

When more than one bull is used, the bulls may be kept together advantageously in a suitable paddock. There is no trouble or danger in keeping two or more bulls of any age together, if they be dehorned. One of the chief advantages is that they take more exercise than when confined alone.

One of the most common plans of exercising the bull when closely confined is by use of a tread power or specially constructed bull exerciser. The power is adjusted to keep the bull walking at rather a slow pace as long as is wished. Another plan is to arrange a long sweep on a post and tie the bull at the end, and allow him to revolve the sweep by walking. Another plan followed is to arrange an overhead cable upon which a ring is placed from which a chain hangs. The bull is tied to this chain and can walk the length of the cable. The use of a heavy barrel or block that may be bunted about the pen is also commonly used.

Proper Handling of the Bull. The bull of a dairy breed is more liable to be vicious than one of a beef breed, since the former is more active and has greater nervous energy than the more sluggish beef animal. In handling bulls it should always be taken for granted that they are dangerous. It is never safe to trust them, and it is usually one that has been considered perfectly safe that injures some one.

A bull should be treated kindly, but never petted, even when a calf, and anything even bordering on teasing must be prohibited. It is best to let the bull strictly alone except when it is necessary to handle him. He must always be handled in a firm manner and made to understand that a man has power to control him and must be respected. The man handling a bull must not show fear of the animal, and must take care that the bull does not gain the upper hand. The animal should be thoroughly trained to being tied and led when a calf. If this is done, he never forgets it, and may be tied or led at any time later, even if handled only at long intervals.

Handling the Vicious Bull. Sufficient exercise is one of the most important factors in preventing a bull from becoming vicious. It is also well to have his stall or paddock so located and constructed that he can see other cattle and the attendants. Solitary confinement in an isolated box stall is not conducive to the development of a quiet disposition in a bull.

Care should be taken that the bull never has a chance to learn to use his really enormous strength in breaking fences, gates, tie straps, etc. Keeping everything strong and in good repair will do much to hold the bull in subjection. An electrified wire on brackets around the inside of the bull pen will effectively prevent his molesting the fence.

In leading a bull, a staff should be used. In case he is regularly tied in the barn, a large, strong halter may be used, or a special bull stanchion, as preferred.

CHECK-UP 17

A. Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. Of the total number of dairy cows raised, the culls represent about: (a) one third; (b) two thirds; (c) one fifth.
2. The dairy temperament is almost entirely a matter of: (a) inheritance; (b) environment; (c) feeding.
3. The problem of getting yourself a better herd for the future is one of: (a) breeding; (b) raising good young stock; (c) feeding.
4. Good breeding is primarily a matter of: (a) selecting the dam; (b) selecting the sire; (c) feeding cows properly.
5. Pure-bred bulls should be used because: (a) they are easier to handle; (b) they cost more than grades; (c) the sire is half the herd; (d) pure-breds tend to be prepotent.
6. There is wide variation in prepotency of bulls because of: (a) difference in the combination of hereditary factors; (b) difference in breeds; (c) differences in feeding and management.
7. If you had a herd of pure-bred Jerseys would you select a pure-bred bull that is a: (a) Jersey; (b) Guernsey; (c) Holstein?
8. What is the most important of these three factors to consider in selecting a bull? (a) the bull's dam; (b) his type; (c) his sire.

9. It is most important that the bull's dam should be: (a) an outstanding individual; (b) a member of a high-producing family; (c) more than five years old.

10. The appearance of the bull has little relation to the milking qualities of his daughters because: (a) milk production is the result of environment; (b) milk production is the function of a gland; (c) milk production is inherited from the dam.

11. In looking for a bull to improve a highly developed dairy herd you would buy: (a) a young bull; (b) a mature bull; (c) a proved sire.

12. The best and only basis for selecting the young untried bull is by: (a) pedigree; (b) conformation; (c) disposition.

13. The most important factor in preventing a bull from becoming vicious is: (a) a ring in his nose; (b) sufficient exercise; (c) gentle frequent handling.

14. It is best to lead a bull with a: (a) staff; (b) rope; (c) pitchfork.

15. The disadvantage of dehorning a bull is that it: (a) reduces his prepotency; (b) disqualifies him in the show ring; (c) makes him more vicious.

B. Assume that you have a herd of grade Guernseys of medium milk-producing ability and that you want to improve your herd. Place the letters V I in the parentheses in front of the *very important* items; or the letters S I in the parentheses in front of items that are of *secondary importance*. If the item is generally of slight or no importance place the letter U (unimportant) in the parentheses.

1. ( ) Dairy temperament, or the ability of a cow to produce milk, is an inherited trait.

2. ( ) A cow lacking the characteristics of a good milker cannot be developed into a good producer.

3. ( ) The best way to improve an average herd is through the purchase of superior heifers.

4. ( ) Use of a good pure-bred sire makes marked improvement in the herd within two generations.

5. ( ) The bull selected should have good conformation.

6. ( ) The mother of the selected bull should be a high-producing cow of a family of high-producing cows.

7. ( ) Records of daughters of the bull in question should be studied.

8. ( ) Short-time records should be scrutinized carefully.

9. ( ) Bulls should be retained until their daughters have had an opportunity to prove their milk yield.

10. ( ) Many people believe that a bull which was a heifer's first calf has unusual ability to pass on good dairy characteristics.
11. ( ) The growing bull should be fattened while young.
12. ( ) As a rule, the breeding bull should be between two and five years of age.
13. ( ) Bulls should be dehorned if they are not to be used for show purposes.
14. ( ) Bulls kept in open air pens acquire a rough coat.

CORRESPONDENCE OR CLASS ASSIGNMENT 5

1. Describe the factors you would consider of great importance in selecting a pure-bred sire for your herd including: (a) age of the bull; (b) pedigree; (c) records of offspring.

2. Discuss the care and management of the sire including such points as: (a) number of services permitted; (b) exercising; (c) dehorning; (d) housing; (e) handling.

CHAPTER XV

CATTLE BREEDING

It would require volumes to set forth fully the present knowledge and scientific theories covering the subject matter embraced in the heading of the chapter. Within the past ten years there probably has been more advancement in the science of breeding than in all the previous time. Consquently the material is presented in a condensed form, and represents only a brief review of some of the more complete works on breeding.

Prehistoric Cattle Breeding. As far back as we can trace authentic records, we find animals under domestication, and the earliest reports of domestic animals indicate that they were already much modified from their wild ancestors. During the pastoral age, when men wandered from place to place with their herds and flocks, there was more or less interbreeding between the domesticated animals and their wild cousins, which may account for the early establishment of differing species in localities where men roamed.

Such early improvement as is shown by the domestic animals over the wild is no doubt largely owing to a crude method of selection which is exercised instinctively by the herdsman whose living depends wholly or in part on the produce of his animals. This process of improvement was exceedingly gradual, and no very marked progress is traceable previous to the time of Robert Bakewell, of Leicestershire, England. He is now recognized as the pioneer in what may be called the improvement and development of modern livestock.

Methods of the Pioneer Breeders. Bakewell's work was with sheep, horses, and cattle; his method was the fixing of desirable types by careful selection and close breeding of the individuals conforming most closely to his ideal of type. Bakewell's breeding operations were carried on during the last half of the eighteenth century and though he worked without the aid of the recently developed knowledge of genetics, he nevertheless pursued the course which is now definitely followed in all efforts to concentrate particular characters; that is, the close breeding of animals which

possess those desired traits. His pursuit of this policy led to much adverse criticism by his contemporaries; but the success of his methods caught the attention of the thoughtful animal breeders of his day.

We find success attending the breeding of Shorthorn cattle by the Colling brothers of England when they adopted Bakewell's methods, although they sought to establish their ideal type through the use of bulls more particularly than through the female lines, and their progress came by using closely inbred bulls. Thomas Bates continued the work of improving Shorthorn cattle by concentrating the blood of desirable females, and he relied as much on pedigree in selecting his bulls as on individual excellence. Thomas Booth, Amos Cruikshank, and William Duthie accomplished their splendid results by selecting animals of the desired type and fixing this type by close in-breeding.

Similar work by Dauncey resulted in the establishment of a strain of high-producing Jersey cattle in England, and from this fountain head the foundation of the St. Lambe t family was drawn.

The Explanation of "Like Begets Like." In the light of our present knowledge of heredity we can offer an explanation of the success which attended the practice followed by these pioneers. The results obtained speak for themselves, and these men, guided by their maxim that "like begets like," s t a pattern followed to the present day. Beginning with foundation stock of assorted breeding, but all conforming to a definite type, the surest and quickest method of fixing this type was to breed and interbreed these animals and their descendants, without recourse to outside blood, until such time as the persistence of undesirable traits called for the introduction of a counteracting influence. By pursuing this method of close breeding and careful selection of the best individuals for breeding purposes, the offspring in each succeeding generation became genetically more and more pure.

The early history of any pure breed invariably shows that resort was had to the same practice of close breeding and selection. The reason is obvious. The number of desirable animals is limited, and those favored with the qualities most sought for are used to the utmost in the formative period of the breed; and thus the offspring of the best foundation animals are used extensively to perpetuate the blood of the best. In-breeding is practiced in order to concentrate the qualities possessed by the leading animals of the breed.

To test the truth of this statement it is only necessary to trace out the pedigrees of animals chosen at random to the early foundation stock and find how often the names of well-recognized individuals appear.

Mendel's Law. Any intelligent discussion of the principles of animal breeding must be based on an understanding of the manner in which the mechanism of inheritance functions. The individual can only develop to the limit set by its inheritance; and perfect health, normal functioning of the vital organs, a favorable environment, and good training are the essentials required for the complete achievement of its inherent capacities. No individual can influence his heredity, for it comes to him from his ancestors through the fusion of the germ plasm of his parents.

As to knowledge of the mode of inheritance, we are indebted to the early discoveries of an Austrian monk, Johann Gregor Mendel, who experimented with garden peas, and by close study of the method of transmission of simple characters such as color and size, discovered the principles embodied in Mendel's Law. By crossing yellow and green peas he produced a hybrid yellow strain. When these hybrids were planted the resulting peas were green and yellow in the ratio of 1 to 3. All of these second generation green peas reproduced green, but two-thirds of the yellow of the second generation behaved the same as the yellow hybrids; while the remaining third of the yellows reproduced yellow.

The Body Cell. In order to comprehend the workings of inheritance according to Mendel's Law, it is necessary to know something of the structure of the organism. All parts of the animal body are made up of cells, much the same as a house is built of bricks. The cells are packed closely together like rubber bags filled with water. Most of these cells contain a small structure called the nucleus, which is the center of life and activity of the cell.

In the mechanism of inheritance we are dealing primarily with the germ cells, which are a group of cells specialized for reproduction, and it is one of these from each parent which unite to form the new individual. The mature germ cell of the male is called the sperm, and that of the female, the ovum or egg. To return to our example of the green and yellow peas, what happens in the crossing is represented diagrammatically by Fig. 39.

The Importance of Dominancy. The factor for yellow is dominant over green, and consequently those individuals of mixed or

hybrid make-up are yellow in color, but because of the presence of the recessive factor for green, the mating of such individuals results in one-fourth offspring pure green, one-fourth pure yellow, and one-half hybrid yellow, like the parents. In these hybrid peas both the factors for green and yellow color are present in the germ cells, but because the factor for yellow is dominant over the recessive factor for green, the peas are yellow. Whenever this mixed condition of factors for unit characters exists in the reproductive cell, the influence of the dominant factor determines the character of the organism.

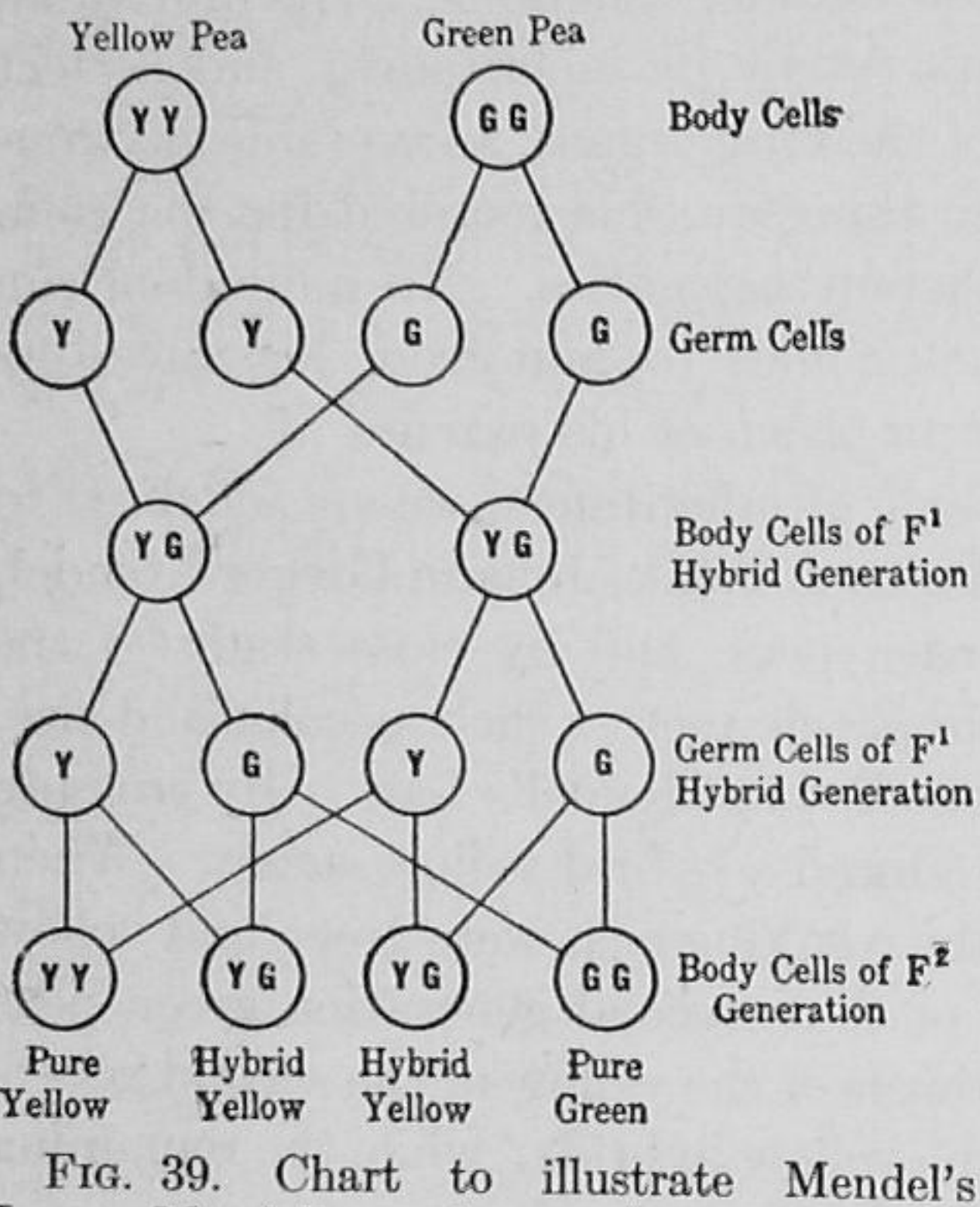


FIG. 39. Chart to illustrate Mendel's Law. Mendel's work was done with peas, but the principles he established apply to animals as well as plants.

This example of Mendelian inheritance deals only with a single unit character, but it serves to illustrate the working of the means whereby inherited characters pass from one generation to the next. All genetic studies are comparatively recent and in dealing with higher animals the inheritable complex is so involved that the limited available knowledge does not yet afford much assistance to the breeder concerned with the problem of milk production. Most characters in animal inheritance depend on the presence of a number of units for their complete development, and this appears to be true of milk production and quality, or percentage of fat in milk, but our present meager information leads to the belief that these two characters are inherited independent of each other. The main point in this discussion is that the factors pass on as units and are not blended in reproduction. As has been aptly stated, "The union of sperm and ovum in its bearing on heredity may be compared to the mingling of two collections of solid beads instead of to a mixing of two liquids." A complete set of units is received from each parent.

Each Individual a Composite of All Ancestry. Each individual possesses all the normal characters of the race to which he belongs, whether the characters are evident or not. In the higher races the characters are so numerous that not all of them can develop in any single individual, the proof of which is found in the fact that he will transmit to his offspring things which are not apparent in the make-up. While milk production is a function of the female, it is transmitted by the bull as well as by the cow. Recessive characters may be carried for several generations without external evidence, as they are concealed by their dominants, but by a recombination of the germ plasm of two individuals carrying the same recessive character, it may come to the surface. This is commonly spoken of as a "reversion of type." It is the proper explanation for the occasional occurrence of red-and-white calves in Holsteins.

Variation. In animal breeding it is impossible to mate individuals which are absolutely identical, and as a consequence variation is bound to occur. This absence of absolute uniformity is readily accounted for by the presence of thousands of factors in the germ plasm of every individual. Variability is the universal rule among living beings.

The Importance of Selection. Wise selection has been the breeder's best aid in the improvement of livestock through the advantages gained by variation. Likewise, selection is the breeder's method of eliminating undesirable variations. The general increase in the productive capacity of the specialized dairy breeds can well be attributed to the established practice of selection, although the improvement in methods of feeding and handling is partly responsible for this advance. For permanent progress there must be consistent selection and mating of these animals which have demonstrated by performance that they carry the desired combination of factors; but in practicing this selection it is well to go beyond the individuals in question to determine the character of the ancestry from which they spring, for inheritance comes not alone from the parents, but is a combination of factors handed down from preceding generations. It is here that the use of pedigrees proves indispensable.

The Offspring of High-producing Cows Are Often Mediocre. It is frequently the case that high-record cows do not hand down their ability to their offspring, so that the ability of the descendants

of the high producers resembles more closely the average capacity of the ancestry from which it sprung. The only animals which can transmit the high-producing ability with any certainty are those which are genetically pure, which means they are descended from a long line of cattle which possessed this same ability. Only the mating of such individuals can insure a satisfactory combination.

Here we encounter the danger of overestimating the value of official records, for unless we are sure that the individual is pure, the offspring from the high-record cow will prove a disappointment from the standpoint of maintaining high production. The use of proved bulls is the best procedure to follow in selecting herd sires, since the proof of germinal purity or prepotency is based on the performance of his offspring. Uniform excellence in a large number of progeny is a sure indication of the presence and purity of those factors necessary for high production.

Effect of Environment. From the foregoing discussion it can readily be seen that environment plays no part in heredity. The influence of environment on the individual can only favor or hold back the complete development and functioning of those characters which are inherited. Long continued selection within the environment may so purify germ plasm by elimination or intensification that environment may be given credit for the change. No amount of training can develop speed in a draft horse, and nothing in the feeder's art can change the beef cow's tendency to lay on flesh into a tendency to high milk production.

Law of Ancestral Heredity. The relative contribution of each ancestor to the germinal make-up of the individual is shown in percentage in the skeleton pedigree (Fig. 40), made up according to Galton's Law.

The relative importance of the individual in the pedigree is clearly brought out by this diagram, and the farther back in the ancestry an animal is located, the less significant it is for the animal under consideration, because its contribution to the germinal make-up is greatly diminished and diluted. This emphasizes the fallacy of stressing the value of a pedigree with two or three well-known individuals in the fourth or fifth generation. Unless the desirable characters are brought down intact through succeeding generations by equally prepotent descendants, they are soon lost in the new combinations of factors; and the only pos-

sibility of their reappearance is in a lucky recombination and segregation of the desirable traits.

Inheritance of Acquired Characters. Animals are subject to modification by the use or disuse of parts and by external condi-

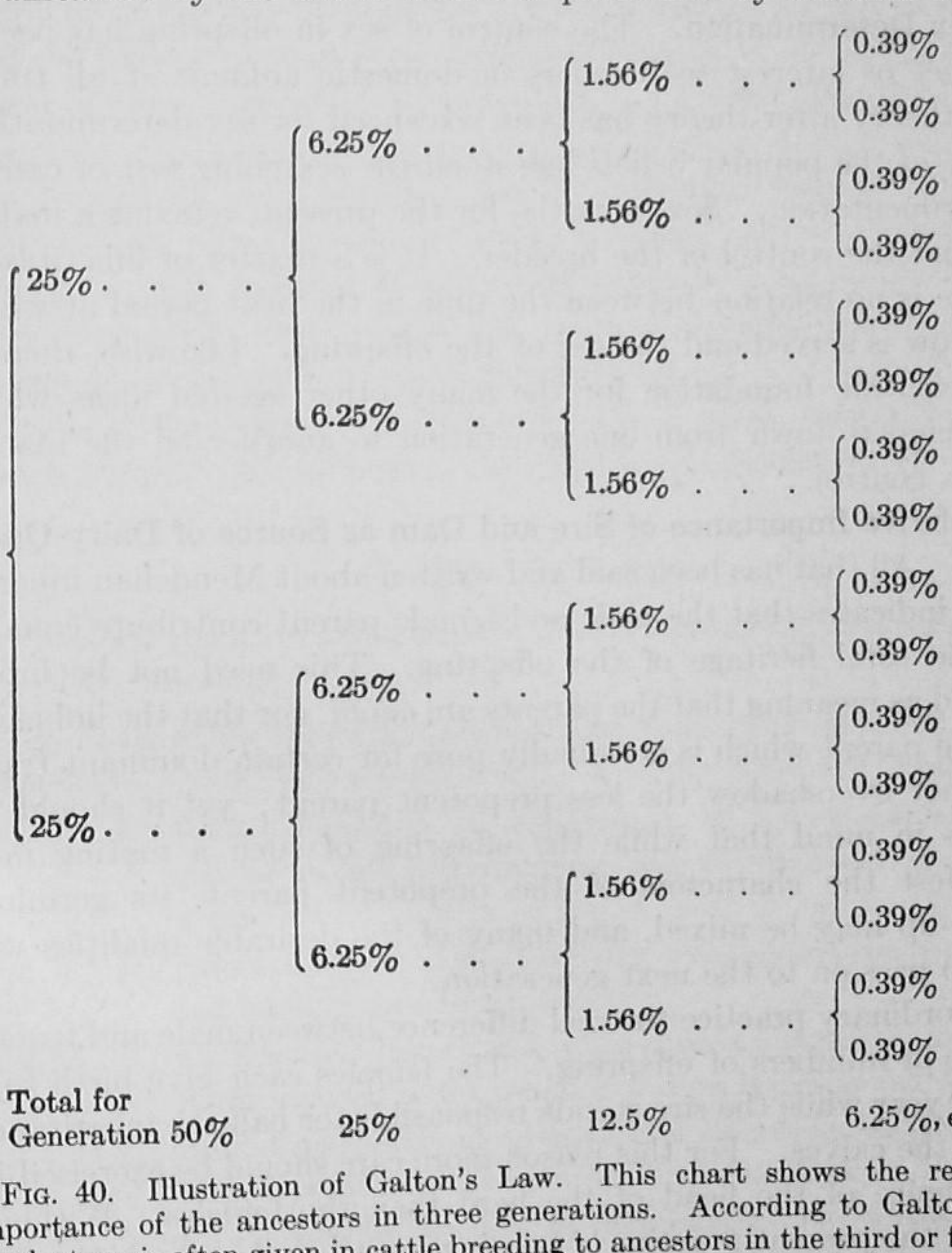


FIG. 40. Illustration of Galton's Law. This chart shows the relative importance of the ancestors in three generations. According to Galton too much stress is often given in cattle breeding to ancestors in the third or fourth generation back. This chart shows that each ancestor in the third generation contributes only 1.56 per cent to the total. The near ancestors are the ones that count.

tions or environment, and it is natural to assume that a given species subjected to similar conditions of climate or food supply will all respond in much the same manner. This led to the popular belief that such modifications were transmitted from parent to offspring. Definite experiments carefully planned to test this

theory have proved its fallacy. This is illustrated by the failure to modify the length of the tails of sheep by continuously cutting off the tails of lambs. Any measure of control over heredity must be through selection of the parents and ancestors.

Sex Determination. The control of sex in offspring has been a subject of interest to breeders of domestic animals at all times, and theory after theory has been advanced for sex determination. None of the popular beliefs has stood the searching test of careful experimentation. Sex in cattle, for the present, remains a matter beyond the control of the breeder. It is a matter of inheritance. There is no relation between the time in the heat period at which the cow is served and the sex of the offspring. Likewise, there is no scientific foundation for the many other age-old ideas which are handed down from one generation to another on the matter of sex control.

Relative Importance of Sire and Dam as Source of Dairy Qualities. All that has been said and written about Mendelian inheritance indicates that the male and female parent contribute equally to the total heritage of the offspring. This need not be interpreted as meaning that the parents are equal, nor that the influence of one parent which is germinally pure for certain dominant traits will not overshadow the less prepotent parent; yet it should be borne in mind that while the offspring of such a mating may manifest the characters of the prepotent parent, its germinal make-up may be mixed, and many of the desirable qualities will fail to pass on to the next generation.

In ordinary practice the real difference between male and female is one of numbers of offspring. The females each give birth to a calf a year while the sire stands responsible for half the inheritance of all the calves. For this reason more care should be exercised in the choice of the head of the herd than the females. Without doubt the present practice of keeping most female calves, but discarding all bull calves except those from the better cows, is resulting in the popular belief that the bull's contribution to the offspring is greater than that of the dam; but as already stated, there is no scientific basis for this belief.

Prepotency. A prepotent animal is one which transmits its characters to its progeny no matter how mated. The only true test for prepotency is the test of offspring. One cannot judge from appearances whether or not an animal is prepotent; even

though it conforms to the ideal sought, its ability to transmit is in doubt until its progeny can be observed.

The ability of the prepotent individual to beget uniformly excellent offspring can be accounted for technically by the dominance of the factors back of these desirable characters and a pure condition of these factors in the germ plasm. In the case of milk production, the question of prepotency is complex, as high production is dependent on a combination of favorable factors, and since chance still plays so large a part in obtaining this favorable combination, the scarcity of prepotent animals is obvious. Careful selection and close study will in time increase the number of animals prepotent for high milk production.

The Freemartin. The freemartin is a sterile heifer twinborn with a bull. Not all heifers twinborn with bulls are sterile.

CHECK-UP 18

What do you know about some of the main points for an understanding of cattle breeding?

A. Some of the following statements are true, others are false. If the statement is true circle the letter T; if it is false circle the letter F.

1. T F Robert Bakewell, an Englishman of Leicestershire, is the pioneer in the improvement and development of modern livestock.

2. T F Bakewell's method was the fixing of desirable types by feeding and housing the animals carefully.

3. T F A. The early history of any pure breed invariably shows that resort was had to the practice of close breeding and selection.

T F B. The pioneer breeders' method of close breeding is the practical application of the maxim "like begets like."

T F C. Present-day breeders are successfully following these same methods.

4. T F No individual can influence his heredity.

5. T F Mendel's law explains some of the workings of inheritance.

6. T F Milk-producing ability is transmitted by the bull as well as the cow.

7. T F Too many dominant characteristics is the explanation for the occasional appearance of a red and white Holstein.

8. T F Variation among animals occurs because it is impossible to mate identical individuals.

9. T F The pedigree is valuable in selecting the individual.
10. T F Modifications as a result of environment are transmitted from parent to offspring.
11. T F Galton's law is that the bull's mother-in-law is 25 per cent of the herd.
12. T F A lot of good ideas for determining sex before the animal is born are handed down from one generation of breeders to another.
13. T F Appearances indicate a prepotent animal.
14. T F Any heifer twinborn with a bull is a freemartin.

The Pedigree. One meaning of the word pedigree is ancestry or lineage, and in this sense all animals have pedigrees. As used in animal breeding a pedigree is a list or table showing the ancestors of the animal in question and their relationship. For convenience the pedigree is generally put in a graphic form. The common practice is to use the bracket form as illustrated by Fig. 41. In this form of pedigree the name of the sire is placed at the top of each bracket and the dam at the bottom. In this pedigree of the Jersey bull Pogis 99th of Hood Farm the sire is Hood Farm Pogis 9th and the dam is Sophie 19th of Hood Farm. The term pedigree really includes only the record of ancestors but since official records of milk and fat products have become such important factors in the selection of breeding stock these records are usually thought of as part of the pedigree and are written in the proper position below the name of the animal concerned. In Fig. 41, for example, it is noted that Pogis 99th of Hood Farm is the sire of cows in the Register of Merit. These official records are given in as much detail as is considered desirable for the purpose for which they are to be used.

In-breeding. In-breeding is the term applied to the practice of mating closely related individuals such as brother to sister, sire to daughter, or son to dam. To generalize a bit, an individual may be said to be inbred when its parents show 50 per cent or more common ancestry in their pedigrees. While the term is used by practical breeders, it might be well to state that nothing so extreme as the in-breeding of laboratory animals and plants by mating full brother and sister for generation after generation has ever been attempted in the realm of practical animal breeding. Figure 42 shows in-breeding.

Advantages of In-breeding. Some of the advantages of in-breeding have already been referred to in the discussion of the early development of Shorthorn cattle. The primary effect of in-breeding is to intensify or fix hereditary qualities and thereby

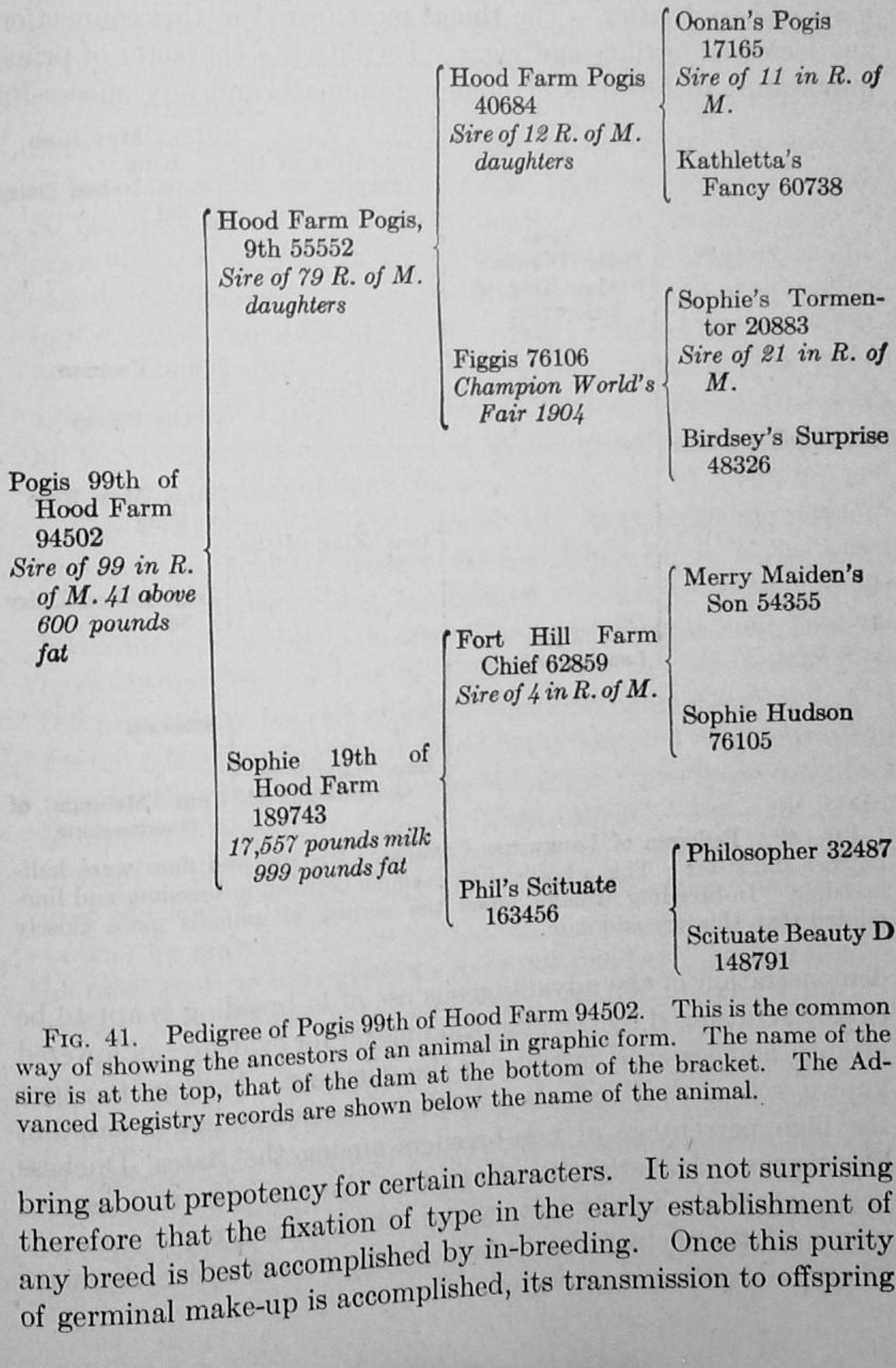


FIG. 41. Pedigree of Pogis 99th of Hood Farm 94502. This is the common way of showing the ancestors of an animal in graphic form. The name of the sire is at the top, that of the dam at the bottom of the bracket. The Advanced Registry records are shown below the name of the animal.

bring about prepotency for certain characters. It is not surprising therefore that the fixation of type in the early establishment of any breed is best accomplished by in-breeding. Once this purity of germinal make-up is accomplished, its transmission to offspring

is almost certain, as in the case of the white faces of Hereford cattle.

Ill Effects of In-breeding. The same mechanism which makes in-breeding so successful in fixing desired characters operates to bring about the concentration of factors in the germ plasm which may lead to disaster. The things most feared in this connection are decreased fertility and vigor. Fertility is a character of prime importance to breeders of domestic animals, and any successful

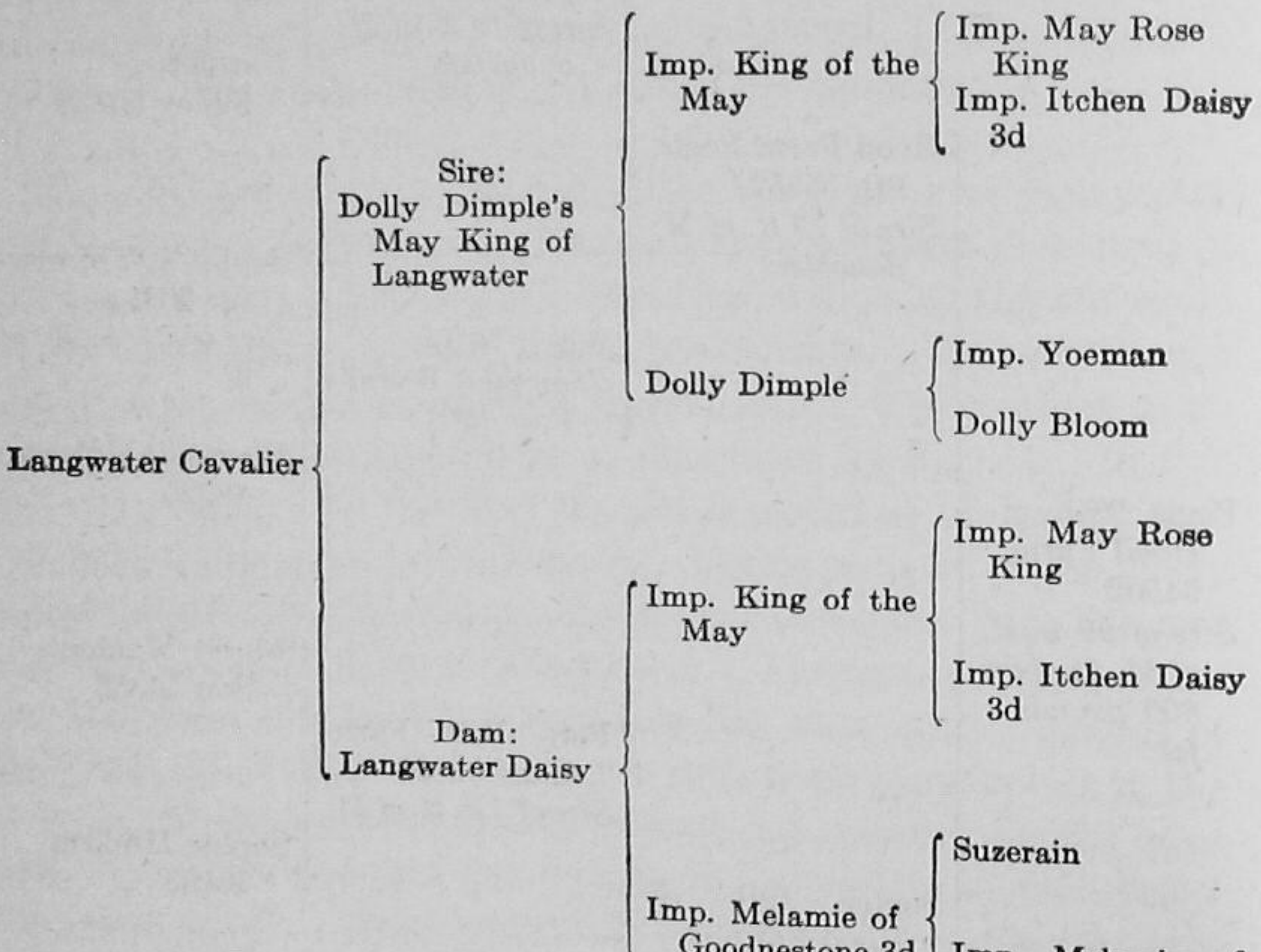


FIG. 42. Pedigree of Langwater Cavalier. His sire and dam were half-brother and sister. This a border-line example between in-breeding and line-breeding. In-breeding usually infers the mating of animals more closely related than this sire and dam.

demonstration of the advantageous use of in-breeding is apt to be closely scrutinized by the practical breeder for evidences of lowered vitality and lessened fertility in the offspring. Perhaps the best known case of the ill effects following close in-breeding is found in the high percentage of non-breeders among the Bates' Duchess Shorthorns. Investigation shows that this strain carried barrenness early in the family history and there was no greater intensification of this defect than would follow in any other character where in-breeding is employed.

Selection and In-breeding. With all the evidence at hand it can be safely concluded that danger lurks in the use of in-breeding by anyone but a breeder who is capable of selecting his breeding animals not alone for the presence of desirable factors he is seeking to concentrate, but as well for the absence of those things which will in the end lower vitality or lessen fertility. It is the most rapid means of advancement in breeding, but is a dangerous tool in the hands of any but those trained to its use.

Line-breeding. The mating of animals related in a lesser degree than that described as in-breeding is known as line-breeding. Where the common ancestry of the parents ranges from 25 to 50 per cent we have what is popularly called line-breeding. For example, the pedigree of Langwater Cavalier in Fig. 42 would be called line-breeding by some breeders because Langwater Cavalier's parents have the same sire. According to Galton's law Imp. King of the May is 25 per cent of the ancestry of both May King of Langwater and Langwater Daisy. This system is said to possess all the excellencies of in-breeding with a greatly lessened tendency toward production of defectives.

Line-breeding is without doubt the most popular system of breeding, particularly in breeds such as Jersey cattle, where definite families have been long established. Much progress in cattle breeding is traceable to line-breeding, as many men have held aloof from in-breeding for fear of disaster; but they have recognized the principle of concentration of desirable characters through the use of related animals and hence have resorted to line-breeding. Results this way may come more slowly, as there is constant introduction of hereditary elements from slightly different lines of descent. But while this may retard the purifying process for desirable characters, it also serves to neutralize defective elements, and in this we may find the cause for the popularity of line-breeding, as most men would prefer to progress slowly in animal breeding rather than to follow short cuts where possible disaster lurks.

One danger ever present in line-breeding is the possibility of selection entirely by pedigree, and the abandonment of individual selection. While the pedigree may picture an ideal combination of ancestry, any system of progressive breeding must be based on the mating of superior individuals.

Out-crossing. Mating of unrelated individuals is commonly called out-crossing. In breeds where families or strains have

become well established, such practice is usually avoided. While it is undoubtedly true that the greatest success of some well-known breeders is founded on the use of a great bull which was unrelated

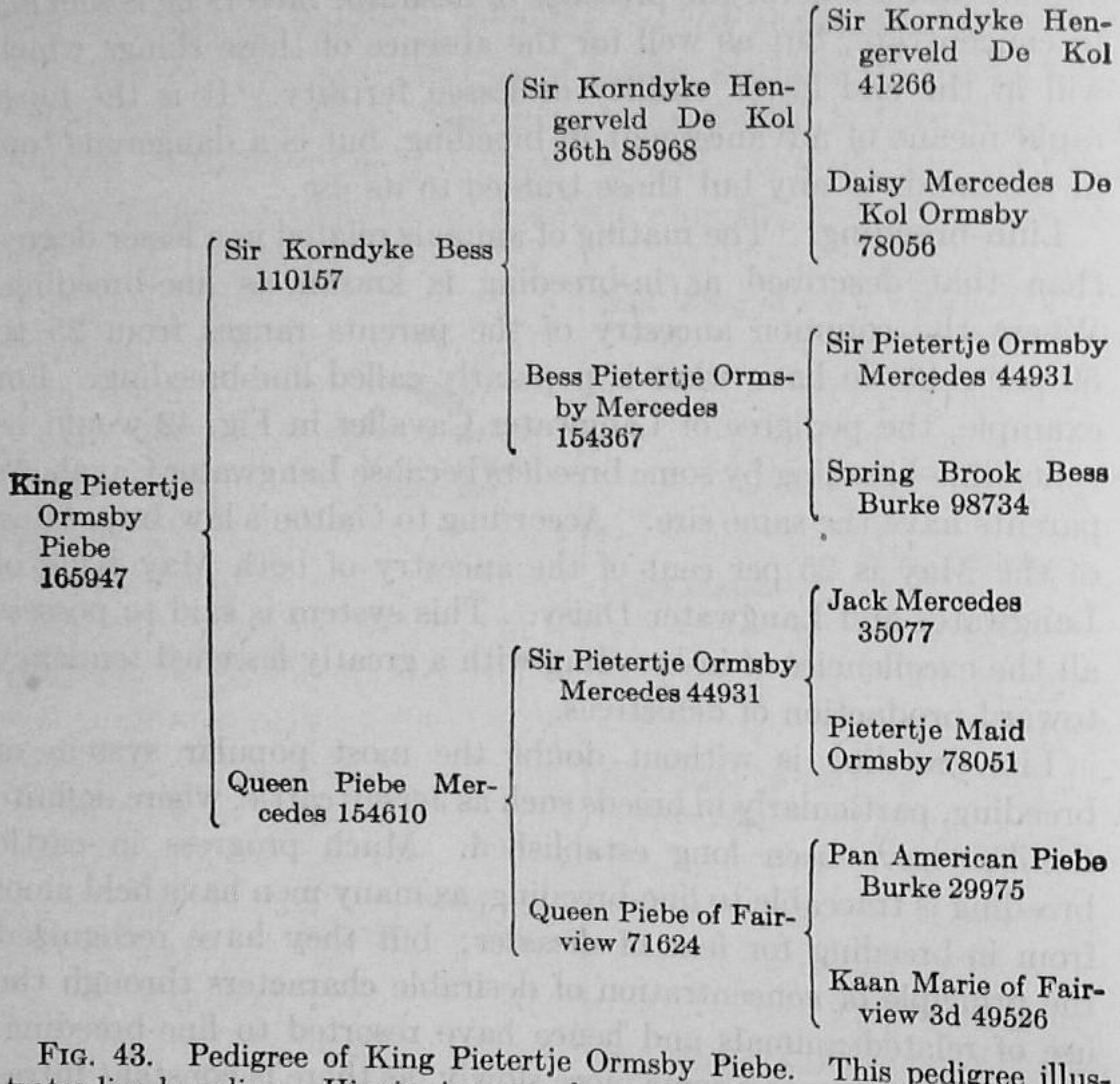


FIG. 43. Pedigree of King Pietertje Ormsby Piebe. This pedigree illustrates line-breeding. His sire is a grandson of Sir Pietertje Ormsby Mercedes and his dam a daughter of the same bull. The breeder practices line-breeding for the purpose of retaining a larger percentage of the blood of a great transmitting ancestor. In the third generation Mercedes 44931 contributes 6.25 per cent to the ancestry of King Pietertje and in the fourth generation Mercedes 44931 contributes 0.39 per cent which increases the total percentage of his blood in King Pietertje.

to the females to which he was bred, it is rare indeed that such a breeder fails to change his practice to line-breeding after this initial out-cross, principally in order to concentrate and perpetuate the blood of his great sire. Once he becomes an advocate of line-breeding, he has tied himself to a certain strain or family and draws back instinctively from the utilization of animals unrelated to his own.

Nicking. The practice of line-breeding by many cattle breeders has resulted in the growth of a so-called nicking theory. It is based on observation, and the theory is that individuals of certain strains within the breed, when mated, produce highly desirable offspring; whereas other combinations fail to "nick" and are not looked upon as successful. Within a certain breed, the factors for high milk production are the same, and if they are carried pure in the germ plasm of both male and female, there is nothing which will prevent their transmission to the offspring regardless of the families to which the parents belong. In other words, if both cow and bull are prepotent for high production, the descendants of such a cross should also be high producers. The nicking theory fails to stand up when applied to other Mendelian characters which are known to be dominant. When two Herefords are mated the offspring will have Hereford markings regardless of family, and we know these markings are as heritable as is milk production.

Pedigree Misuse. The use of the pedigree is resorted to extensively in selling cattle, and this has led to abuse in the preparation of pedigrees. As every handler of pure-bred cattle knows, values are largely based on records of animals concerned. In order to build up the production story in a pedigree, resort is often made to entering records of distantly related animals. As an example, we may find a statement that a young bull is sired by a son of a half-brother to some cow with a large record, or that his dam is a half-sister to the sire of a great bull. In either case, the animal with the record will not be found in the pedigree under consideration. This is called pedigree filler and is an abusive practice of unethical pedigree compilers.

This subterfuge is easily detected by a careful reading of the pedigree, and it is a safe rule to ignore all statements except those which bear directly on the animals listed in the pedigree. At a public auction, close analysis is not possible when animals are sold quickly, but the wise buyer secures a catalogue in advance, studies the pedigrees at his leisure, and then confirms his selection by inspecting the animals at the sale before they are brought into the ring.

Crossing Breeds. The development of a modern breed of dairy cattle is the result of a long-continued process of selection of individuals showing characters sought by the breeder. By this method, the desired characters have become fixed, thus insuring a

degree of certainty in the transmission of the desired traits when individuals of the same breed are mated. By crossing distinct breeds we interfere with this transmission of the factors and combinations of factors which account for the distinctive characters of the individual breeds. The result is not an exact blending of the characters of the two breeds, but an entirely new combination of factors and units, which may result in the loss of most of the valuable traits of each parent. It is likewise true that the offspring of such a cross may prove desirable in many respects, but from a standpoint of breeding these cross-bred animals are an unknown quantity, since they carry in their germinal make-up a mixture of the factors of two separate breeds, and how these will pan out on recombination is most uncertain. While it is often observed that the first cross shows promise, it is certain that many of the second generation individuals will prove unsatisfactory for this practice is mainly a repetition of the steps followed in the early development of any breed, when close culling was essential.

Ill Effects of Cross-breeding. As a rule, little is gained in cross-breeding, and the outcome often is disastrous. However, it is a common practice with many. A farmer having perhaps a good grade herd of Jerseys observes the larger yield of milk secured by his neighbor who breeds Holsteins and decides to make a Holstein cross, thinking he will combine the quality of the Jersey with the quantity of the Holstein. The next year the farmer possibly decides his animals are too small, and uses a Shorthorn to increase the size. The result of such practice is to lose the breed characters, and the occasional good animal that appears from such a mixture does not transmit any definite characteristics.

It is a well-known fact that as a rule in crossing breeds of animals for market, such as hogs or beef cattle, the first cross between distinct breeds is good, and some animals may have the good characteristics of both breeds to some extent. But herein lies the danger of cross-breeding, as the excellence of these individuals may tempt the breeder to use them as breeding stock. The proper course to pursue is first to select the breed that seems to meet the requirements or tastes of the breeder, then to select the best individuals and the ones most likely to transmit these characters from this breed, and continue along the same line unless it is found after sufficient trial that a serious mistake has been made.

Value of Testing. In order to measure progress in breeding

work it is necessary to have some standard of excellence by which to compare individuals of succeeding generations. In this respect the breeder of dairy cattle is fortunate, as the comparative producing ability of mother and daughter afford him an unquestioned measure of the degree of progress or decline he is able to accomplish. To make this comparison as accurate as possible, the conditions under which his cattle are tested must be uniform, and due allowance should be made for differences in the ages of daughter and dam. Herein lies perhaps the greatest value of cow testing, as it is a far more accurate measure of ability than any estimate which can be made from observation of conformation or type, and the results of testing are unerring in detecting those individuals which may appeal to the eye but fall down in performance at the pail.

Cow testing can hardly be overemphasized, for in addition to aiding the breeder in his work, it enables the dairy farmer to cull his herd and eliminate cows which fail to pay for their keep, and it assists him in building up the productive capacity of his herd by selecting heifers from his best cows. In addition, the test is the sure way of locating the prepotent sire. It also adds great value to pure-bred animals, as purchases are largely based nowadays on official records, and there is a direct correlation between high and low records and prices as established in public sales.

For the man who is handling pure-breds, official testing is indispensable. The cost of this work will be returned many times over in the price realized for the stock he has to sell.

Smaller breeders and dairy farmers will reap great benefit by joining cow-test associations. This will give them a true index of the ability of the various cows in the herd, and it often adds materially to the value of such animals as show more than average ability. Carefully and regularly conducted private tests will serve much the same purpose as the association work, but it has already been pointed out that other things are allowed to interfere with private testing which detracts greatly from its efficiency. Furthermore, cow-test association records are receiving more and more recognition by the purchasing public.

Bull Associations. There is still another movement on foot for the improvement of dairy herds by the use of better sires. The value of a good bull is fully appreciated, and his extensive influence in the herd is recognized; but many dairy farmers are deterred

from purchasing a pure-bred bull because the number of females they keep is too limited to warrant the expense. To overcome this obstacle, bull associations are being organized. This movement had its beginning in the state of Michigan in 1908. These are community organizations, wherein a number of dairy farmers agree to purchase one or more pure-bred bulls of recognized breeding ability for use jointly in their herds. Where the association is large, the farmers are grouped in blocks, and one bull placed in each block. At intervals of about two years these bulls are moved from block to block, in order to avoid breeding them to their own daughters. The movement made slow progress at first, and in 1918 there were only forty-four associations; but since that time the advance has been more rapid. The work of organization is carried on jointly by the Bureau of Dairy Industry of the United States Department of Agriculture and the Extension Service of the several states.

Advantages of Bull Associations. The advantages of the pure-bred bull association are obvious. First of all it permits the pooling of resources of a number of farmers in the purchase of a bull, enabling them to pay better prices and secure correspondingly better sires. These bulls have a larger opportunity to demonstrate their worth, as they are bred to more cows than if they were used in a single small herd. The bulls are also kept in service for a longer period of time, and those that prove prepotent can be retained in the community until old age ends their usefulness. Like all other cooperative movements, the bull association creates a greater interest in the breeding of stock, and it often results in the development of dairying as a community enterprise. It also arouses enthusiasm for better cattle, and the introduction of several good pure-bred bulls into a county may be followed later on by pure-bred females in many of the herds.

Why So Few Pure-bred Bulls? Innumerable instances are on record and countless stories have been written of the rapid improvement in dairy cattle through the use of pure-bred bulls, and the question naturally arises why so few pure-bred bulls are in use. Records in pure-bred cattle associations show that less than half as many males as females are registered. This is due partly to closer culling of bulls; but if all the pure-bred bulls dropped were kept there would not be enough to replace the scrub sires now in common use. One fact that contributes to this condition is the small size of many herds kept by dairy farmers, but this can be

overcome by the organization of bull associations, or the cooperative purchase of a good bull by two or more farmers in one neighborhood. Another factor entering into the problem is the poor salesmanship on the part of breeders of pure-bred stock. Many of them ignore this large field for disposing of their bulls to the many ordinary dairy farmers, and limit their selling efforts to herds of pedigreed stock. While it is true that better prices are usually realized from the latter class of buyers, it is also true that their demands are more exacting and their number greatly limited. Every good pure-bred herd has a surplus of males that could well be placed in grade herds at a fair profit to the breeder and at a great benefit to the dairy business.

CHECK-UP 19

1. Gus Swanson is milking five grade Jerseys which he bought and he is keeping records. His Jerseys average 6,000 lbs. of milk per year. He wants to increase the size of his herd by raising his own replacements, but he would also like to sell his bull calves for veal. He buys a Brown Swiss bull whose dam produced 8,000 lbs. of milk. He breeds this bull to his cows. The bull calves make much better veal than he had been getting but his records show that the daughters of this bull milk 4,500 lbs. His feeding and management are good. What is likely to be his trouble?

Instructions: Consult the lists of mistakes and remedies which appear after Case 3. Indicate the order in which mistakes were made in each of these three cases by placing the letter of the mistake in question after the numbers in the column headed "Mistakes" below each case. Show the proper order of application of remedies for each mistake for each case by placing the letters of the remedies on the lines under the heading "Remedies" for each case. For example: The first mistake in case 1 may have been Item J—so J would be placed on line 1; the first remedy might be Item N, the second, Item E, so N and E would be placed on line 1 under Remedies in that order.

	Mistakes	Remedies
1.	_____	_____
2.	_____	_____
3.	_____	_____

2. Dennis Gleason has six pure-bred Guernseys all of which are half or full sisters. His best cow milks 10,000 lbs. and he has raised one of her bull calves to be his herd sire. He loans this bull to a neighbor who also has Guernseys. Dennis finds that this bull, whose name is Oscar, throws

heifers that are better than their dams. Dennis brings Oscar home and breeds him to his cows. Most of the calves are born weak or dead. One is a freemartin. His feeding and management are all right. Where has he made a mistake?

	Mistakes	Remedies
1.		
2.		
3.		

3. Roy Alexander has eight Holsteins all of the same family. He buys a young unrelated bull very cheap to breed to these cows. As a result all the daughters show a substantial increase in milk production over the dams. Roy is sold on out-crossing. He sells this bull and buys another to breed to the daughters of the first bull. This time he buys an older bull and at a higher price. However, the daughters of the second bull show a decrease in milk production as compared with their dams and granddams. Where has Roy gone wrong? His feeding and management have been all right.

	Mistakes	Remedies
1.		
2.		
3.		

Mistakes	Remedies
a. Cross-breeding	a. Nicking
b. Shorthorns	b. Culling
c. Pedigree misuse	c. Careful selection of the individual
d. Close in-breeding	d. Effect of environment
e. Inbreeding	e. Prepotency
f. Freemartins	f. Line-breeding
g. Selection entirely by pedigree	g. Proved bulls
h. Reversion to type	h. Like begets like
i. Red and white Holsteins	i. Out-crossing
j. Out-crossing	j. Pedigree of ancestry
k. Beef-type individuals	k. Testing
	l. Bull associations
	m. Pure-bred bulls
	n. In-breeding

END-OF-COURSE TEST

At this time you should apply to the United States Armed Forces Institute, Madison, Wisconsin, for your End-of-Course Test. If the form to be used for this purpose is not attached to the cover of this book, ask your Educational Services Officer, your Special Service Officer, or your Librarian to supply you with one.

CHAPTER XVI

CALF RAISING

Economic Considerations. According to a recent Agricultural Statistics Report, there were approximately 39,758,000 cows and heifers used for dairy purposes in the United States. It has been found that cows are milked on the average of not more than five years each, which means that they are replaced when not more than eight years old. On this basis, 7,551,000 heifer calves must be raised each year to maintain the number of dairy cows in use in the United States in 1943.

The individual dairyman who raises heifers to replace his discarded cows finds it necessary to retain at least three heifer calves yearly for each ten cows in the herd in order to be safeguarded against loss of calves by death and to replace cows eliminated because of their inferior dairy qualities or those lost through disease.

It is estimated by the Bureau of Markets that in addition to the skim milk used, 4 per cent of the whole milk produced in the United States is used for calf raising.

Importance of Maintaining the Herd. The success of the dairy farmer depends to no slight extent upon the careful rearing of the calves. The careful dairyman sees in every heifer calf the possibility of a cow that will not only replace a discarded member of his herd, but help to raise the average production. By proper care in the choice of the sire, and by careful attention to the rearing of the calves, the dairyman who is compelled to start with a herd of ordinary quality may, within a few years, raise the average production of his herd to a marked extent. On the other hand, carelessness in breeding and in calf raising is bound to result disastrously to a herd or, at least, to keep it at a standstill as far as improvement is concerned.

Disadvantage in Replacement Buying. One of the common mistakes made in the localities where whole milk is sold for market purposes or to condenseries or cheese factories is the failure to raise any calves. In this case the milk producer depends upon buying cows to replace those discarded from his herd. The excuse for this practice is that the cost of raising cows is too great. Under such a system a dairyman will almost invariably produce milk year

after year without improving the standard of his herd in the least. When more cows are required, they are purchased from a shipper or dealer, and without any information available regarding the merits of the animals beyond what can be determined from appearance. The dairy cows placed on the market through such channels are almost certain to be of ordinary grade, since a cow whose value as a milk producer is known is not offered for sale at the market price. The practice of replacing cows by purchase also involves the danger of introducing such diseases as tuberculosis, contagious abortion, and mastitis which may result in the destruction of the entire herd.

In a few localities the practice is even worse because the cows are purchased when about to calve, and after being milked for only a single milking period, are then fattened when the milk flow slackens, and sold for beef. In this way the general average of production is exceedingly low, and the occasional good cow is not even saved for future usefulness. Many cases are known of herds maintained for over twenty years without the slightest increase in the average production because the discarded cows were replaced by purchase rather than by raising calves. The only means by which the average quality of dairy herds in the hands of practical dairymen can be materially improved is by the raising of their own cows from carefully selected calves sired by pure-bred sires and from only the best cows of the herd.

Birth Weight of Calves. Table 16 gives data on the weight of calves at birth.

TABLE 16. BIRTH WEIGHT OF CALVES

Breed	Males		Females		Av. Both Sexes		Weight of Calf in Proportion to Weight of Dam Per Cent
	No.	Lbs.	No.	Lbs.	No.	Lbs.	
Jersey	102	58	94	53	253	55	6.3
Holstein	69	93	85	88	229	89	7.8
Guernsey					57	71	7.1
Ayrshire	27	73	26	65	80	72	7.3
Brown Swiss					5	100	8.9
Dairy Shorthorn	11	74	19	73	30	73	6.0

This table shows the males average heavier than the females at birth. The Brown Swiss and the Holstein calves are the largest

at birth, and are also heavier in proportion to the weight of their dams.

About three out of five calves come within 10 per cent of the average weight. Breed is the most important factor influencing the size. The maturity of the cow also has some effect as shown in Table 17.

TABLE 17. INFLUENCE OF AGE OF DAM UPON WEIGHT OF CALF AT BIRTH

	JERSEYS		HOLSTEINS	
	No. of Calves	Average Weight Lbs.	No. of Calves	Average Weight Lbs.
First calf	44	41	45	85
Second calf	35	55	31	88
All subsequent calves .	116	57	79	95

There is a tendency for cows of advanced age to produce calves rather smaller than those from cows in the prime of life.

The size and vigor of the calf at birth is not influenced as much as might be expected by the previous feeding and condition of the dam. The reproductive function is so strong that in case of insufficient feed the fetus draws on the mother's body, and it is the mother that suffers mostly from the deficiency in nourishment. On the other hand, when a cow is excessively fat, the calf is more often somewhat undersized.

Raising Calves by Hand. The dairy calf is almost always reared by hand, although a small amount of the total milk production of the country is from cows whose calves are allowed to take a portion of the milk from their mothers. As a rule, the milk of the dairy cow is worth much more on the market than in the calf. The question of calf raising is divided into two parts. One deals with calf raising where skim milk is available — as is generally the case when cream or butter is sold. The second part is concerned with methods of raising the calf where the wholemilk is sold for market purposes or to a condensery or cheese factory. In this case no skim milk is usually on hand, and the calf must be fed whole milk, which makes an expensive ration, or it must be given some substitute for milk.

Raising Calves on Skim Milk. It is a well-established fact that a calf can be raised on skim milk and be as good as one

nursed by its mother. In localities familiar with dairying this is well understood, but in other places is virtually unknown. Some have seen unhealthy and under-sized calves that have been fed skim milk, and have considered them as the necessary result of feeding skim milk. Such calves are the unfortunate victims of their owners' ignorance or carelessness. The skim milk calf raised

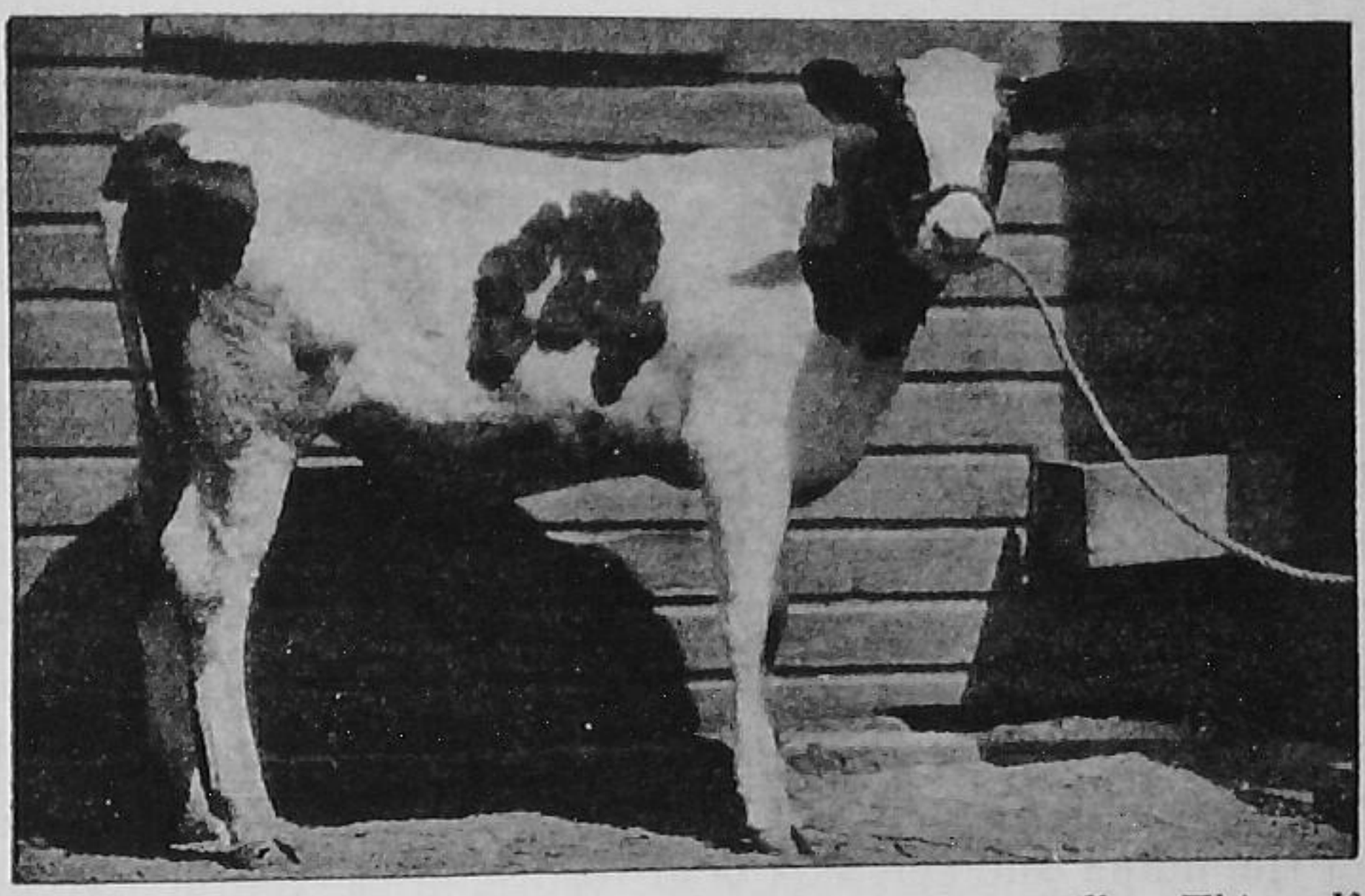


FIG. 44. A calf six months old raised on skim milk. This calf made a growth somewhat above normal on a ration of skim milk with the usual grain and hay supplements. Daily gain from birth 1.5 pounds.

according to modern methods differs little, if any, in size, quality, thrift, and value from the same animal when raised by the cow. The poor results which have so often followed the feeding of skim milk have been due to the faulty methods because the cream which has been taken out is absolutely indispensable to the normal development of the calf.

Composition of Skim Milk. The following statement gives the average composition of whole milk and separator skim milk:

	WHOLE MILK	SKIM MILK
Water, per cent	87.10	90.50
Fat, per cent	3.90	.10
Proteins, per cent	3.40	3.57
Sugar, per cent	4.75	4.95
Ash, per cent	.75	.78

It will be observed that the skim milk differs from the whole milk only in having most of the fat removed. The other constitu-

ents are slightly increased. The butterfat or cream is by no means the most valuable part of the milk for the calf. The fat does not serve primarily to support growth in the young animal, but to keep up the heat of the body and to supply fat for body tissue. Material which serves these purposes can be supplied much cheaper in the form of carbohydrates in corn meal or other grain. Milk fat is one of the carriers of vitamin A, but fortunately the precursor of this essential substance is also present in the leafy portions of many forage plants and can be supplied to the animal in the roughage portion of the ration. The raising of the calf on skim milk is economical, because it is possible to make this substitution of a comparatively cheap grain for butterfat, which has a commercial value for human food out of proportion to its food value for a calf.

Taking the Calf from Its Mother. There is great difference in opinion and practice regarding beginning of hand feeding. Some take the calf away from its mother at once, without allowing it to nurse at all. Others prefer to let it nurse once; and some allow it to remain with the cow three or four days, or until the fever is out of the udder and the milk is fit for use in the dairy. It probably makes little difference as to this point; but it is a fact easily established that the earlier the calf is taken from the cow, the easier it will be to teach it to drink. The calf that has never nursed is easily taught to take the milk from a pail, while one a week or a month old is often a difficult subject to teach. A safe practice and one generally followed is to take the calf away from its dam on the third day. When the udder is caked it is best to leave the calf with her until this condition is removed.

Importance of Colostrum. One point that must be kept in mind is that at first the milk from the mother should always be given the calf, and not milk from some other cow. The first milk, or colostrum, given by a cow is especially suited to the requirements of a young calf. The usual explanation has been that the colostrum acts as a physic and stimulates the digestive organs. Recently it has been found by one investigator that two proteins of the blood which are absent in the new-born are present following the ingestion of colostrum.

Investigations emphasize the importance of the colostrum milk to the new-born calf and give a new explanation of its value. In experiments all of ten calves allowed to take colostrum survived,

while eight out of twelve which did not get colostrum died, and one other did not thrive. Their explanation is that calves deprived of the colostrum lack something which permits intestinal bacteria to invade the body and multiply in the various organs. In most cases a rapidly fatal septicemia (blood poisoning) is the result. The calves which do survive are able to resist the invading bacteria and develop into normal animals, or in some cases the joints or kidneys may be affected. According to the view of the investigators the function of the colostrum is to serve as a protection against miscellaneous bacteria which are harmless when the protective functions of the calf have begun to operate. Colostrum also has a high vitamin A content. For these reasons the calf must get one and preferably more feedings of the colostrum milk from its dam.

Under natural conditions the calf takes its milk frequently and in small quantities. The calf's stomach at this time is not suited for holding a large amount, and an excessive amount always results in indigestion or scours. For this reason it is well to feed the young animal three times daily for a week or two. It is an easy matter to teach a calf to drink milk from a pail. Omit the first regular feeding period after the calf is removed from its dam and it will be eager and hungry. Then offer it a small amount of milk in a pail and gently lower its head until the muzzle is in the milk by allowing the calf to suck the feeder's fingers, drawing its head down into the bucket, and withdrawing the fingers when it tastes the milk.

Importance of Fresh Milk. In order to make a success of raising the calf on skim milk, the condition of the milk must be uniformly good. One of the common causes of indigestion and its most pronounced symptom, scours, is the feeding of stale milk. The younger the calf, the more sensitive it is to the condition of the milk.

The Creamery and the Skim-milk Calf. Patrons of creameries who deliver whole milk for separation and take back skim milk have often experienced difficulties in raising calves on this returned milk, especially in warm weather, when the milk sours on the return trip. Another grave danger incident to this practice is the introduction of disease into the herd, as the milk which the patron receives is part of a mixed lot from a number of farms. These troubles can only be avoided by thorough pasteurization

of this skim milk at the creamery before it is taken back to the farm. Every creamery receiving whole milk should be equipped to handle skim milk in this manner, and patrons should insist upon careful pasteurization as a safeguard against disease and calf troubles.

The Farm Separator and the Skim-milk Calf. The rapid introduction of the hand separator has largely solved the question of

FIG. 45. A group of skim-milk calves on pasture. Up to two months, calves do best kept in the barn. Later they may be given the freedom of a special pasture.

getting good skim milk for calf raising, as well as having several other important advantages. Warm, sweet skim milk, separated within a few minutes after being drawn from the cow, is in the best possible condition for the calf, and by observing the points already mentioned and as practiced by the most successful dairymen, little trouble will be had in raising as good calves as are raised in any other way. The majority of those producing cream or butter for sale insist on some means of raising the calf satisfactorily, and the hand separator seems to fill the want better than any other system.

Importance of Keeping Pails Clean. The greatest cause of sickness in hand-raised calves is feeding from dirty pails or cans. Every utensil which comes in contact with milk to be used for feeding should be kept clean by scalding as thoroughly as though the food were to be used for the owner's family. A good rule is to

keep the calf pails as clean as the milk pails. In feeding grain, no more should be fed than will be eaten up clean. If grain is allowed to remain in a trough, it often becomes damp and partly decayed, and may cause sickness, just as dirty pails will often do.

Clean Pens and Barns a Necessity. Another point to be kept in mind is that the young calf must be kept in a clean, well-bedded stall while in the barn. Experience has taught many men that a

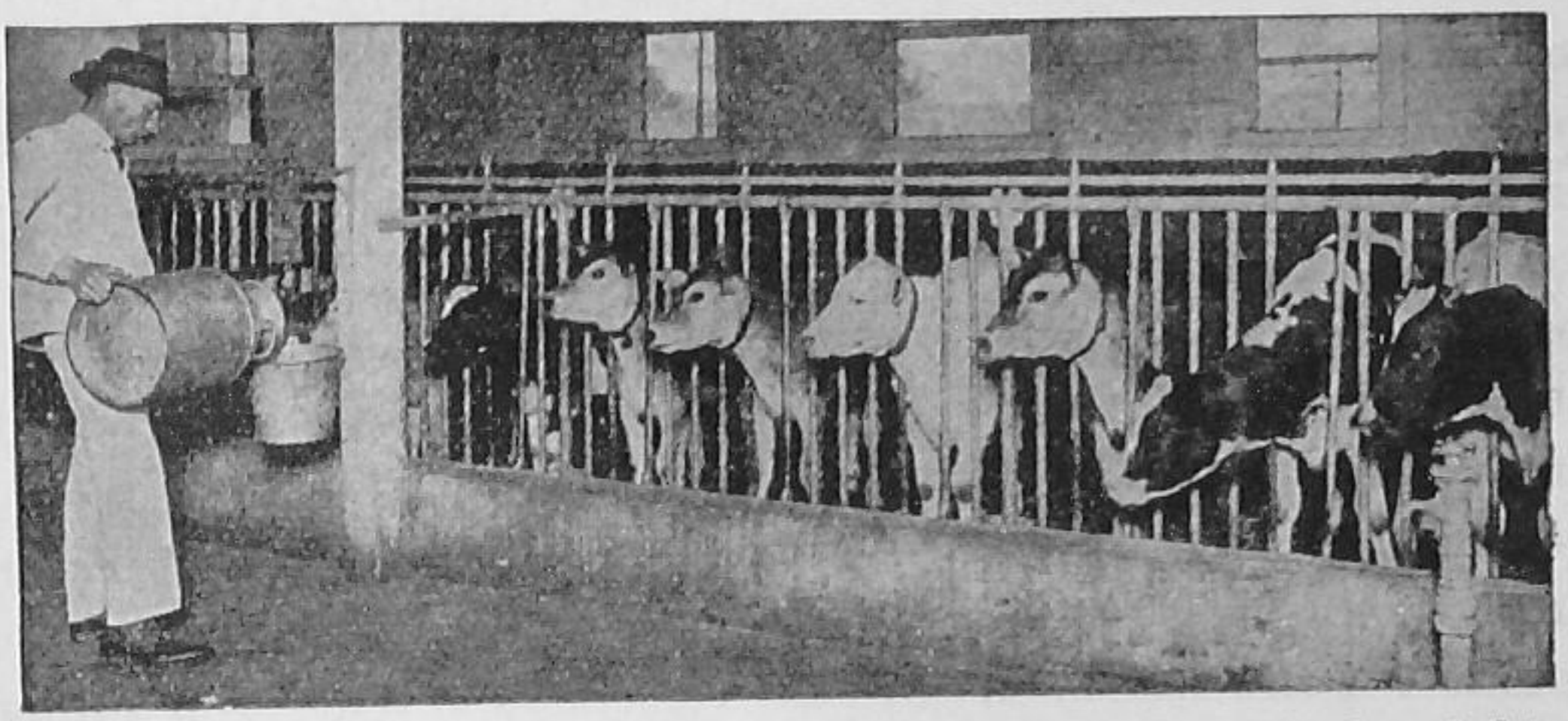


FIG. 46. Calves tied for feeding. Calves should be tied when fed to insure that each individual will get the proper amount of milk and as a convenience for the feeder. Note the feeder is weighing the milk.

calf will not do well in a damp, dirty pen or stall. Under such conditions pneumonia is common. The calf needs all the sunlight it can get, and the well-lighted stall is always best. In arranging a barn, the sunniest and warmest part should be reserved for the calf pens. In the summer the calf should have access to a small pasture with plenty of shade.

Plenty of Water Needed. An abundance of clean water should be accessible at all times or at frequent intervals, as the calf is not satisfied with milk alone as a drink, and wants to drink a little water at a time, quite often during the day. This thirst for water is often overlooked when calves are raised by hand, and as a result the calf is thirsty as well as hungry, and gorges itself with milk when it has a chance.

Mineral Matter. Our present knowledge of mineral requirements for growing animals show that calves should always have an abundant supply of at least calcium and phosphorus. Keeping a supply of finely ground bone meal before the calves will insure a sufficient supply of calcium and phosphorus. Salt should also be kept within reach when the calf is old enough to eat grain and hay.

Fall or Spring Calves. There are a number of advantages in arranging that the calves to be raised by hand shall be dropped in the fall. The calf can be kept growing nicely on skim milk until the grass comes, then weaned and turned out to pasture without checking its growth in the least. The disadvantages of winter feeding and cold weather are more than offset by the hot weather and annoyances from flies experienced by the spring calf. For the calf under six months it does not make much difference whether the roughage be grass or hay. Some prefer the latter, but for the second six months grass gives much better results. In the winter season the young calf is also more apt to receive the careful attention it needs than during the busy summer season. As most heifers come into milk at about two years of age, a fall-dropped heifer is ready to begin milk at the season when the results are the most satisfactory.

Summer calves when young are greatly annoyed by flies and can be made most comfortable by allowing access to a darkened stall during the daytime. Breeders of valuable pure-bred animals find it a good practice to inclose a small pen with fly screen for the young calves.

Weaning. Unless the supply of skim milk is abundant, there is no particular advantage in continuing the milk feeding period beyond six months of age. When the calf reaches this age it is capable of eating a sufficient amount of grain and hay to continue its growth unchecked when the milk is eliminated from the ration.

Raising Calves without Skim Milk. Dairymen who sell their product as market milk, or to a cheese factory or condensery, are confronted with the problem of raising calves without skim milk, as the separation of a small quantity of milk for calf feeding involves additional labor cost and further complicates the marketing problem. The use of whole milk entirely for raising young stock on these farms would make the cost of feeding calves prohibitive, as a calf would require 400 to 500 pounds a month for proper development, and at $2 per hundred pounds the calf would consume about $50 worth of milk during the first six months, or the ordinary milk feeding period. Under such conditions there is a strong temptation to veal the calves; but the unsatisfactory results and dangers which follow the practice of replenishing the herd by purchases have already been pointed out.

Three methods are suggested for successfully raising calves on

farms where whole milk is sold, and the purpose of each is to limit the use of milk to a minimum quantity. The first is by using a so-called "milk substitute," either a commercial calf meal or home mixture fed as a gruel. The second is the use of a small quantity of whole milk either by dilution or feeding it in conjunction with calf-meal gruel. The third is to use whole milk during the first six or eight weeks to insure a good start in growth and then put the animal on a ration of grain and hay.

Raising Calves with the Minimum Amount of Milk. Another plan of raising the calf when whole milk is sold is coming into use.

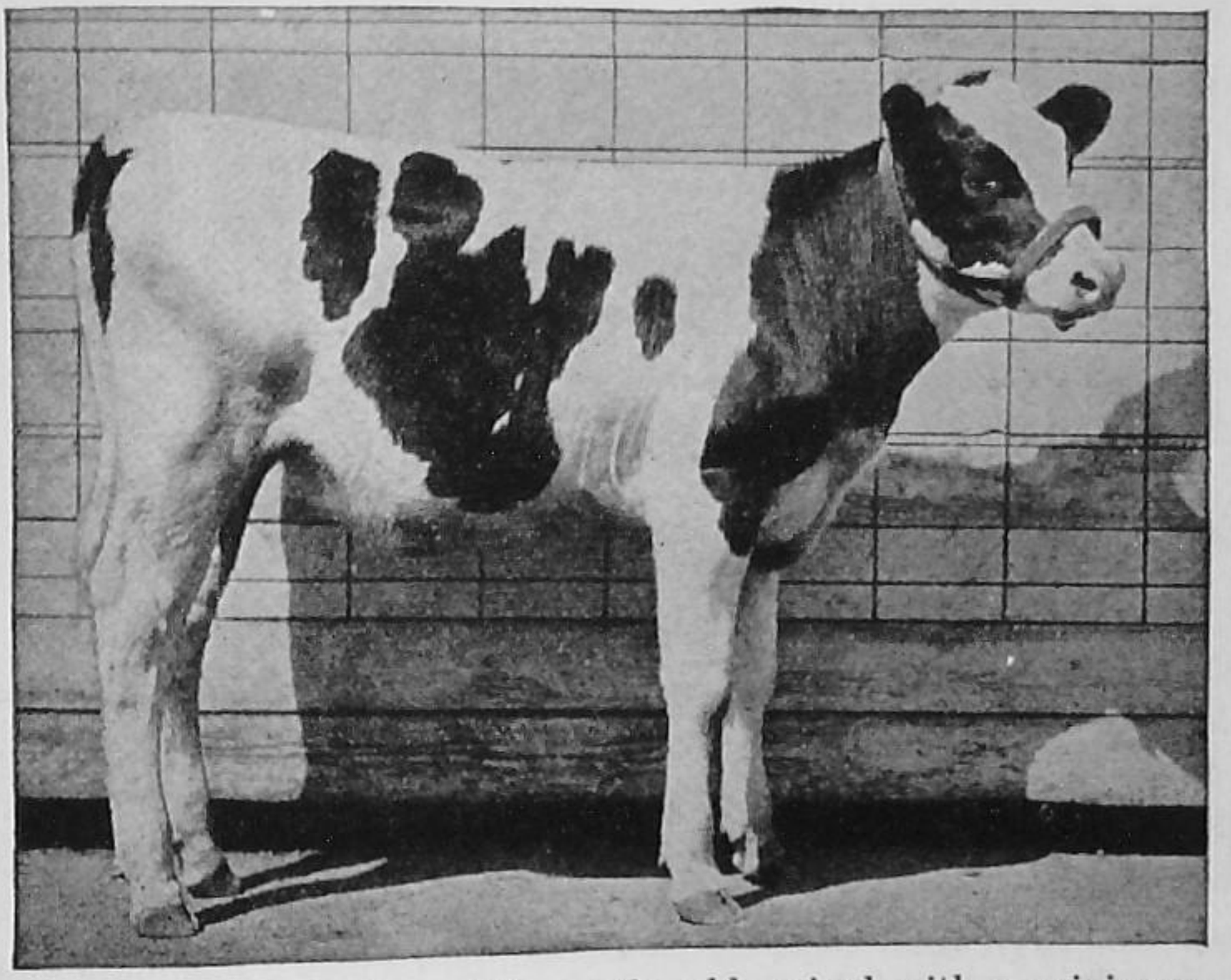


FIG. 47. A Holstein calf 6 months old, raised with a minimum amount of skim milk.

The basis of this practice is the admission that there is no substitute for milk and that the important thing in calf raising is to give the animal a good start by using milk and then to change the ration as soon as practicable to one of grains and roughage.

Another method of limiting the milk feeding to a minimum quantity is to get the calves well started on a milk ration, at the same time encouraging them to eat as much grain and hay as possible, and then wean them as soon as they are able to continue to develop satisfactorily on grain and hay alone.

Calf Feeders. Several calf feeders have been devised and used

in a small way. They are mostly made on the plan of having a rubber nipple for the calf to suck, and a tube of some kind to draw the milk from the pail. The claim is made that it is better for the calf to drink the milk slowly and mix the saliva with the milk, which is done when the calf takes the milk from the rubber nipple. In practice it is found difficult to keep the tubes clean, and it is more work to feed the calf in this way than by teaching it to drink

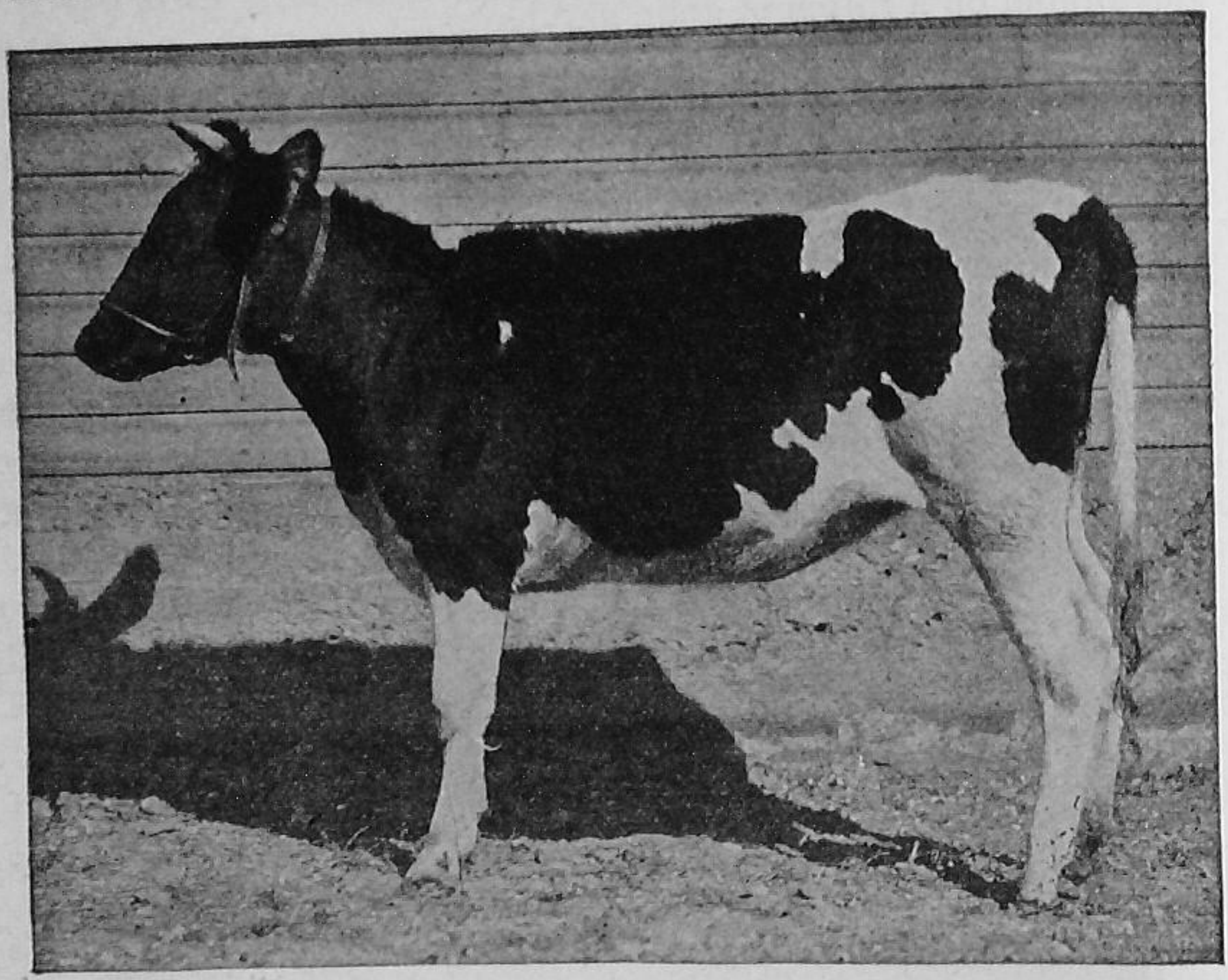


FIG. 48. A Holstein heifer 18 months old, raised with a minimum amount of milk. She received only 449 pounds of milk, and none after 50 days of age. Her grain ration and hay were as recommended in the text. At one year of age she weighed 522 pounds and was 92 per cent normal in size. At 18 months she was in splendid condition and of average size for the breed.

from the bucket. As to the injurious effects of rapid eating, it is doubtful if saliva has much to do with the digestion of the milk, since the principal office of saliva in digestion is to moisten the food and convert the starches into soluble sugars, and there is no starch in milk. Rapid gulping of milk, however, is thought to cause injurious curdling within the stomach in some cases.

Separate Pens for Calves. Where valuable calves are raised and it is desirable to take every precaution to keep them in good condition, it is advisable to arrange a series of small pens so each animal

may be kept by itself. This not only allows each animal to get the proper amount of feed, but enables the feeder to observe the individual more readily and detect any unusual conditions. The belief has been growing in recent years that much of the sickness of calves, including a portion of that usually classed under the term "scours" is really infectious in character. For this reason in the best-equipped barns, not only are individual pens used but the partitions are of solid construction to prevent any communication from one animal to another. A case of common scours from indigestion may often be stopped by decreasing the feed of a certain calf after observing an abnormal condition of the manure so slight that it would not be possible to locate the affected animal in a group.

Stanchions for Calf Feeding. The best arrangement next to the individual pen, and the one most commonly used, is a large pen or series of pens constructed in modern barns, of steel — although wood will serve the same purpose — with a row of stanchions along the front for tying the calves during feeding. Some means of tying the calf during feeding should be provided by all means, not only to save labor, but to allow each calf to get its proper share of milk and grain. Calves should never be fed in a trough, as some will drink faster than others and be overfed, while others will be underfed. The same rule applies to the feeding of grain.

Stanchions for calves are constructed much like the old-fashioned rigid stanchions for cows, but smaller. A feed trough is put in front and divisions provided to keep the feed of each calf separate. The pail of milk is set in the trough for the calf to drink. After drinking the milk, the proper amount of grain is put in the trough, and the calves are left tied for some time to eat their portion. This usually prevents them from forming the habit of sucking each other, which is a point of some importance. If the calves are in the pasture, a convenient way is to fasten the stanchions on the fence. In the barn provision should be made for holding a sufficient supply of hay. A rack constructed of steel or wood and placed with the back against the wall and at suitable height is quite satisfactory for this purpose.

VEAL PRODUCTION

Veal Production. Under European conditions, where few cattle are kept especially for meat production, veal occupies a decidedly important place in the meat supply of the people. In America,

where the abundance and comparative cheapness of feed has made possible the raising of large numbers of animals primarily or exclusively for beef, veal is of far less importance and has not received much attention. In fact, veal calves are merely a by-product of milk production and the source of supply for a city is in general the same herds which supply it with milk. In milk-shipping districts the practice is altogether too common of selling the heifer calves as well as the males for veal.

Returns in Veal Production. The first question that arises in connection with the veal calf is whether the price received justifies the amount of milk necessary to feed the animal until it can be put on the market. The veal calf commanding the highest price on the market is one weighing from 140 to 160 pounds at an age of from six to eight weeks. The carcasses of such calves are characterized by flesh of light color and fine grain. The most important factors contributing to the value of a veal are condition and weight for age. With these facts in mind it can readily be seen that the birth weight of the calf is a pertinent factor in the economy of its use for veal, since a calf weighing 100 pounds at birth will reach the most desirable weight in half the time and on approximately half as much milk as the 50-pound calf. Assuming that an average of 10 pounds of milk is necessary to produce one pound of gain, and that milk is worth $2 per 100 pounds and veal ten cents a pound, the cost of raising veal calves to weight of 150 pounds is as shown in Table 18.

TABLE 18. RELATION OF BIRTH WEIGHT OF CALF TO VEAL PRODUCTION

Birth Weight of Calf, Lbs.	Amount of Milk Fed, Lbs.	Value of Milk	Value of Veal
40	1,100	$22.00	$15.00
50	1,000	20.00	15.00
60	900	18.00	15.00
70	800	16.00	15.00
80	700	14.00	15.00
90	600	12.00	15.00
100	500	10.00	15.00

At these values a calf weighing less than 75 pounds at birth will not bring enough as veal to pay for the milk it consumes. Whether or not the calf can be raised profitably for veal clearly depends upon

the price of milk, the market price for veal, and the size of the calf at birth. It is often found that it costs more to feed calves, especially of the smaller breeds, than is received when the calf is sold and for this reason many do not attempt to do so, but destroy all calves not needed for breeders at birth. Where a number of cows freshen at intervals, some of the calves are often raised that otherwise would not be by feeding the milk of the fresh cows up to the time it is fit for market.

Approximately 10 pounds of milk are required for every pound of gain made by the veal calf, but seldom will the selling price of the calf by the pound equal the market value of 10 pounds of milk. Under common conditions every pound of gain on a veal calf is made at a loss. The only profit made is by selling the weight of the calf at birth, and it follows that the younger a calf can be sold as a rule the greater the profit, even though the total income is less. It is for this reason that the tendency is to sell the calf as young as possible and that cities and states have found it necessary to establish regulations concerning the minimum age at which calves may be sold for veal. Three weeks is the standard regulation, but it does not prevent many from going to market before this age is reached. The practice of putting calves on the market too young results in poor quality and a relatively small demand.

Classification of Veal on the Market. Calf carcasses weighing less than 300 pounds and having comparatively light-colored flesh are classed as veal. The grade and value of a calf carcass depends upon its form, quality, finish, and weight. The most desirable is a well-fatted calf about six weeks of age and weighing 120 to 140 pounds. The flesh should be as nearly white as possible. Dark-colored flesh is an indication of too much age, or too much coarse feed. Calves four to six weeks old are preferred, while some are at their prime at eight weeks. Calves under three weeks are condemned. The following are the grades used on the market:

Grades	Extreme Weights	Age
Choice	80 to 120 lbs.	4 to 8 weeks
Good	70 to 130 lbs.	6 to 10 weeks
Medium or fair	60 to 160 lbs.	5 to 12 weeks
Light or common	40 to 75 lbs.	3 to 8 weeks
Heavy	150 to 300 lbs.	Wide range

The market price varies widely for veal calves depending upon the quality. The most common faults are: either too heavy or too light, lacking in fat, or flesh too dark colored.

Feeding for Veal. It is a well-established fact that a first-class veal calf must be fed exclusively upon whole milk, or at most must be allowed to consume a very limited amount of hay and grain. The calf is generally taught to drink from a pail as it is not desirable to have a cow that is to be milked nursed by a calf more than two or three days at most. From ten to twelve pounds of milk a day are used at first and gradually increased until a vigorous calf may receive 8 to 10 pounds (4 to 5 quarts) twice a day before it is marketed.

DISEASES OF CALVES

In discussing diseases of calves we are dealing with a subject on which present-day knowledge is scant, and the field of calf ailments and their prevention and cure affords a splendid opportunity for study and research. The subject is now receiving more serious consideration by a number of investigators; but the nature of some of the maladies which afflict young animals, and methods of control and cure are still in doubt. This lack of knowledge is causing great economic waste, as the rate of mortality for young calves of the dairy breeds is appallingly high. Many of the animals are lost each year through lack of care and intelligent handling on the part of feeders.

Disease-free Foundation. The first step toward insuring healthy calves in any herd of cattle is to breed only animals that are free from disease of the reproductive organs. When conception occurs as the result of the mating of two animals with normal and healthy genital organs, and care is taken to protect the pregnant cow from subsequent exposure to diseases which would affect her reproductive ability, then we may be reasonably sure that the offspring will be born in perfect health.

Importance of Sanitary Quarters. The next step is to take precautions for the reception of the new-born animal, by providing the dam with a clean, roomy stall, freshly bedded with dry clean bedding. After the calf is born, remove any persistent membrane or mucus from the mouth and nostrils, and allow the cow to lick the calf dry. Later the navel cord should be dipped in tincture of iodine and dusted with boric acid.

All precautions having been observed to insure a healthy calf at birth, the animal, if worth raising to maturity, can best be raised by housing it in sanitary, dry, well-ventilated quarters with provision for sunshine, fresh air, and exercise, and by feeding it to induce satisfactory growth and development.

CHECK-UP 20

Having read this chapter, you have picked up some of the major considerations about calf-raising.

A. Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. If you are a dairyman compelled to start with a herd of ordinary quality, you can raise the average production of the herd within a few years by: (a) proper choice of sire; (b) careful attention to rearing of calves; (c) letting the bull run with the herd.
2. Most dairy calves are raised: (a) by hand; (b) on the dam; (c) on another cow.
3. The best way to prevent fatal septicemia in young calves is to make sure they get: (a) plenty of whole milk; (b) skim milk; (c) colostrum milk.
4. In hand-raising calves it is of great importance that: (a) feeding utensils be perfectly clean; (b) pens and barns be kept clean; (c) clean water be accessible at all times; (d) minerals be available.
5. It is most advantageous to have calves dropped in the: (a) spring; (b) summer; (c) fall; (d) winter.
6. Very young calves may be fed on: (a) whole milk; (b) skim milk; (c) calf meal; (d) turnips.
7. The profit, if any, in veal production comes largely from: (a) the birth weight of the calf; (b) the value of the hide; (c) the use of the colostrum.
8. The first two steps toward insuring healthy calves are: (a) breeding disease-free animals; (b) breeding pure-bred animals; (c) sanitary quarters; (d) good feed.
9. When a cow is excessively fat at the time she calves the calf is likely to be: (a) excessively fat; (b) oversize; (c) undersize.
10. Poor results following the feeding of skim milk to calves may be caused by: (a) the removal of the cream; (b) faulty feeding methods; (c) lack of attention from the cow.

11. Skim milk differs from whole milk in that: (a) the butterfat is removed; (b) the other constituents are slightly increased; (c) the taste is altered.

12. It is well to feed the calf two or three times daily because: (a) its stomach cannot hold large amounts; (b) under natural conditions the calf takes milk frequently and in small quantities; (c) large amounts of feed cause indigestion or scours.

13. The most important factors contributing to the value of a veal are: (a) condition and weight at birth; (b) cost of milk; (c) condition and weight of dam.

14. First-class veal must be fed almost exclusively on: (a) grain; (b) hay; (c) milk.

15. Under common conditions the only profit from veal is made by: (a) selling the birth weight of the calf; (b) selling the milk fed to the calf; (c) selling the calf skin.

B. Charles Ashley bought a dairy farm with a herd of 20 Guernsey cows. Ashley's market is for whole milk. At the end of his first year Ashley found that his herd was producing an average of about 6,000 pounds of milk per cow. He had kept records and knew which cows were good or superior producers. He sold the poor producers and bought other Guernseys to replace them. He had sold his calves for veal though he lost a number of calves. What would you have done if you had been Ashley?

Place an x in front of each item in the left-hand column that you would have done during the first year if you had been Ashley. Place an x in front of the items in the right-hand column that Ashley should do during his second year of operation.

Ashley's First Year	Ashley's Second Year
a ( ) Bought more cows to replace low producers	a ( ) Market veal calves at age of not more than a month
b ( ) Bought no cows to replace low producers	b ( ) Wean calves when they are about two months old
c ( ) Retained six carefully selected heifers	c ( ) Plan breeding so calves are dropped in the fall
d ( ) Scald all utensils used to feed calves	d ( ) Test cows for abortion and tuberculosis
e ( ) Raised no heifers	e ( ) Cull out inferior cows
f ( ) Fed calf colostrum milk from its dam	f ( ) Provide means to feed calves separately

ASHLEY'S FIRST YEAR—*Continued*—ASHLEY'S SECOND YEAR

g ( ) Obtained services of a pure-bred Guernsey sire

h ( ) Fed calves bone meal and salt

i ( ) Obtained services of a pure-bred Holstein sire

j ( ) Fed young calves once daily

k ( ) Raised calves on whole milk

l ( ) Raised calves on substitute milk

m ( ) Fed young calves on fresh skim milk

n ( ) For first two months fed young calves three times daily

g ( ) Obtain services of a pure-bred Guernsey sire

h ( ) Raise bull calf with strong dairy-type ancestry

i ( ) Provide clean roomy stalls for dams

j ( ) Sell cows after first milking period is over and retain only heifers

k ( ) Hand-feed calves

l ( ) Buy additional heifers

m ( ) Keep water accessible to calves and cows at all times

n ( ) Provide plenty of sunshine, fresh air, and exercise

o ( ) Keep quarters dry and sanitary at all times

CHAPTER XVII

RAISING DAIRY HEIFERS

A correctly grown and developed dairy heifer is the basic foundation for a satisfactory dairy cow. Every breeder of dairy cattle is therefore interested in knowing what factors are at work during the growing period of the heifer's life and what effect these forces may have on the development and future producing ability of the animal. The economic importance of a thorough study of the problems of growth and factors bearing thereon has made this a fruitful field for research and experimentation, and the progress of scientific study has led investigators deeper and deeper into the mysteries of growth, the natural laws and forces which govern it, and the influences and effects of nutrition on the functioning of those laws and forces.

Nature of Growth. An entirely satisfactory definition of the term "growth" is lacking, but the general understanding is that it embraces that series of changes in size and structure by which an individual of any species develops from the fertilized egg to maturity. Increases in size may be brought about by multiplication of the cells, enlargement of the individual cells, or deposition (placing) of material between the cells. The first of these is without doubt the most important. In all higher organisms, increase in size is accompanied by a differentiation of the cells into groups, called tissues and organs, many of which assume a high degree of specialization of function.

Two Factors Concerned in Growth. Growth is an exceedingly complicated phenomenon. Although the outward manifestations of growth have been observed by man since human intelligence first came into existence, the nature and cause of growth are still far from a complete solution. The general conception should be developed first of all that the causes operating in growth are of two general classes: (1) the internal factors and (2) the external factors.

It might be well to point out at this point the analogy to the production of milk. The secretion of milk likewise is controlled by two classes of factors which may be described in the same terms,

internal and external. The external factors in both milk production and growth are the environment of the animal, including feed, housing, care, and management in general.

Limits of Growth. The upper limit of the skeletal size attained by any individual under favorable conditions is determined by heredity. Even the greatest intake of food will not permit the animal to grow beyond his inherited capacity for growth but good feeding will help it attain its greatest possible size. This heritage of growth falls within the limits of size of the species, and in every species there are individual variations between the upper and lower limits, although the great majority of the members are grouped close to the average size.

Measuring Growth. Students of the effects of various factors on growth often conduct their experiments with laboratory animals. These are used in large numbers, and weight is the most common basis for measuring growth. By weighing a great many animals receiving a normal ration, figures have been secured which represent the normal average growth, and these figures represented graphically are known as a curve of normal growth. The growth of experimental animals is compared to these normal growth curves to determine the effect of the factors studied on the growth of the animals.

Until comparatively recent times the growth of larger animals has been measured almost entirely by means of their body weight. It is now recognized that this is not the most satisfactory way to measure growth, because the body weight and skeletal growth are, to a considerable degree, independent of each other. On account of the small limit of error, and the ease with which it is taken, the height at withers was selected as a satisfactory measure of skeletal growth. The growth of the animals, therefore, may be measured by combining: (1) gain in live weight, and (2) increase in height at withers.

Internal Cause of Growth. At the time of the fertilization of the egg, or union of the sperm and ovum, powerful forces are set in motion. These forces have long been included under the rather vague term "growth impulse," because some vital force seems to operate in an organism until spent in the achievement of its complete growth. Other general evidence for such a view is the apparent persistence of some sort of stimulus as shown by the dogged efforts of animals to grow under most unfavorable circum-

stances, and the revival of growth, often at an accelerated rate, when favorable circumstances for growth are restored.

Heat, Light, and Ventilation. Proper development and satisfactory growth are dependent upon proper heat, light and ventilation; but these are ordinarily adequately controlled by the breeder and can be regulated by proper housing. Young animals exposed to inclement weather or stabled in dark and poorly ventilated quarters will usually be backward in growth and susceptible to disease. These matters will be dealt with in more detail in later chapters.

Effect of Nutrition on Growth. Food supply is by far the most important factor under the control of man in rearing domestic animals. The inherited capacity for growth and the factor of nutrition are closely related, growth being largely dependent upon proper food. Nutrition can only give growth capacity full play, but neither can succeed without the other. The capacity to grow is suspended when adequate food is lacking. On the other hand, no amount of food can force the animal to grow beyond its predetermined size.

As a result of extensive study and observation, we now realize that for the successful accomplishment of our aims in cattle feeding the dairy ration must not only be sufficient in quantity, but must be complete in the quality of its make-up. In other words, we must recognize and incorporate into our feeding practices the facts which have been brought to light by careful studies in animal nutrition.

Until recently, proteins, carbohydrates, and fats in quantities as specified by feeding standards were believed to fill the demands of a complete diet. Then came recognition of the fact that the mineral constituents of the diet are of importance. Physiologists studied the digestion of proteins and their use in the animal body, and soon realized that proteins are not all alike. Chemists took up the problem and analyzed the proteins, thereby discovering the remarkable differences in their structure. Feeding of purified food substances brought to the notice of investigators other heretofore unknown dietary essentials, which were first made conspicuous by their absence in supposedly complete diets. Each new discovery was the result of extensive investigation, and one by one the new factors have been studied, analyzed, and finally embodied in our fund of knowledge regarding nutrition.

Function of Carbohydrates. The chief function of the carbohy-

drates in foods is to supply energy to carry on the life processes, maintain the warmth of the body, to build reserve tissue, and in the case of lactating animals to furnish materials for the milk sugar and butterfat in the milk. The ordinary feeding stuffs contain an abundance of carbohydrates, and the matter of adequate supply of energy need not give the feeder any trouble.

Function of Proteins. The proteins of the ration are utilized to replace worn-out tissue and to build new tissue as the animal grows. It is the specific amino acids (parts of proteins) in the food proteins, not the proteins themselves, which are used for these purposes. In addition the highly specialized cells and organs also demand specific amino acids in order to continue their normal functions, and unless the proteins in the food furnish these substances in adequate amounts, physiological disturbances result. When the total energy supply in the food is deficient, amino acids are used for energy and even under normal feeding conditions surplus amino acids are employed for this purpose. During lactation the food proteins are needed for the formation of milk proteins and may even be raw material from which milk fat is formed.

The best recommendation for the feeder is to use as large a variety of protein feeds as is compatible with economical practice, as variety is the best assurance that the amino acid content of the proteins fed will be satisfactory. During the growing period there is greater need for protein and the proportion of protein in the ration should be greater than when the animal is mature.

Function of Fats. Until recently fats have not been regarded as furnishing any specific nutrients other than being an especially rich source of energy. It has been assumed that the animal body possesses an unlimited capacity to produce the fat constituents of the body from the food carbohydrates and fats. Recent work points to a limited capacity of animals to form certain of the unsaturated fat acids which are apparently needed for specific purposes. Fortunately these are abundant in many of the foodstuffs commonly fed to dairy cattle, especially the grains and protein concentrates. The importance of food fat in the production of milk fat is receiving renewed attention, although it is still recognized that food carbohydrates play an important role in this regard.

Function of Mineral Matter. The importance of mineral matter

in the ration is receiving more and more attention as the productive ability of dairy animals increases. In growing animals the construction of new tissue, particularly bones, requires proper amounts of minerals — especially calcium and phosphorus — and when lactation sets in this demand is increased to supply those same minerals for the milk. In all animals certain inorganic elements such as sodium, potassium, iodine, iron, magnesium, phosphorus, etc., are necessary in the life processes, such as contraction of the muscles, carrying oxygen in the blood, maintaining neutrality of the blood, contributing to the metabolism of protein and carbohydrates, assisting in the digestive processes, activating enzymes, and controlling osmotic pressure. Recently copper has been shown to be essential for the utilization of iron and cobalt for the formation of normal blood cells. Regions where copper and cobalt deficiencies occur, affecting the growth and development of dairy cattle, have been found in Florida. Cobalt deficiency also occurs in sheep and cattle in Australia and New Zealand.

When leguminous hays and such feeds as bran, oats, cottonseed meal, and linseed meal are used liberally, the mineral content of the ration need cause the feeder no concern, except in feeding high-producing cows, when it may be well to allow the cows to have access to commercial bone meal or some analogous, especially palatable form of calcium phosphate.

Calcium and Growth. Care should always be taken to require growing calves to consume sufficient calcium containing roughage to insure an adequate calcium intake when their milk has been replaced by a grain ration. In fact the roughage will not only supply the calcium which is lacking from grain rations but will also usually provide a sufficient amount of vitamin D, also lacking in grains, to insure the proper assimilation of both the calcium and the phosphorus consumed.

Functions of Vitamins. A great deal still remains to be discovered regarding the importance for dairy cattle of several of the known vitamins. However, it has been established that growing calves and also mature cows require both vitamin A and vitamin D.

Cows can store large quantities of vitamin A. Most of this storage normally occurs when cows are on fresh green pasture, which is especially rich in carotenes.

Calves receiving available sunshine throughout most of the

year in all but the most northern latitudes of the United States probably do not lack vitamin D. Care should be taken that calves receive direct sunshine during mid-day on clear days of the winter in northern latitudes unless the weather is too severe. Sun-cured hay is an important source of vitamin D for calves. The hay normally received by mature cows, together with the sunshine obtained in good herd management, provides all the vitamin D they require. Corn silage also contains some vitamin D available for calves.

Palatability of Ration. To all of the above should be added the requirement of palatability (agreeable to the taste). This is

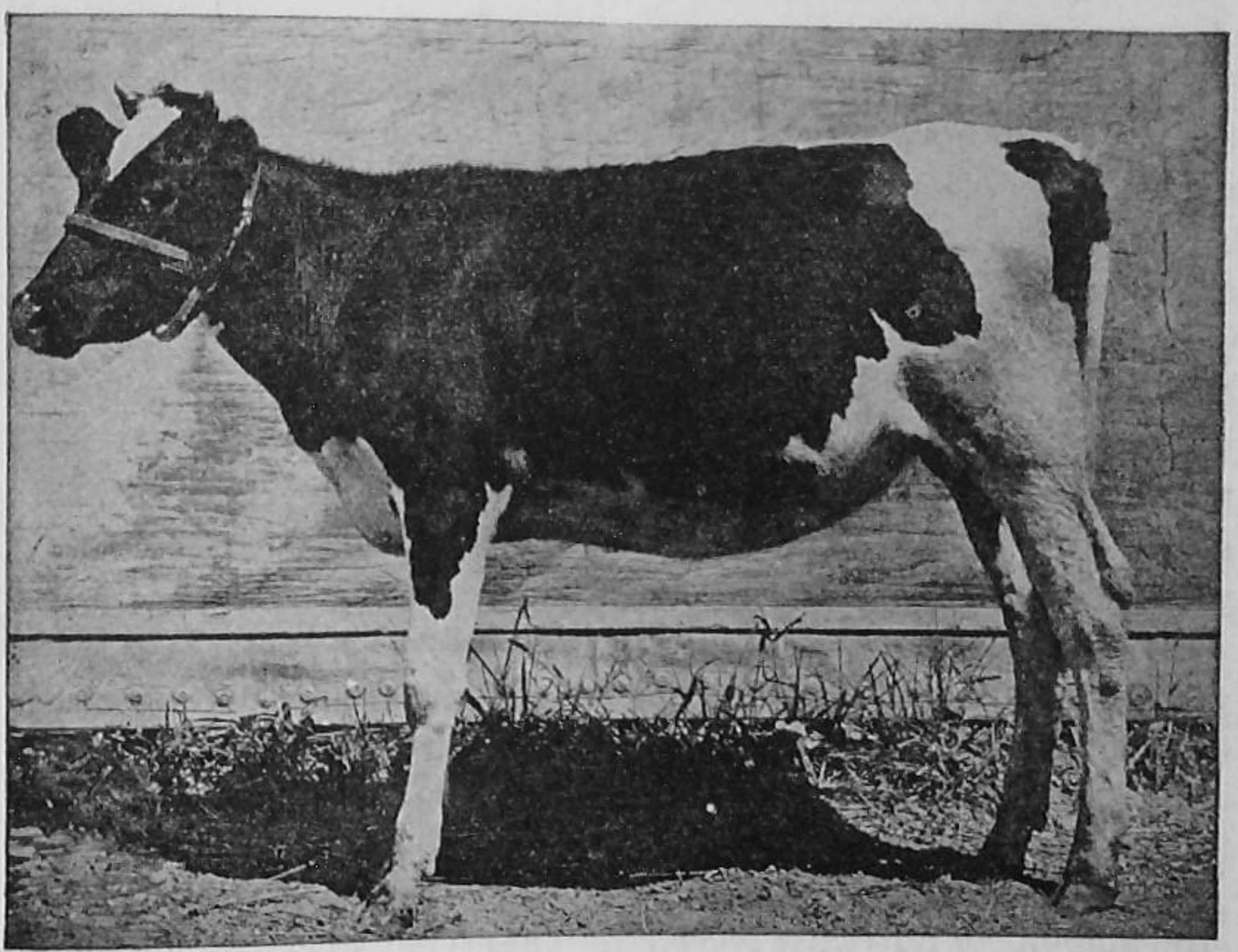


FIG. 49. The influence of the ration on the size and conformation. This Holstein heifer, one year old, weighed 396 pounds, which is only 70 per cent of normal. She received only skim milk and hay—no grain.

secured through the use of a variety of feeding stuffs and those of a succulent (juicy or watery) nature. Succulent feeds help to maintain the tone of the bowels, and in this class are included pasture grasses, silage, roots, green feeds, and beet pulp. It is well to avoid a ration drawn from a single plant source. A satisfactory balance of bulky and concentrated feeds is maintained by allowing the animal as much roughage as she will consume and

feeding grain in proportion to her requirements for growth and milk production. Grain rations should always be made to include some bulky feed, such as bran, to promote better mastication and digestion.

Liberality of the Ration. It is a well-known fact that the rate of growth of an animal is dependent to a considerable extent upon

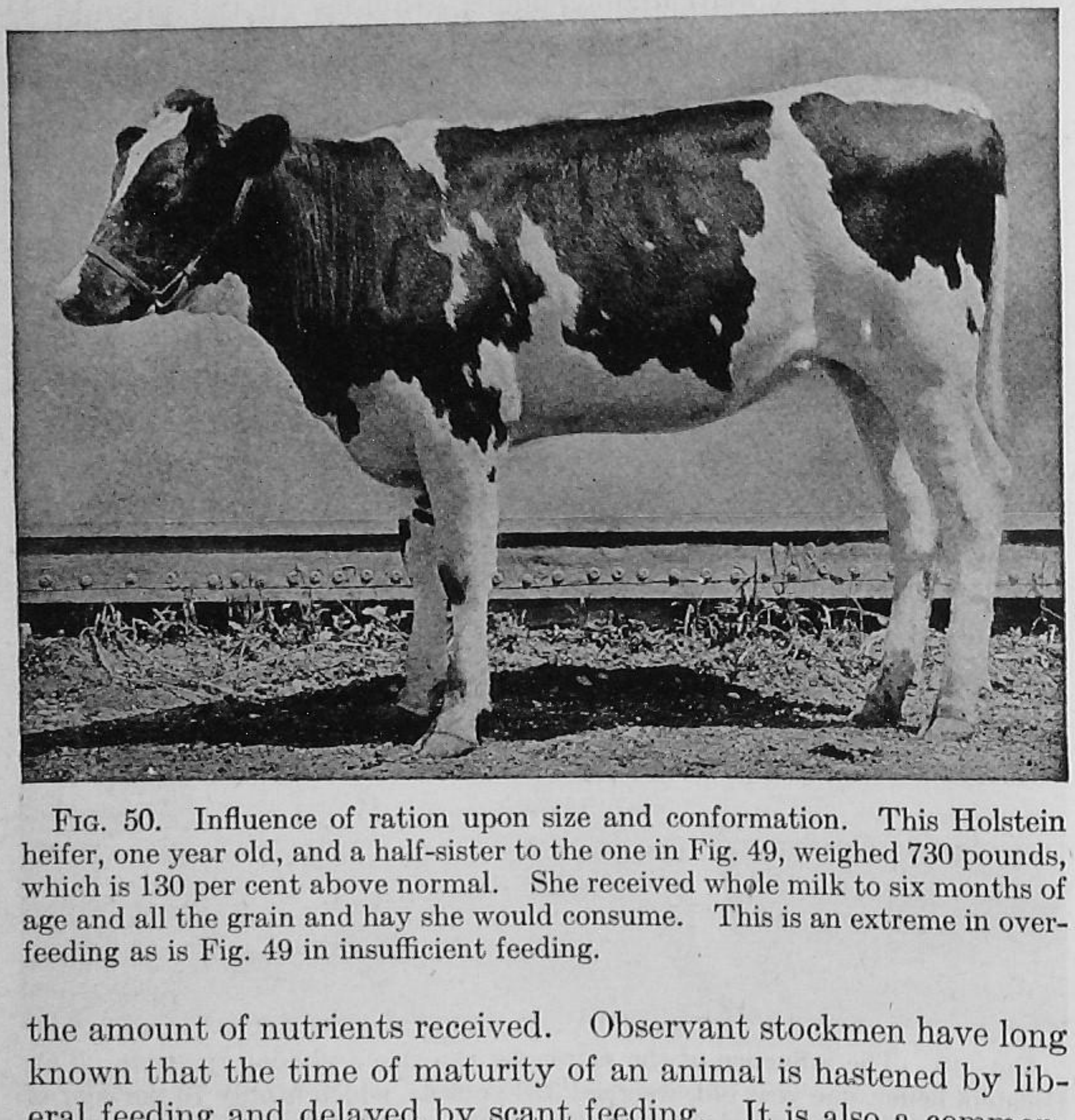


FIG. 50. Influence of ration upon size and conformation. This Holstein heifer, one year old, and a half-sister to the one in Fig. 49, weighed 730 pounds, which is 130 per cent above normal. She received whole milk to six months of age and all the grain and hay she would consume. This is an extreme in over-feeding as is Fig. 49 in insufficient feeding.

the amount of nutrients received. Observant stockmen have long known that the time of maturity of an animal is hastened by liberal feeding and delayed by scant feeding. It is also a common, although not universal, belief among stockmen that liberal feeding of the young animal results in a larger animal at maturity. Concerning this point probably the correct view is, that with sufficient feed it is possible for the animal to grow to the full extent of its inheritance, while insufficient feed may cause the animal never to reach the full development made possible by its inheritance.

Conclusion. As a general conclusion it can be said that it is possible to influence the rate of growth, size when mature, and

type — to some extent — by the liberality of the ration during the growing period, and the age at first calving. The character of the ration with reference to amount of nutrients supplied does not exert any appreciable effect upon the milking functions of the cow when mature. The age at first calving is a factor of some importance with reference to the development of the milking function in the cow. Calving at an extremely early age is detrimental to the best development of the milking function, while nothing is gained by too great delay.

CHECK-UP 21

A. In each of the following incomplete sentences write the appropriate word or phrase in the blank space or spaces.

1. The series of changes in size and structure by which an individual of any species develops from the fertilized egg to maturity is called _____.

2. Growth of cows is usually measured by the _____ _____ and _____.

3. The causes operating in growth are of two general classes: _____ _____ factors and _____ factors.

4. The most important factor under the control of man in rearing domestic animals is _____.

5. The substances in foods which supply energy are called _____ _____; those substances used to replace old tissue and build new tissue are _____.

6. The cheapest source of vitamin A for cattle is _____ _____; of vitamin D _____.

7. It is possible to influence the rate of growth of a heifer by _____ _____ and _____.

B. Walter Burton is raising his first heifer calf, sired by a pure-bred Jersey. The calf's dam is a good Jersey. In each of the groups below indicate the proper order of the things Burton should do by inserting the letter *a* in the parentheses in front of the item that Burton should do first, the letter *b* in the parentheses in front of the item that Burton should do second, and so on. If the item represents something that should not be done, or could not be done, cross it out.

1. ( ) Separate calves from dam not more than three days after birth.
( ) One and preferably more feedings of colostrum milk from dam.
( ) Teach calf to drink from pail or pan.

2. ( ) Introduce grain and hay into the ration.
( ) Wean calves from two to six months after birth.
( ) Feed three times daily for about two weeks.

3. ( ) When heifer comes into milk provide additional bone meal.
( ) Feed growing heifer bran, oats, cottonseed meal, linseed meal.
( ) Feed calf roughage with high calcium content.
( ) Feed heifer only one variety of roughage.

4. ( ) Overcome inherited growth limitations by heavy ration.
( ) Feed young heifer only skim milk and hay.
( ) Provide well lighted, well ventilated, dry housing.

CORRESPONDENCE OR CLASS ASSIGNMENT 6

1. Mention and give reasons for the relative advantages and disadvantages of: (a) increasing the herd by purchasing cows; (b) increasing the herd by raising heifers; (c) spring freshening as compared to fall freshening.

2. Describe in their proper order the main steps in calf-raising from the birth of the calf to the age of 18 months when heifers are ready to breed and young bulls are ready for light service. State what factors should be considered in deciding what calves, if any, are to be raised.

CHAPTER XVIII

PURE-BRED HERDS — THE BUSINESS SIDE OF THE PURE-BRED BUSINESS

What Is a Pure-bred? The terms pedigreed stock, pure-bred, or registered stock are used interchangeably. The term thoroughbred, formerly in common use — although incorrectly in this connection — has largely given way in recent years to the term pure-bred. A pure-bred is an animal descended in all lines of its ancestry from animals imported from the locality in which the breed to which the animal belongs had its origin. Evidence of such descent must be available in the form of registration records of these ancestors.

Registration. Early breeders of improved cattle are known to have had private records of their breeding operations long before registrations were established for the purpose of preserving these records. The first registration of animals in the modern sense began in 1822 when the first volume of the English Shorthorn Herd Book was published.

At the present time breeders interested in the various breeds have organizations to keep the records of ancestry in a systematic way and to make these records accessible to the public. This is a great aid to convenience and accuracy where thousands of breeders are involved. The books containing these records are generally spoken of as herd books. When pure-bred animals are imported, records of their ancestry and of their registration in the herd book of their native country are presented by the importers to the registry association of the breed in the United States. If the records are correct and the identification of the animal established, the registration is made in the books of the American association.

An animal born in this country is eligible to registration only when both sire and dam are registered. In making application for registration, the owner is required to certify to the name and registry number of sire and dam, the date of birth of the animal to be registered, the date of breeding of dam, and the owner of sire and dam. A sketch showing the color markings for identification is required of those breeds such as the Holstein or Guernsey, which

are not solid colored. Photographs are now being advocated for this purpose. Tattooing is required for Jerseys.

The expenses of the registry association are met by charging a fee for registration and another for a transfer certificate issued to the buyer when an animal is sold. The fee is greatly increased if registration is delayed until the animal is past a year of age, and with most breeds is more for males than for females. It should be understood that the registration certificate is merely a record of ancestry. It does not in any way certify to the quality of the animal as a representative of the breed to which it belongs, although uninformed and new breeders have given undue emphasis to registration as a badge of perfection.

Advanced Registration and Official Testing. The present system of official testing which is the basis of Advanced Registration has grown from a small beginning to one of the most important factors in the breeding and development of pure-bred dairy cattle.

With the importation of many highly developed pure-bred dairy cattle in the decade following 1875, a wide public interest was aroused in the exceptional milk and butter production of many of these animals. Certain of the leaders among those interested in these newly established breeds recognized the importance of giving proper publicity to these records. They were not satisfied with the practice of registering animals upon the basis of ancestry alone, and conceived the idea of a second or Advanced Registry to which only those animals would be eligible that showed a high order of merit.

How Tests Are Conducted. When a breeder desires to test a certain cow or herd, he makes such arrangements with his breed officials as is required by the rules of the association. The breed association then requests the Superintendent of Official Testing in the state where the herd is located to conduct the test for the specified length of time. A test supervisor is sent who watches each cow milked, personally weighs the milk, and makes a test for butterfat, using the Babcock method. The results are reported on suitable blanks, under oath, and serve as the basis for Advanced Registration of the animal tested. The supervisor in doing the testing is a representative of the college or experiment station having the work in charge. He is subject only to their orders and receives his compensation from them. The breeder is in turn charged by the Experiment Station for this expense.

The growth of official testing among breeders of pure-bred herds has been very rapid. The states in which the largest amount is done are New York, Wisconsin, Michigan, Ohio, Pennsylvania, and Minnesota. In some states more than one hundred supervisors have been employed to handle the work. Official testing is for the breeder of pure-bred cattle, not for the dairy farmer who is interested in milk production alone. For him the cow-test association serves the purpose to better advantage.

Purpose of Official Records. In doing official testing the purpose is not primarily that of finding out which cows are profitable producers as is the case with the cow-test association. The owner generally knows himself about what his animals are producing before beginning official testing. His purpose is to obtain records of production that will be unquestioned by the public, on account of having been authenticated by an institution in which the public has confidence. The purpose of the breeder in having such records is primarily to increase the market value of his stock, both for the future and for the present. Official testing has come to serve as the basis upon which most of the breeding animals of dairy breeds are selected. It is also the chief factor in determining the value of registered dairy animals. With the high price level of earlier years, a single test covering a period of only seven days often added thousands of dollars to the value of an animal.

The Herd Improvement Test. This test includes the whole herd rather than one or more selected individuals. It gives a much more reliable index as to the actual worth of a herd both as to production and for breeding purposes. It makes possible dam and daughter comparisons and has been the means of proving many worth-while sires. When carried on year after year in the same herd it may be considered the almost ideal type of test. It is gaining in universal esteem and use and may largely displace all other types of testing among pure-bred cattle in the near future.

Number of Pure-bred Cattle. Before establishing a business of any kind a study of the available supply and probable demand for the product would be wise. If this is done for the pure-bred dairy cattle business the conclusion must be that the opportunities are unlimited.

The census estimates for 1935 show 26,236,000 cows and heifers two years old and over. There was an estimated total of 1,280,161 pure-breds of which 1,059,538 were females and 220,623 were males.

The place and opportunity for the pure-bred business is obvious. These figures show that there is an opportunity for more than double the number of pure-bred dairy cattle to be used to advantage in the United States.

Table 19 gives the number of pure-bred dairy cattle by breeds as estimated by the census of 1930.

TABLE 19. PURE-BREDS OF THE DAIRY BREEDS IN THE UNITED STATES

BREED	TOTAL PURE-BRED 1930
Holstein	649,739
Jersey	354,939
Guernsey	200,721
Ayrshire	48,236
Brown Swiss . . .	25,734
All other pure-breds .	34,985

Pure-breds vs. Grades. The great bulk of dairy products on the market comes at present, and should come in the future, from herds which are high grade but not registered. The typical herd for nine out of ten farmers producing milk for market is one of well-selected, high-grade cows headed by a pure-bred bull. Many farmers who buy a registered cow for the first time are disappointed that she is not far superior to their grades. If the grade herd has been bred up by the use of pure-bred bulls for several generations, and the inferior producers eliminated, there is no reason to expect that a pure-bred will excel the grades.

Registration papers do not insure any greater or more economical production than is possible by selected high grades of the same breed. It is true, however, that registered cows produce on the average more milk than grades of the same breed, partly on account of their purity of blood, but also on account of the fact that they are usually in the hands of men who give more careful attention to individual selection and to proper care and management.

The difference in the production of grades and pure-breds under conditions as they exist on dairy farms is shown by results reported by the Extension Service of the Pennsylvania State College from a compilation of records from cow-test associations in that state.

The Holstein pure-breds surpassed the grades 39 pounds in fat

production and the Jersey pure-breds showed a lead of 33 pounds of fat.

	Number of Animals	Average Lbs. Fat Production for Year
Holsteins		
Pure-breds, all ages	306	299
Grades, all ages	707	260
Jerseys		
Pure-breds, all ages	101	308
Grades, all ages	306	275

Pure-breds Always the Seed Stock. Pure-breds are the seed or breeding stock for the grade herds that will continue to supply the bulk of the milk products. The pure-bred breeders have the great responsibility of maintaining and improving the breed. In these herds all breed improvement is made, and by the distribution of seed stock, largely in the form of pure-bred bulls, this improvement is gradually spread to the great mass of grade animals representing the substrata of the breed.

Classes of Pure-bred Breeders. There are two fairly distinct classes of breeders, with other classes ranging between. The first class is the well-established breeder with a high-class herd, and includes the great breeders and the real improvers of the breed. Such herds supply the bulls and the foundation females for the second class. Their stock is mostly too high in price to supply the dairy farmer desiring a bull to head a grade herd. Other breeders of pure-breds supply the market for this class of stock. The second class is composed of those breeders not so well established in the business, or those having herds less valuable in breeding and individual excellence. This class of breeders are the distributors of pure-bred bulls to the dairy farmer. The beginner must expect to find himself in this class in the early stages of the development of his herd. The ability of the breeder will determine whether he stays in this class or advances to the point where he is considered a constructive breeder, and animals of his breeding are in demand by other breeders of pure-breds.

Possibilities of a Pure-bred Herd. To a person who has a love for animals, business ability of a high order, and the patience to await results, the pure-bred business offers opportunities. Many

examples could be cited. The author at one time purchased four foundation cows for the institution with which he was connected at the low price of $600. No other females were purchased. At the end of fifteen years it was found that surplus animals had been sold to the amount of $13,800, and that 44 females were on hand, which had an inventory value of $17,000. The value of the milk sold was not included in these figures, but it was sufficient to pay expenses under practical conditions, making the pure-bred herd a splendid investment. A Guernsey breeder reports a herd of 21 pure-bred animals on hand, all descended in ten years from one cow. Forty-one pure-bred calves were dropped on the farm during the ten-year period. On the other hand, thousands of dairymen have started in the pure-bred business only to give up after a period of time, disappointed and in some instances financially ruined. Among other causes for their failure may be usually found the lack of that highly important factor called by old time-breeders "the breeder's art."

Successful Breeding a Gradual Development. Investigation will show that nearly all successful breeders started in a small way and gradually grew into the business, developing their herd and extending their prestige as a breeder from year to year. The pure-bred business is of slow growth and cannot be forced. The young man going into business should not count too much at first on the sales of pure-bred animals. He should make his plans with the idea of paying the operating expenses from the sale of dairy products, and not from the sale of breeding stock. It requires at least ten years for a pure-bred breeder to become established and for his herd to become known to the extent that his stock is in demand at good prices. During this period the breeder must manage his herd with skill and judgment, cull out the inferior animals without regard to pedigree and under no conditions be persuaded to sell his best, and he must give the most careful attention to all details of his business.

Reputation an Asset. The reputation of the breeder is no small part of his capital stock and should be most carefully guarded and built up by square dealing and liberal treatment of the buyers. A reputation once built up is an asset that remains during the entire lifetime of the breeder and beyond. The foundation of the business of breeding pedigreed animals depends upon the honor and integrity of the men engaged in it. Probably 90 per cent of the

pure-bred males in use are purchased by correspondence and the transaction is based upon the reliability of the breeder.

In selling pure-bred livestock it is good business policy to make every effort to have all customers satisfied, even though it may mean considerable expense and being asked at times by purchasers to make adjustments which are unreasonable. The more successful breeders to a large extent adopt the policy of some of the successful retail stores that "the customer is always right."

Breeders' Business Code. A breeders' association recently adopted a set of rules to govern the relations between buyer and seller of pure-bred cattle which are worthy of wide adoption. They are as follows:

All prices quoted are on the basis of free delivery of the animal to the seller's shipping station.

Animals to be shipped by express are crated free by the seller and the crate returned at the expense of the seller.

All animals shipped are to be provided with a strong halter.

Every bull over one year old is guaranteed a breeder provided the buyer's cows are in good condition. If not a breeder the animal shall be replaced by one equally as good or to be returned to the seller and purchase price refunded at the option of the seller. In case of exchange buyer and seller each are to pay transportation charges one way. If the animal is taken back the seller pays transportation charges.

Every cow or heifer over one year old when sold is guaranteed a breeder and taken back or exchanged on the same basis as bulls.

The seller must call attention to any unsoundness of udder or otherwise, but, if an animal sold as a heifer proves to have a defective udder when she calves, it is the purchaser's loss.

Registry certificate, transfer papers, and tabulated pedigree are to accompany every sale.

In states where provision is made for accredited tuberculosis-free herds it is recommended that all breeders have their herds enrolled. When a buyer tests an animal inside of three months after purchasing and finds the animal tubercular and no other reactors in his herd the loss falls on the seller, unless he is able to show a test made within ninety days before the sale and that no reactors were in the herd at this time.

Delay on the part of the seller in supplying the purchaser with the registration and transfer papers is the cause of much friction and is inexcusable.

It is a wise precaution for the purchaser to withhold part of the purchase price until registration and transfer papers are secured.

Advertising the Herd. A mistake made by most beginners in the breeding business is to expect to find a sufficient market for

their surplus animals among their neighbors. Experience soon teaches that a wider market than the immediate neighborhood must be found. It is human nature to think that conditions at a distance are better than at home, and there is a tendency to go away from home to purchase, even if equally good animals are available close at hand. No livestock breeder ever made much of a success selling breeding stock to his neighbors alone. He must in some way get a reputation wide enough to bring buyers from a distance.

The breeder of dairy cattle has three ways of bringing his stock to the attention of the public: (1) advertising in good agricultural papers, (2) exhibiting at fairs, and (3) making official milk and butter records so good that they will attract attention.

Exhibiting Cattle. Exhibiting at fairs, with the publicity that goes with it, is an effective means of advertising. However, there are some serious objections. One is the danger in shipping and exhibiting high-producing cows in the stage of lactation necessary to make the best impression in the show ring. Another, and at times more serious, danger is that of contracting disease. More stringent rules are being adopted from year to year, and in the near future danger from this source may be mostly eliminated. In the past many times a herd came back from a fair bringing with it an infection which could only be eliminated by years of effort.

For most breeders the best means of getting before the public is by means of official testing. This is especially true of the small breeder and beginner. The man who has a herd so small that he can look after it himself has an opportunity along this line, except in regard to numbers of animals to choose from, equal if not superior to that possessed by the large breeder who depends entirely upon employees. Good records become news material and are gladly printed by local papers and even by agricultural papers having a wide circulation. This is the best possible advertising.

Naturally a breeder must have the stock to show when buyers come. When animals are shipped it is very important that they be in splendid condition. When a man receives a high-priced bull calf his neighbors all come to have a look and the animal should be one he can show with pride.

Acquiring a Knowledge of Pedigrees. If one is to become a successful breeder of pure-bred cattle it is necessary to become familiar with the prominent animals and best known lines of

breeding within the breed used. To gain this information and to keep up to date require constant study. A breeder who is engaged in the business on a considerable scale will do well to purchase a set of herd books and become a member of his breed association in order to secure the volumes as they are issued.

Anyone, with a little study, can make up a tabulated pedigree from the herd books. However, the official records are an important part of the pedigree and these are obtained from another volume or series of volumes depending upon the association concerned. Even when the breeder does not feel justified in purchasing a set of herd books it will be advisable to have a copy of the most recent volume giving reports of official records at hand. Because many breeders do not feel justified in keeping a full up-to-date set of such records, many pedigree firms who make a specialty of pedigree writing will supply complete pedigrees at small cost. Sale catalogs should be preserved and studied. Attendance at a few high-class public sales, with a careful study of the pedigrees of the animals sold with reference to the selling price, is also an excellent means of becoming familiar with the popular lines of breeding. The breeder should also be a close reader of the special publication or journal published in the interest of his breed.

Public sales and cattle shows also afford opportunities to meet fellow breeders and to widen the scope of one's information regarding his own breed. Any really successful pure-bred breeder must be able to quote from memory at least the pedigrees of his most important animals.

Naming Pure-bred Cattle. The rules for the registration of pure-bred animals require that no name can be accepted that has already been used in the herd book. This requirement causes some difficulty in selecting a suitable name, when in some associations over half a million have been registered. This annoyance may be avoided, and at the same time advertising possibilities realized by having a suitable plan of naming.

The best plan for naming involves the use of either a certain prefix or a suffix to the name of all animals registered from the herd. The common practice is to select a suitable name for the herd or farm and use this as the prefix or suffix. An example is the word "Pontiac" used as a prefix by a well-known Holstein herd and the phrase "of Hood Farm" used as a suffix by a Jersey breeder.

The plan adopted by the author involves the use of a prefix indicating the herd, the second name indicates the sire, and the third indicates the individual and generally suggests some of the ancestors of the animal. In this particular case the herd prefix is "Minnehaha." Offspring of Majesty's Origa, for example, are named Minnehaha Majesty ——— with a third name to designate the individual. The breed organizations recognize the value of such a prefix or suffix and give a breeder the exclusive right to use it in naming registered animals. In time the public comes to associate the particular name with the herd, and each time the name of an animal appears in print the herd from which it came is fixed in the minds of the reader. Care should be taken that the name be short, easy to pronounce and remember. Some breed associations limit all names to not more than thirty letters.

A satisfactory plan to use in connection with a naming system is to give each animal a herd number at birth which is never changed and to keep all records by this herd number. The animal is more often referred to by number than by name among the attendants.

Rigid Culling of Pure-breds. The breeder will be most successful who insists upon individual merit as well as good pedigrees. The breeder building up a herd is often reluctant to discard animals of inferior individuality from his herd when they are well bred and possibly the offspring of some of his best breeding stock. A pedigree, no matter how popular, should never be made the excuse for keeping animals in the herd that are not creditable representatives of the breed. Inferior animals will appear in any herd but the breeder of judgment does not retain them for breeding purposes, neither does he sell them to others for breeding animals; but he sends them to market, or, if too valuable for slaughter, disposes of them as grades without giving registration papers. Probably the greatest criticism of pure-bred breeders is the failure to cull as rigidly and as consistently as they should.

Danger of Fads. Fads frequently develop for certain colors or combinations of breeding which have no real foundation of value. The breeder should avoid the danger of injuring his herd by attempting to follow these temporary fads, although some attention must be given to meeting the popular demands. For example, a black nose is considered undesirable in pure-bred Guernseys. While this is something of a fad insofar as it has no real significance

from the standpoint of the milk-producing ability of the cows, a breeder would be wise to avoid breeding animals with this characteristic, for it will interfere with the sale of his stock.

The Breeder a Good Judge. The breeder should become a good judge of the breed of cattle in which he is interested, and attendance at fairs when the judging is under way is of material assistance. Visits to leading herds, with a careful study of the breeding animals in use, are also worth while.

Other Suggestions to Breeders. It should be kept clearly in mind that feeding is of equal importance with breeding. No herd of cattle, no matter how well bred, will make a creditable showing either in appearance or in production without liberal and intelligent feeding. Many of the failures in the breeding of pure-bred cattle are clearly due to improper feeding — often combined with the keeping of inferior animals in the herd on account of their pedigree. A suitable system of marking the animals is of great importance, not only on account of the danger of mistaking one young animal for another, but a practice of depending upon the memory of the owner does not tend to inspire confidence in prospective buyers.

A system of keeping the herd records is also necessary. A form for this purpose has been described in a previous chapter. In addition to the book for keeping milk and butter records a barn book is needed in which information concerning breeding and the birth of calves may be recorded. Satisfactory books for these purposes can be prepared by suitable ruling in a blank book, or well designed books may be had from the publishers of dairy journals.

The pure-bred breeder must also recognize the importance of keeping his premises in an attractive condition. The sale of meat animals taking place in a general market away from the farm does not in any way depend upon the condition of the premises where they were grown, except insofar as the presence of disease might be a consideration. With the seller of pure-bred cattle the conditions are quite different. His premises must be neat, well kept, and free from disease. A set of buildings showing a run-down appearance and a general lack of thrift will do more to destroy confidence in the seller than the most active salesman can counteract.

Selling by Mail. A large share of the business of selling pure-bred livestock, especially by those who sell the less expensive grades including bulls for grade herds, is done by mail. To sell

goods successfully by mail taxes the ingenuity and resourcefulness of the best trained business man. The beginner in the pure-bred business has much to learn and he must make a study of the proper methods of handling these details satisfactorily or he cannot long remain in business. The amount of correspondence required to make a sale surprises the inexperienced man. If one sale is made to each five inquiries, the seller should consider he is doing as well as the average. A breeder should provide some office equipment in the form of a suitable desk, a typewriter, filing cases, and well-printed letter heads. Every inquiry should be answered promptly, although no animals of the description called for are for sale. This is important as a means of holding the good will of possible buyers in the future. Carbon copies of all letters should be kept to avoid disputes over prices quoted and descriptions of animals. The breeder, or someone in his family, should learn to use the typewriter sufficiently to type all letters.

Printed Pedigrees an Aid to Sales. When the animal to be sold is of a class to justify the expense, a printed tabulated pedigree may be obtained in sufficient quantity to meet the probable needs, at a moderate expense. A copy of the printed pedigree which will give all official records in the pedigree is sent to each prospective buyer together with a written description of the animal. When the breeder does not feel justified in having a pedigree printed for each animal offered for sale, he may wish to have printed pedigrees available of his herd sire. In answering an inquiry with these available it is possible to send a copy of the sire's pedigree, leaving only the breeding on the dam's side to be given especially. Care should be taken to avoid all long, involved statements of ancestry. Some prefer to make out a fully tabulated pedigree written either by hand or with a typewriter. The objection to this is that often many inquiries are answered before a sale is made requiring a large expenditure in time in preparing the pedigree.

A plan followed by the author for a number of years with satisfaction is to prepare a statement concerning each bull to be sold shortly after it is born. This description is typewritten on thin paper, enabling several copies to be made at once. In answering an inquiry, a printed pedigree of the herd sire is sent together with the descriptions of such animals as seem to meet best the needs of the buyer. The following is the form of description used:

HOLSTEIN BULL, HERD NO. 320

Name: Minnehaha Homestead Ormsby.
Born: January 2, 1922.
Description: About two-thirds white, large and vigorous for his age, level rump and good barrel.
Sire: See enclosed pedigree.
Dam: Facile Aaggie of Shady Nook. Dam has an official record of 23,372 pounds of milk and 781 pounds of fat in one year. She was first prize aged cow at the Minnesota State Fair in 1918. Her daughter, a full sister of the bull offered, has a record of 20.001 pounds of milk and 697 pounds of fat as a two-year-old.
Tuberculin Test: The herd is on both State and Federal accredited lists.
Price: $350 includes registration and transfer papers and tabulated pedigree, f. o. b. St. Paul. Photograph and fully tabulated pedigree will be supplied upon request.

For nine out of ten buyers a description of this kind is all that is desired. A tabulated pedigree is prepared and a copy sent only on special request. When the animal is sold the tabulated pedigree is forwarded with the registration and transfer papers.

The Individual Public Sale. There are two classes of public sales, individual and consignment. A public sale has many advantages and some disadvantages as well. Only a large breeding establishment can furnish sufficient animals to justify a public sale except in case the herd is dispersed. There is always considerable expense in conducting a public sale. To make a successful sale the breeder must be well known and have a reputation for desirable stock that will lead buyers to come some distance to buy. Unfavorable weather may nearly ruin a sale. Often the prices realized at public sales are better than could be obtained at a private sale. This is especially true when the demand is brisk and conditions such that the general trend of prices is upward. At such a time the enthusiasm of the buyers often results in prices much above the going price at private sale. When conditions in the business are unfavorable and confidence is lacking among prospective buyers, the reverse is true and the prices at public auction are usually lower than can be received at private sale. For the individual, the public sale has the advantage of concentrating into a short period all the labor of preparing animals for sale, getting the necessary information ready, and attending to the numerous details the sale of breeding animals requires.

The Consignment Sale. The consignment sale may be held by

a group of breeders and may be of local character or a state or national organization may assume the responsibility, giving the sale a state or national scope. In recent years the conditions under which such sales are conducted are usually controlled in a satisfactory manner, insuring fair treatment to the buyer. Care should be taken that the animals consigned are sound and of good quality. By-bidding is forbidden, and a genuine effort is made to conduct the sale in a manner which shall be above criticism. The expenses of conducting a public sale are considerable. Consigners to public sales usually pay 10 per cent of the selling price for the expenses of the sale. This covers advertising, the auctioneer's fee, providing of the facilities for the sale, and all minor expenses. The consignor pays all expenses of preparing his stock, shipping to place of sale, and caring for them until they are sold and delivered.

CHECK-UP 22

A. What are some of the main points about pure-bred herds?

Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. An animal born in this country is eligible for registration if: (a) he is a pure-bred; (b) his sire and dam are registered; (c) he is a good individual.
2. The type of testing most valuable to a pure-bred herd owner is: (a) advanced registration; (b) cooperative cow-testing associations; (c) herd improvement test.
3. There are great opportunities in the pure-bred business because: (a) pure-breds are the seed stock for good grade herds; (b) pure-breds produce on the average more than grades; (c) all dairy farmers should use pure-bred bulls.
4. The best method of advertising your pure-bred herd is by: (a) buying space in agricultural papers; (b) exhibiting at fairs; (c) making outstanding official milk and butter records.
5. A successful pure-bred breeder is one who knows how to: (a) judge cattle; (b) cull; (c) feed cattle; (d) write good business letters.

B. If you have a love for animals, business ability, and the patience to wait for results, the pure-bred business offers opportunities.

Below are a group of (1) Characteristics, (2) Aptitudes, (3) Attainments. If you consider an item necessary for success with a pure-bred herd, place the letter N in the parentheses in front of an item. If you think it is

unnecessary for success write the letters UN. If you think the item would prevent success with a pure-bred herd, write the letter P.

Characteristics

a ( ) Dislike of slow results.
b ( ) Liking for fads.
c ( ) Willingness to work every day.
d ( ) Capacity for attending to details.
e ( ) A cooperative attitude toward community and national dairy enterprises.
f ( ) Ability to overcome disappointments.
g ( ) Liking for experimentation.
h ( ) Desire to learn new things.
i ( ) Unwillingness to admit mistakes.
j ( ) Ambition to get ahead in farming.

Aptitudes

a ( ) Fast worker.
b ( ) Good salesman.
c ( ) Flair for advertising.
d ( ) Ability to plan.
e ( ) Ability to write intelligent letters.
f ( ) Ability to judge cattle.
g ( ) Ability to repair milking machines.
h ( ) Ability to rope and brand cattle.

Attainments

a ( ) Twenty years' experience with cattle.
b ( ) College education.
c ( ) Some experience with grade cattle.
d ( ) Knowledge of internal combustion engines.
e ( ) Knowledge of cattle judging.
f ( ) Knowing how and when to cull.
g ( ) Knowing that you still have a lot to learn.

CHAPTER XIX

CARE AND MANAGEMENT

Importance of Proper Management. It is pointed out elsewhere that the results obtained from a dairy cow depend first of all upon her inherited capacity to produce milk — that is, the efficiency of the machine — and, second, upon how skillfully the machine is used. Skill in using the machine includes, first of all, intelligent feeding, but in addition the care and attention with which the numerous other details of management are carried out has a large share in the final results obtained. The astonishing milk and fat records made in recent years are caused, not by any sudden increase in the capacity of cows to produce milk, but by better methods of breeding and handling.

Regularity and Gentleness in Handling. The dairy cow is a creature of habit. She easily becomes accustomed to a regular routine regarding feed and care, and any change from this program tends to disturb her and to cause a decrease in milk production. Experience shows that regularity in all details is one of the essential factors in keeping the milk flow constant. Either the grain or the roughage may be fed first, but the same order of feeding should be followed regularly day after day. A cow may be readily accustomed to eating grain before milking, at the time of milking, or following, but she will be uneasy if the same routine is not followed all the time. It is especially important that the milking be done at the same hour, by the same attendant, and under the same conditions as far as possible.

The highly developed dairy cow is inclined to be of a nervous disposition and is easily excited. Furthermore, it is necessary for the attendants to come into close contact with her in feeding, milking, and other work in the barn, and consequently, it is exceedingly important that the best of relations exist between the cow and her keeper, in order to get the largest amount of milk and do the work as quickly as possible. In order to establish the right relationship, the cow must not be afraid of the attendant. The cow is not adapted for rapid locomotion and should never be hurried from a moderate walk. Chasing cows with dogs or driving them on the

run with horses is not allowed on any well-managed dairy farm. In the barn the attendant must work quietly. Loud shouting and quick movements among the animals excite them and often result in cows forming a habit of holding up the milk or of kicking.

Exercise. When the question is raised of how much exercise a dairy cow should have, the thought is how much time should she be turned loose out of doors and to what extent should she be required to walk. The fact is often overlooked that all the organs of the body are performing heavy labor during lactation. A cow producing twenty-five pounds of milk daily must chew and digest roughage containing from fifteen to eighteen pounds of dry matter and grain containing from six to eight pounds. The process of changing this into blood and then into milk is a severe tax upon all organs of the body. The cow, except insofar as the muscles used in walking about are concerned, is doing more work than is a horse working all day in the field. These facts explain why cows in milk can thrive for long periods with little exercise so far as walking about is concerned. In fact, the cow does not need any large amount of exercise to keep in good condition since her job is not walking but producing milk, and her organs are well exercised for this purpose.

It is well, however, to allow the cow some exercise regularly, although heavy producers should not be required to walk long distances. During mild, fair days in winter, cows should be turned outside for a few hours, and in summer all ages should have the freedom of the pasture for a part or all of the time.

Grooming. Dairy cows when kept confined in the barn most of the time should be groomed daily. When on pasture less frequent attention is necessary although always desirable. The value of grooming is primarily that of keeping the skin of the animal clean, which is necessary for the production of clean milk. Grooming is also desirable for the health of the animal. Well-groomed cows look better and add to the pleasure and satisfaction of the attendants who spend much of their time with them.

The Period of Gestation. The average period of gestation for the cow is 282 days.

Spring Calving. Under conditions of nature, the cow normally gave birth to her young in the spring or early summer as do wild animals of related species at present. Under conditions of domestication, where feed is supplied in abundance the year around and

all conditions of physical comfort of the animals provided for, the seasonal character of reproduction has been lost. The herdsman now regulates the time of the year in which the calves are to be born.

Under rather primitive conditions of agriculture, where dairying is rather a side line to general farming, the custom is to have the calves born in the spring. The cows then produce most of their milk during the pasturing season, are nearly dry by the beginning of winter, and are completely so by mid-winter. Under this condition the largest milk flow is produced from pasture which is generally the cheapest feed if the labor of growing winter feed is taken into account. This practice, as a rule, goes with a small average milk production.

After dairy farming has passed through the early stages of development in a community, provisions begin to be made for better feed supplies, including succulent feeds such as silage or root crops, for periods when pasture is not available. Better accommodations in the way of barns become common and the cows are expected to continue to produce milk at least ten months in the year. When these conditions are reached, the advantages of having the cows freshen in the fall begin to be recognized.

Advantages of Fall Calving. It is found where good conditions are maintained that cows calving in the fall will produce more milk during the year than those calving in the spring, and that the average fat content will be a little higher. Furthermore, the farmer has more time to give to the cows and to calf raising in winter. It is also of considerable advantage to have the dry period come during the heat of late summer when the weather conditions are unfavorable for milk production. Having cows dry at this time makes possible having them out on the ground in pasture and in the sunshine which is certainly an aid to health and vitality. Still another advantage is that fall calving brings the highest production at the time of highest market prices.

Dehorning. For the ordinary business herd there is every reason why the animals should be dehorned. Before domestication, horns were a useful protection against other wild animals, but horns on a dairy cow of today serve no useful purpose and are the source of much annoyance. They are responsible for frequent injuries — often serious, and especially to the udder. Dehorned cattle may be housed in a much smaller space, and when they are fed and

watered together in the ordinary manner there is a material saving in labor. Horns on a bull are extremely dangerous. The only cases where it is advisable not to remove the horns are those of high-class animals which are likely to be used for show purposes.

Training the Horns. The breeder of pure-bred cattle, especially when in the habit of exhibiting in competition, not only desires that his animals retain their horns, but is interested that they be developed in such a way as to add to the beauty of the animal. The horns can be made to grow in almost any shape desired by the proper use of horn trainers. The horn trainer is a metal device so constructed that such pressure may be applied to the growing horn as seems necessary to give it the desired form. They may be homemade or purchased from a number of manufacturers.

Methods of Individual Identification. In breeding pure-bred cattle it is very essential that some practical system of identifying

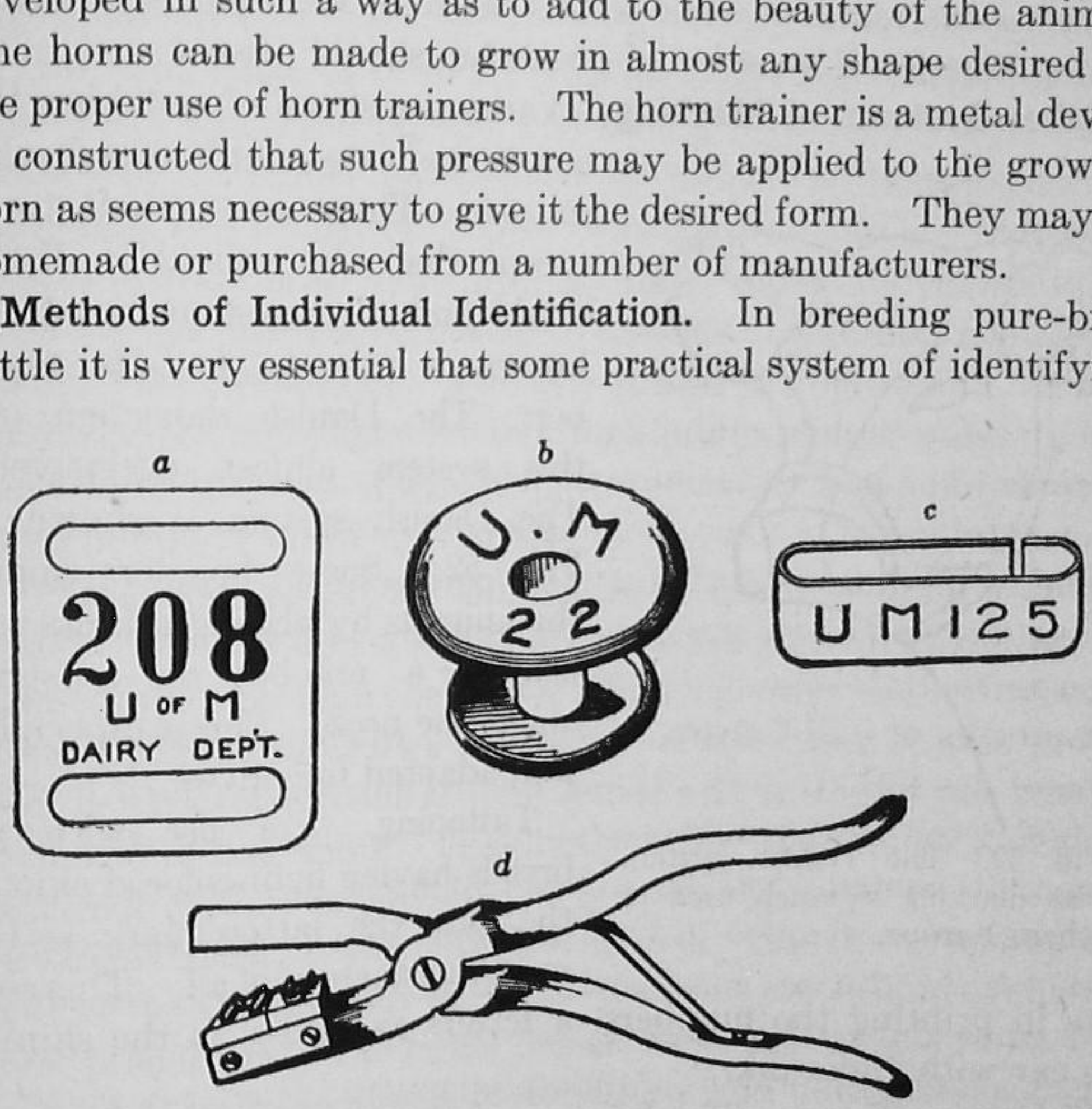


FIG. 51. Devices for marking cattle. *a*, brass tag to go on strap; *b*, *c*, ear tags; *d*, tattoo marker.

the individuals be adopted. Even if a breeder feels that he can depend upon memory alone, it is not advisable to do so. The records of some valuable herds have been lost through the death of the owner, who was the only one who knew the individual animals.

The common practice of taking dairy-bred calves away from the dams soon after birth to be raised by hand makes it much more uncertain to depend upon memory to identify these animals than is the case with beef-bred cows, where the calf is raised by the

mother in the natural way and the owner has several months' time in which to learn the individuals.

The Use of Tags. When a buyer visits a herd, a much better impression is made if every animal bears a tag. Every calf should be tagged in some manner within a few days after birth, and a record made in the herd book to identify the animal. It is important, even in grade herds, especially when they are large, to have a permanent mark of some kind that may be used as a means of identification if question of ownership should arise.

Other Systems of Marking. Various systems of notching the ear to indicate numbers are also in use. These are satisfactory, except that the animal is disfigured, and the system must be known in order to read the number. The Danish dairymen use this system almost exclusively. The Danish system is shown in Fig. 52. Some breeders mark the animals by placing a brass tag bearing a number on a strap about the neck. This is especially well adapted for calves.

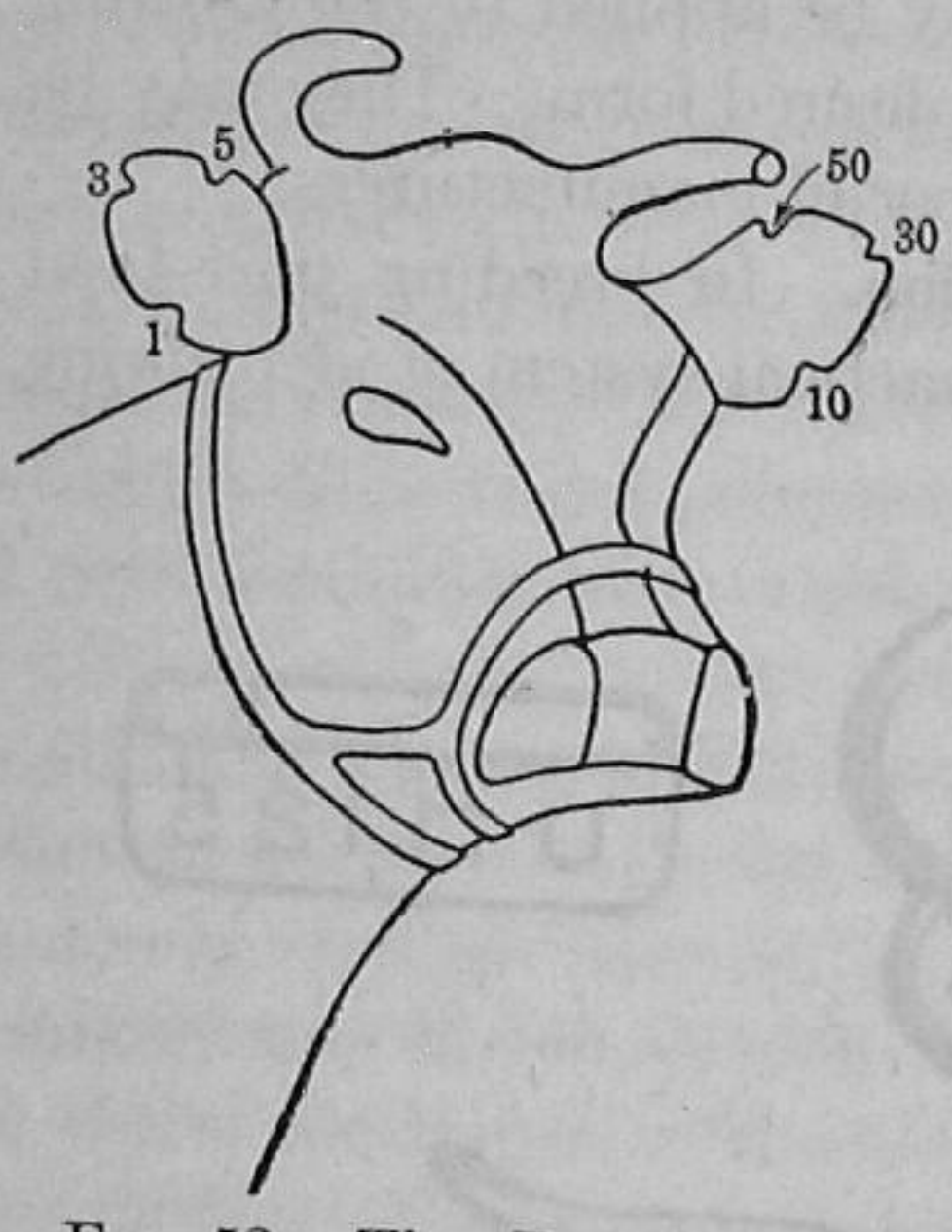


FIG. 52. The Danish system of ear marking is much used in northern Europe.

Tattooing. For use with all breeds having light-colored skin in the ears the tattoo mark is the most satisfactory of all. This consists in printing the numbers or letters as desired in the skin of the ear with India ink.

Sheltering Cows. The housing of the dairy cow naturally depends upon the climatic conditions. In regions with long hot summers and little cold winter weather, the main problem sometimes is the protection of the animal from the sun during the heat of mid-day. Under these conditions sheds of inexpensive construction, open on all sides but protected against insects by means of netting, are used.

The cow, however, is not protected by thick layers of fat as is the steer, and she is far more susceptible to cold. Dairy cows and young stock should not be unduly exposed to severe weather, while cold rains and snowstorms are especially to be avoided.

Cattle, when well fed, are not so sensitive to low temperatures if protected from wind and dampness.

In cold climates cows should remain in the barn except for a few hours in the middle of the day when the weather is mild. On stormy days or during periods of excessively cold weather cows in milk will do best if kept inside constantly. In this connection the use of individual watering cups in the barn is especially to be recommended.

An abundance of fresh air is as necessary for the health of the cow as of any other animal, and should be provided without fail. However, it should be supplied by proper ventilation, and not through the walls of poorly constructed barns. Excessively warm weather is far more injurious to the dairy cow than cold, and there is no practicable means of making the animal comfortable under such conditions. For this reason hot weather and warm climates are not conducive to a high production of milk. This is especially the case where high temperature is combined with a high humidity of the atmosphere.

Persistency in Production. A cow that maintains a medium production over a long period often makes a greater total production for the year than one that is much higher in the beginning but does not hold to this high level long. Persistency in milk production is partly the result of inheritance and is in part the result of feed and management. Frequently a cow that milks well at the start but declines rapidly does so because she is not receiving sufficient feed to supply the nutrients needed. She draws on her body reserve for a while, then when this becomes low declines rapidly in milk production. The feeder should especially concern himself to feed as liberally as necessary to supply the nutrients needed for the milk produced in order to maintain the production as long as practicable.

It is very important to understand that when the stimulation to produce milk is lost, it is impossible to restore it. When a cow is allowed to drop in milk production as the result of insufficient feed, it is impossible to bring the milk flow back to the point where it should be by remedying the defect in feeding.

The successful herdsman makes sure that the dairy cow is so handled and fed that the decline in milk yield with the advance of lactation is no more than normal. The secret of record making is maintaining persistency.

The Fly Annoyance. Cattle in the United States are troubled mostly by two varieties of flies, the stable fly and the horn fly.. The stable fly resembles the ordinary house fly in appearance; but while the house fly does not bite, the stable fly has mouth parts that enable it to pierce the skin and suck the blood of animals. The eggs are laid mostly in manure, horse manure preferably, but also in cow manure and in piles of straw which are fermenting and rotting. The period of development is about fifteen days from egg to adult fly.

The horn fly was introduced into America about 1886. It is considerably smaller than the house fly, and gets its name from the characteristic of gathering about the base of the horns. It is also recognized by the habit of feeding with the wings spread and usually goes in swarms. Its bite is very irritating, and causes a congestion resembling the bite of a mosquito. The eggs are laid in fresh manure, and require about ten days to develop adult flies. These flies remain with the cattle constantly, roosting largely on the horns.

Since flies that annoy cattle are hatched mainly in manure, the first precaution to be observed in reducing the numbers to the minimum is to avoid an accumulation of manure where it will remain moist, especially near the barn. Since horse manure seems to be preferred by these pests, special care should be taken not to allow it to remain in heaps near the barn.

Fly repellents. The popular idea of the great injury done by flies has resulted in many proprietary mixtures being put on the market designed for the purpose of keeping off the flies.

Experience covering several years leads to the conclusion that unless used properly fly repellents may do more harm than good. When used regularly the skin of the animal often becomes covered with a sticky gummy substance that apparently is more objectionable to the animals than the flies.

Within the last few years the best dairymen have turned largely from the practice of using special fly-killing sprays on the cows to using such sprays in the barn after the cows have been milked and turned out. By using such sprays with heavy pressure spray guns, a very fine fog is produced which kills the flies. This is spoken of as "fogging the barn" and is best done about three times per week during the fly season. The barn should be closed tightly for some time after the spray has been used.

The use of screens. The inexperienced often are surprised that screens are not used more generally on barns. Experience shows that screens on windows of a dairy barn are worse than useless unless some means can be devised of getting the animals into the barn free from flies. The trouble is that when the cows enter the barn a multitude of flies accompany them. While the animals are in the barn many of the flies leave the animals and go to the windows and are left behind when the cows leave. Screens may actually act as fly traps and add to the fly problem in barns. When the cows return, the barn then contains a large number of hungry flies which at once attack the animals and interfere decidedly with the handling and milking.

Screens should be used by all means on the milk room, and a double screen door provided between it and the barn. It will be found advantageous to have the screen open outward in order that the room may be cleared of flies during the day. A fan blowing a current of air over the milk strainer will keep flies away completely.

Electric Fly Screens and Traps. Within the past few years especially constructed sections of window screens and sections of doors have been charged with electricity. The same principle has been used in especially constructed fly traps. They are coming into favor where electricity is available.

Length of Time a Cow Is Profitable. The dairy cow is mature in regard to milk production at five years of age. Between this point and the age of 10 to 12 years, age exerts no particular effect upon the amount of milk to be expected. Another factor having an important relation to the value of the cow in the herd is the relation of age to breeding. After the age of 10 years difficulties in breeding increase rapidly.

The market price of the grade dairy cow is usually the highest when she is three or four years old. At this time her first milking period, or possibly the first two, are completed and it is possible to judge as well as at any time in her lifetime as to her dairy qualities. She still has the best part of her productive life ahead. After the age of eight years is reached, her market value begins to decline even though she may be at her best in milk production. A decrease in value is clearly justified since her period of future usefulness is short because of the decline in milk production that will come within three or four years, and the knowledge that fully

one-third of all high-class dairy cows fail to breed when past ten years of age. On the average in the grade herds of the country, a cow is milked between five and six years, although in every herd of any size a few will be found that have been in use for ten years. This rapid replacement is due in part to a considerable number being eliminated as unprofitable producers; others have udder troubles, and some develop difficulties in breeding. The replacement in American dairies is much more rapid than in European. Cows stay in Danish dairy herds for approximately seven lactations as against about five for herds in the United States.

In order to have a basis for a decision as to when a cow is no longer profitable, records of milk production and of breeding should be kept. The inferior producers and those which are diseased should be sold regardless of age. The high-producing cows, however, if they continue to breed, should be kept until at least between ten and twelve years of age.

CHECK-UP 23

A. Below is a list of some practices observed on dairy farms. In the parentheses in front of each item place the letters AT if the item is a general rule to be followed at all times. If the item represents a practice that should be followed only under unusual circumstances place the letters UC in the parentheses. If the item is not good practice under any conditions cross it out.

1. ( ) Regular routine in feeding and care of cows.
2. ( ) Same order of feeding and milking day in and day out.
3. ( ) Intensive feeding to develop growth beyond inherited capacity for growth.
4. ( ) Driving cows with aid of dogs.
5. ( ) Driving cows at moderate walk.
6. ( ) Frequent driving of cows to provide exercise.
7. ( ) Daily grooming of cows confined in barns.
8. ( ) Calving in spring.
9. ( ) Calving in the fall.
10. ( ) Dehorning of all animals in the herd not used for show or sale.
11. ( ) Retaining of horns on all animals in the herd.
12. ( ) Identification tags or other means for identification of entire herd.
13. ( ) Open sheds to protect animals from heat in summer.

14. ( ) Controlled ventilation of cow stables.
15. ( ) Disposal of all cows that drop off rapidly in production during the first lactation.
16. ( ) Removal of horse manure from vicinity of cow stables.
17. ( ) Habitual use of fly repellents during warm weather.
18. ( ) Use of fly-killing sprays in barns after cattle are driven out.
19. ( ) Fitting of all windows and doors on cow barns with screens.
20. ( ) Separate quarters for calves.

B. Place an X in the column or columns which indicate the approximate age of the animal in relation to the item listed below.

	Age of Animal in Years	1	1½	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	Minimum age for breeding heifers																	
2.	Minimum age for light service by bulls																	
3.	Peak of breeding powers of bulls																	
4.	Cow reaches maturity in milk production																	
5.	Peak market price for grade dairy cow																	
6.	Market value of most cows begins to drop																	
7.	Value of cow as a breeder at its peak																	
8.	Value of average good cow as a breeder becomes doubtful																	
9.	Value of average good bull as a breeder becomes doubtful																	

CHAPTER XX

CARE AND MANAGEMENT (*Continued*)

Giving the Cow a Rest. The production of a liberal amount of milk is a severe tax upon a cow. Even the moderate amount of 6,000 pounds of milk in a year means the manufacture of 750 pounds of dry matter, or more than the total dry material in the carcass of a steer weighing 1,250 pounds. Experience has shown that a cow will produce more milk in a year if allowed to have a dry period of six weeks or two months than she will if milked continuously. For this reason the universal practice among experienced herdsmen is to allow this interval for restoring the physical condition preparatory to the work of the following year. Under ordinary conditions the cow should be dry six weeks at least, and if in poor flesh, two months is better.

The belief is often held that milking a cow up to the time her calf is born will result in the calf being weak and small from lack of proper nourishment. This assumption is not borne out by experimental observations. The mother and not the calf is the one to suffer.

Drying Off the Cow. With a large proportion of the cows used for dairy purposes more difficulty is experienced in keeping them milking as long as desired than in getting them to take a rest. However, many of the highly developed dairy cows will milk continuously unless dried up intentionally by the owner. With such animals difficulty is sometimes experienced in getting the secretion of milk stopped. Occasionally the excuse that she could not be dried off is given for not giving a cow a rest before freshening.

There is far less danger of injuring the cow's udder in drying her up than is generally believed. After the cow has passed the eighth or ninth month in milk, milk production depends largely upon the stimulation from the act of milking. If a cow is free from mastitis and is producing as little as ten pounds per day, milking can be stopped at any time, and no harm will result. The udder should not be milked out at all. It will fill up for a few days, and then the milk contained is gradually reabsorbed and no harm will result

in any case. If a cow is producing more than this amount of milk, it is advisable to reduce her feed.

Management of the Dry Cow. The physical condition of the cow at time of freshening has a distinct relation to the milk production for the entire lactation period. Experience shows that if a cow freshens in a poor physical condition as the result of not having been dry long enough, or because of poor rations during a period preceding, she starts considerably below her normal level of milk production and no amount of care in feeding and management later will bring her up to the level she would have reached had she been in proper condition.

Rations for the Dry Cow. The feeding of the cow while dry will depend largely upon her condition of flesh when she goes dry. If she is in good order, that is somewhat more than moderate in flesh, little more than a good maintenance ration will be needed while dry. There is no more suitable ration for such a cow than good pasture or legume hay and corn silage.

The dry cow should have some exercise and nothing is better for this purpose than freedom in the pasture. She should never be hurried or be driven by dogs or driven through narrow gates.

Milking before Calving. With some very heavy milkers the udder becomes so distended before parturition (act of calving) that the breeder, especially if inexperienced, is often afraid that injury to the cow will result if she is not milked. Milking before the birth of the calf is not advisable. It is evident that an animal may suffer under these conditions from the great distention of the udder, and some experienced dairymen massage the udder, but no fear need be felt that injury to the udder will result if she is not milked. Milking previous to the birth of the calf tends to delay the onset of parturition because there is a close relation between the nerves of the udder and of the reproductive organs. Sometimes as the result of milking, parturition may be delayed for a week or more and when it does come the contractions of the uterus which expel the fetus are weaker than normal, resulting in more trouble in the delivery of the calf.

Care of the Cow at Calving Time. If the cow has been dry for a time and has been properly fed so she is in good condition at calving time, complications will not be frequent. If the cow is on pasture and the weather is good, she should be allowed to remain there, but looked after at least twice a day. If not on pasture,

the cow should be turned loose in a box stall of sufficient size several days before she is expected to calve. The stall should be thoroughly cleaned and disinfected before being occupied. As the time of parturition approaches, the udder becomes distended and hard, and filled with colostrum milk. When the tendons and muscles relax, leaving a hollow appearance on either side of the tail head, parturition may be expected within 24 hours, or three or four days at the longest.

The cow should be left strictly alone at time of calving, unless some assistance is evidently necessary. As a rule the calf will be born within half an hour. If the calf is not expelled after an hour or two, an examination should be made. The normal position of the calf at the time of delivery is front feet first with the front of the hoofs and knees upward while the nose lies between the knees. If the condition of the calf is normal, the cow may be assisted by pulling on a rope attached to the fore feet of the calf. This must be done carefully and only when the cow strains.

If the position of the calf is abnormal, that is, if it is coming hind feet first or the head doubled back, or any other abnormal condition is presented, the owner should waste no time in securing a competent veterinarian.

Retention of the Afterbirth. The cow is especially subject to retention of the afterbirth, and special attention must always be given that it comes away. When the cow is in good condition, the afterbirth is usually expelled within a few hours after the calf, often almost immediately. Cows far along in years, in low condition of health, or following abortion, are especially subject to this trouble.

The water given the cow following calving should be warmed as it is believed the drinking of very cold water, or exposure to cold weather, results in premature closing of the uterus. In chilly weather, the cow should also be blanketed. The afterbirth, when expelled, should be removed to prevent the animal from following her instinct and eating it. If the afterbirth is not expelled, a serious condition of the cow is brought about by the decomposition of the tissues within the body and the absorption of the poisons. The best course to pursue is to call a skilled veterinarian, and the next best thing is to let the afterbirth alone. There are few conditions that call for greater skill and judgment on the part of the veterinarian. It is utterly impossible for one who has not exam-

ined an animal to say whether a given afterbirth should be removed, or, if it should be removed, when.

Care of Cow after Calving. It should be borne in mind that the vitality of the cow is low following parturition, and she should be treated accordingly. She should be protected from cold drafts, and in case of severe cold weather it is well to cover her with a light blanket for a day or two. The water given her should be warmed for two or three days. The ration for the first few days should be light in character and not very abundant. A bran mash made by moistening bran with warm water is well adapted for the grain portion. With this can be given such amount of hay as will be readily eaten. If the udder is swollen and hard, the grain ration should be increased very slowly until this condition disappears, when more feed can be added, using as a rule two weeks at least, and with a heavy milker still longer, to get her on to full feed. The most successful herdsmen watch this point with great care. No alarm need be felt if the udder remains inflamed and somewhat hard for a number of days, provided milk can be drawn freely from each quarter. The cow should be milked at least three times daily, or oftener, until the inflammation leaves the udder.

Guarding against Milk Fever. Milk fever occurs most often with high-producing cows. It seldom occurs following the first calf of a heifer. It affects mature cows, and especially the heaviest milkers. In recent years the practice has become general, especially with high-producing cows liable to have milk fever, of milking out a little milk at a time several times during the day until the danger of this trouble is past. Only sufficient milk is drawn to relieve the extreme pressure, as it is believed advantageous to leave enough milk in the udder to cause considerable pressure during the dangerous period. When the age and condition of the cow suggest danger from this source, a careful watch should be kept of the animal, especially during the first 48 hours, and to a less degree for a few days more.

Care of New-born Calf. After the calf is born the mother should be allowed to lick it dry. If the weather is very cold or the mother does not seem disposed to lick the calf vigorously, it is advisable for the herdsman to assist in cleaning and drying the calf, using a piece of burlap or other coarse cloth for the purpose. The entire navel cord should be disinfected by dipping it into a cup containing

tincture of iodine or by painting the iodine over the surface. This should be done immediately after the calf is dropped, otherwise infection may be picked up from the floor or bedding.

If the calf is strong and vigorous it will be on its feet and nursing within a few hours. In case it is weak and does not take milk after three or four hours it is well to give some assistance by holding it up to its mother. The calf should have the first or colostrum milk, but if this is impossible because of sickness of the dam, and milk is used from another cow, about an ounce of castor oil may be given with advantage to assist in cleaning out the digestive tract.

While the calf is still with its dam it should be marked according to the system in use in the herd.

It is generally best to take the calf from its mother at the end of 24 hours and place it in an individual stall. The care and feeding from this point is explained under the title of "Calf Raising."

Water for Cows. Cows that are producing milk require a much larger quantity of water than is necessary for growing animals or for those that are merely being maintained, as in the case of wintering breeding stock of the beef breeds. This is caused by the necessity of providing water to be used in the milk itself and for the digestion and assimilation of a large quantity of feed, much of which is roughage.

The author found that a Jersey cow producing 27 pounds of milk daily consumed 77 pounds of water. Another of the same breed producing 13 pounds of milk used 40 pounds of water. A Holstein cow producing an average of 110 pounds of milk daily consumed from 215 to 350 pounds of water daily during the seven days covered by the data. These figures bear out the results obtained by others and indicate that the cow uses water at the rate of about three pounds to each pound of milk produced.

The best source of supply for drinking purposes for dairy cattle is deep well water supplied through individual drinking cups and available at all times. Next to this are running streams or springs. Ponds may be used if they are so placed that there is no drainage from barnyards or about dwellings, and if the animals are not allowed to wade into the water. Ponds which are filled with contaminated drainage water or in which stock of any kind are allowed to wade and pollute with their own excrement, are entirely unsuitable as a source of water supply. Not only should the use of such

water be avoided for sanitary reasons, but the amount of water consumed under these conditions is liable to be below the real requirement of the body.

Watering Cows in the Barn. One of the most useful features of modern barn construction and equipment is the use of watering cups in the barn. The outstanding advantage is the possibility it affords for the cow, requiring as she does such large quantities of water, to drink a small amount at a time and at frequent intervals. There is no question but that when the plan is followed of watering at an outside tank once or twice a day, the heavy-producing cows, during the winter especially, often fail to consume as much water as they need for best results.

The economy of labor is also an important factor to be considered, because provision for watering inside avoids the necessity of turning the cows loose for the purpose of watering. The first plan introduced for watering in the barn was that of building the manger in the form of a continuous trough with a drain to carry away the surplus. When the cows were to be watered the manger was swept clean of feed and filled with water. This plan is no longer advocated because of the spread of tuberculosis and other mouth-borne diseases. In recent years the plan has become general in well-equipped barns to provide individual drinking cups. These are constructed so that the animal opens the valve by pressing with the nose or by raising the cover and water continues to run so long as she drinks. When the animal drinks small quantities at a time the necessity for warming the water is removed.

Perhaps no part of the modern barn equipment yields more return on its cost price than well-constructed individual drinking cups. When properly installed, about the only difficulty experienced is from freezing, if the barn is not so constructed as to keep the temperature above the freezing point.

Warming Water for Dairy Cattle. In climates where the temperature remains below freezing for long periods it is profitable to use some means of warming the water when the animals drink from a tank outdoors. In addition to the minor advantage of having the tank free from ice the chief value of warming the water in the outside tank is to insure that the cows will drink a sufficient amount. A heavy-producing cow requires from 70 to 150 pounds of water daily and will not consume a sufficient amount if near the freezing point.

Salt Requirements. All animals that consume large quantities of vegetable food require salt. Carnivorous animals do not have this craving, neither do human beings who live mostly upon meat.

Salt may be supplied by mixing the proper amounts regularly with the feed, or it may be placed where the animal can consume such amounts as the appetite demands. From one to three ounces per day is needed, depending upon the amount of milk produced. Some feeders prefer rock salt, in which case a lump is placed where it can be licked by the animals as their appetite calls for it. Heavy-producing cows should not be required to secure their total salt requirements in this manner, however. The common plan of salting the cattle only at intervals of one or two weeks is not recommended.

CHECK-UP 24

Cows require consistent attention and care. The successful dairy farmer plans well ahead.

A. Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct answer to a statement.

1. In order to obtain the most milk per cow in any twelve month period: (a) she should be milked continuously for the entire period; (b) the cow should have a dry period of six to ten weeks dependent upon her condition; (c) the cow should be dried off before freshening.
2. In drying off a cow: (a) there is considerable danger that the udder will be injured; (b) stop milking when she produces not more than ten pounds a day; (c) if it is necessary to dry her off gradually because she is milking heavily do not milk her out; (d) reduce her feed, especially the concentrates.
3. The cow should not be milked before calving because: (a) the birth of the calf may be delayed; (b) even though the udder becomes swollen and hardened no injury is likely to result; (c) the cow is in a very nervous condition at this time.
4. When the cow is calving she should: (a) usually be left to herself; (b) always have the attention of a good veterinarian; (c) should have assistance if parturition is delayed more than an hour.
5. During the two weeks following the birth of the calf the cow should be: (a) fed gradually increased rations until normal diet is restored; (b) milked at least three times daily until there is no inflammation in the udder; (c) watched carefully for signs of milk fever; (d) allowed to look after the calf.

6. Cows should have access to pure drinking water in the stable because: (a) they consume about three times as much water per day as the milk produced; (b) they will drink more water if it is always available; (c) lack of sufficient water lowers milk production.

B. Cows heavy with calf should receive the kind of care they need. Bart Hall is a young farmer who only recently got started in dairying. He bought good grade cows bred to freshen in the fall. As the time approaches when his first calves are to be born he wants to be certain that he will not forget anything that is needed to insure a successful calving time. So he made the following list and nailed it up in the barn. Cross out any items which are not likely to be of benefit to the cow and calf at calving.

(a) Stop milking eight weeks before calf is due and give cow vacation on full feed.
(b) Clean and disinfect quarters.
(c) Provide roomy well-bedded box stall.
(d) Avoid disturbances in the barn.
(e) If, before calving, cow's udder becomes hard and swollen, milk her out.
(f) Assist cow at first sign of calving.
(g) Make sure calf gets colostrum milk.
(h) Teach calf early to drink.
(i) Weigh milk for calf.
(j) Keep all utensils clean.
(k) Dip the entire navel cord of the calf in iodine as soon as it is born.
(l) Mark the calf for identification after it has been allowed to mix with the herd.

CORRESPONDENCE OR CLASS ASSIGNMENT 7

1. Outline, in their proper order, the chores involved daily in caring for dairy cows and explain the relation of this routine to the dairy temperament.

2. Discuss the part played by each of the following in good dairy farm practice; (a) frequency of weighing and testing of milk; (b) maintenance of individual records; (c) relation between milking and feeding.

Have you applied for your End-of-Course Test? See "What the Book Is About and How to Use It," at the front of the book, pages iii-v.

CHAPTER XXI

MILKING AND MILK

MILKING

Milking the Heifer. If the heifer is properly handled before she has her first calf, there is little difficulty in teaching her to be milked. If the heifer has been tied while being fed as a calf, there will be no further trouble about tying her at any time. The heifer should be accustomed to the stable where she is to be tied for some time before she calves. For a month or more before she freshens it is best to tie her in the stall she is to occupy when in milk, and to make a point of handling her daily. A careful attendant should have the milking of her at first, who must go about it carefully and without exciting her. Very little trouble will ever be experienced under such conditions. The attendants who care for cows should always move about among them gently and not startle them by sudden movements or loud talking.

Methods of Milking. Milking is generally considered such a simple operation that any common laborer is supposed to be able to milk. However, there is an immense difference in milkers, and one of the most difficult parts of carrying on dairy farming is that of securing competent men to do this work. One milker may be able to get 20 per cent more milk than another, one may dry the cow within a few months, while another may keep her in milk the entire year. The milker should not be allowed to excite or worry the cows by loud talking or cruelty or abuse of any kind.

The secretion of milk is involuntary, but may be affected indirectly by excitement of any kind. Even the presence of a stranger or a dog at milking time is sufficient to affect the milk yield of many cows. The changing of milkers results in some loss for a few milkings, unless the new milker is unusually proficient.

A cow should be milked quietly and quickly. A cow is largely a creature of habit. If usually fed at the time of her milking she cannot be milked satisfactorily until she has her feed. Special care should be taken to secure all of the strippings (the last drops of milk). The first milk drawn may contain as little as one per cent

of fat, while the last drawn runs from six to ten per cent fat. In milking, the whole hand should be used, closing first that part next to the udder; then the milk is forced past the sphincter muscle by closing the remainder of the hand. The milking should not be done by using the thumb and forefinger alone, neither should the thumb be enclosed with-

in the palm, as is sometimes done. The cow's teats should always be dry when milking. Wetting the teats not only is a dirty, filthy practice, but it also allows the teats to chap and become sore in cold weather. If there is difficulty in milking dry, a small amount of vaseline may be rubbed on the hands. This serves the same purpose as wetting the teats, and is beneficial rather than harmful, both in a sanitary way and as it affects the cow's teats.

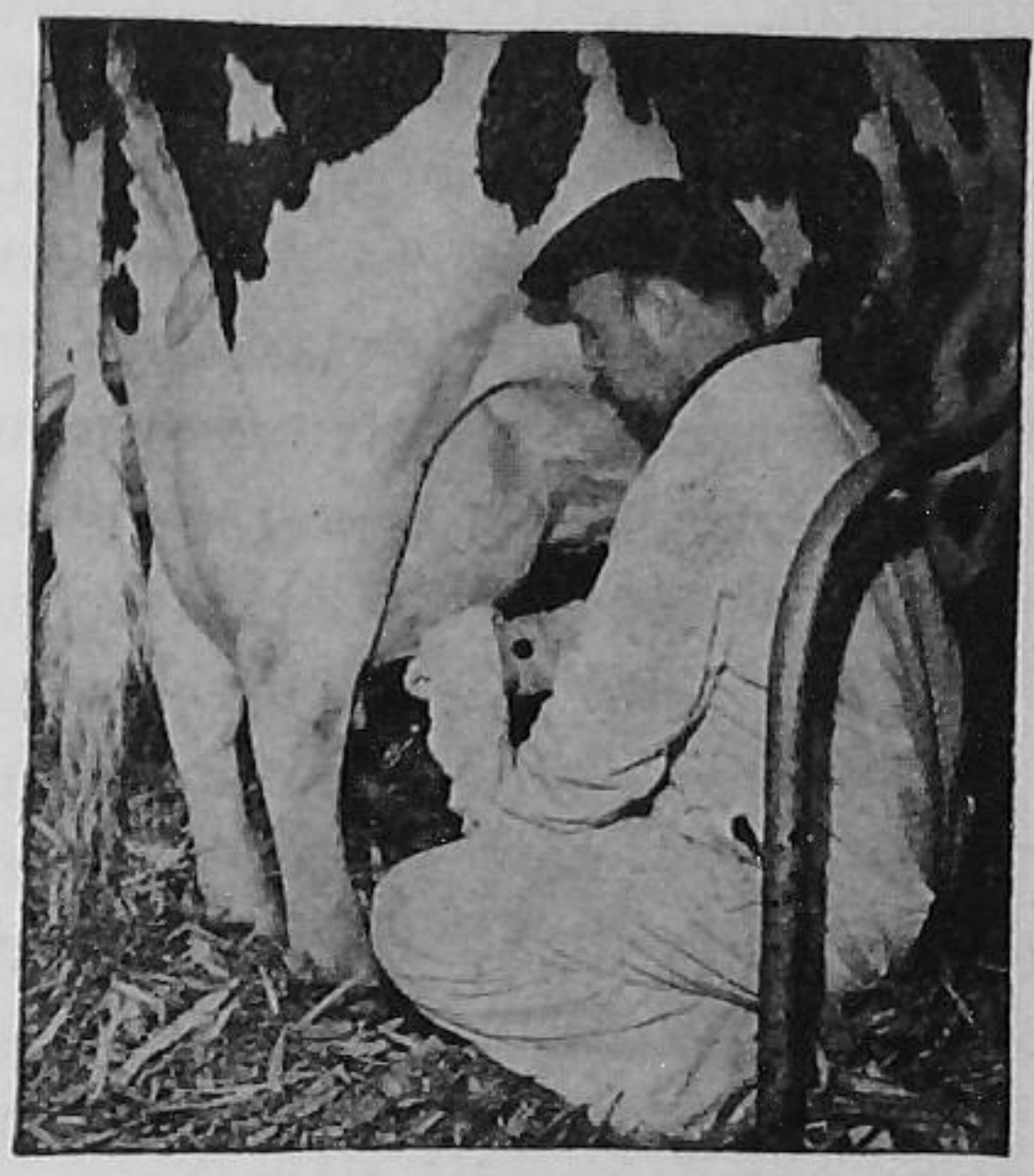


FIG. 53. Having the udder clean before milking is highly essential.

Milking More than Twice Daily. Under ordinary conditions the usual practice of milking twice daily is practical and sufficient. The intervals between should be as nearly equal as possible. Occasionally there are conditions which justify milking three times daily even when the production of milk for market is the objective. Heavy-producing cows will increase their yield by an additional milking while small or medium milkers show no appreciable increase. Few cows will produce over 50 or 60 pounds, at the most, with twice-a-day milking. For the Channel Island breeds 35 to 45 pounds mark the same limits. With cows of this grade a third milking makes it possible not only to make use of the full capacity of the animal but also apparently to hold up the production to a high level for a longer period.

Hard-milking Cows. Some cows cause considerable annoyance to the milker because they milk unusually hard. This is caused by a strong sphincter muscle, which closes the teat opening tighter than it should. Allowing the teats to become dry and harsh also tends to produce this condition. The use of vaseline or oil on

the teats and milking by a milker with strong hands may partially remedy the condition.

Chapped Teats. Sore teats may be caused by cold weather, milking with wet hands, or other causes of local irritation. When so affected the cow does not stand quietly for milking, because of the pain. The trouble may be easily remedied. The application of vaseline for a few times on the first appearance of the trouble will usually check and cure it. If chapping be severe, the teats should be thoroughly washed and softened with warm water, after which zinc oxide ointment may be applied. An application of olive oil is also often recommended.

Kicking Cows. Cows are given to few vices, and those are mainly due to faulty management. The most common vice is that of kicking when being milked. The cows often kick at first, either from pain or fear, and if not handled properly, this may grow into a habit. Under no circumstances should an attendant strike a cow that kicks. It does no good, and always makes them worse. Gentle measures, however, will not work with all cows, and some old cows that have been taught by mismanagement to kick cannot be cured by the best of care. Such animals should always be tied during milking. This is best done by taking a rather heavy strap with a strong loop. The strap is put around one leg above the hock, and the end drawn through the loop. The strap is then put around the other leg and buckled, so the two legs are held close together. The cow may struggle a little at first, but soon learns to stand quietly as long as the strap is in place.

The Milking Machine. A satisfactory mechanical milker has long been one of the greatest aids of the dairy farmer. The wide opportunity offered for a successful device of this kind early attracted the attention of inventors. The reports of the Commissioner of Patents show that 127 patents on milking machines or parts were taken out in the United States alone between 1872 and 1905. The successful milker of today is the result of a long period of development. The first really practical mechanical milkers appeared on the market between 1900 and 1910. Modifications and improvements were made constantly until the development now reached a point of satisfactory service.

The use of milking machines has increased rather slowly as compared with that of some other types of machines. A large number of designs have been on the market for a time, only to disappear

later. One of the discouraging things about the milking machine so far is that a large number of farmers, probably fully one-half of those who have installed them, have later discarded the machine. On the other hand, others who have used machines for several years are entirely satisfied and would not continue in the dairy business without them. This suggests that success in using a machine of this kind depends largely upon the operator.

Efficiency of Milking Machine. Tests of the efficiency of machines of different types, the relation to the milk yield and to the sanitary condition of the milk have been made by several experiment stations and the United States Department of Agriculture. From these reports it is possible to arrive at a reasonably safe conclusion regarding the general working of these machines in practice.

It has been thoroughly demonstrated that milking machines will milk cows and that a skilled operator will do as efficient work as the average hand milker. It is questionable, however, if the milking machine is equal to a skillful experienced hand milker in the amount of milk secured. During the early part of the lactation period the cow apparently milks better by machine as compared with hand milking than is the case later in the milking period. Most users have found it more difficult to hold up the yield of milk during the last part of the milking period when the machine is used. After a cow has been in milk for some months the stimulation to produce milk is due partly to the act of milking itself. Hand milking undoubtedly results in more stimulation of this kind than does machine milking unless machine milking is followed by careful stripping.

The cow is not injured in the least and usually very quickly becomes accustomed to machine milking.

Disadvantages of Milking Machines. Probably the greatest real criticism of the milking machine is the ease with which it spreads infectious udder troubles. This has become so great in some herds that machine milking has been discontinued. Care must be taken to milk any cow last which shows any suspicion of inflammation of the udder, or better still, not to use the machine at all in such cases. A careful sterilization of the teat cups is always advisable, but especially so when there is any evidence of udder trouble.

Since the chief source of dirt in milk is the body of the cow from

which dirt drops during milking, it would appear that the use of the milking machine by excluding this dirt would be an important factor in improving the sanitary condition of milk. However, surveys show that machine-drawn milk usually is inferior rather than superior to hand-drawn in bacterial content. This is the result of careless cleaning of the outfit. If the machine is properly cleaned and used, the sanitary condition of the milk is improved over hand milking; on the other hand, if not well cleaned, the milk is in decidedly worse condition.

A farmer considering the purchase of a milking machine will do well to visit farms where different makes are in use and observe their operation. It is also well to select a machine that has been on the market long enough to make certain that the defects have been discovered and corrected. The chances are also better that a company which has been manufacturing a machine for several years will remain in business, making it possible for the user to secure parts when needed. The portable unit is a recent development with many advantages.

CHECK-UP 25

Is milking a simple operation that anyone can perform effectively? Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. A cow should be milked: (a) quietly; (b) slowly; (c) quickly; (d) with dry hands; (e) with wet hands; (f) with the whole hand; (g) with thumb and forefinger.

2. Three-time daily milking will increase the yield from: (a) high-producing cows; (b) low-producing cows; (c) medium producers.

3. Milking machines milk cows: (a) as well as the average hand milker; (b) better; (c) not as well.

4. The greatest criticism of the milking machine is that it is: (a) noisy; (b) complicated; (c) sometimes the means of spreading udder trouble.

5. One of the most important factors in the successful use of the milking machine is: (a) keeping it clean; (b) getting the cows used to it; (c) getting spare parts.

FACTORS INFLUENCING THE QUANTITY AND QUALITY OF MILK

The Breed. It is a well-known fact that the breed of the animal bears a distinct relation to the quantity of milk produced and especially to the fat content. Within a breed the variation in milk yield is far greater than that of the fat percentage. For this reason many individuals within a breed do not show the typical milk yield of the breed they represent. For example, while the Holstein breed has the highest average milk yield, the lower producing animals within the breed are decidedly below even the average animals of breeds that rank considerably lower in production. Milk produced by individuals within a breed varies much less in composition than yield, and is generally fairly typical of the breed.

Table 20 gives the average per cent of fat by breeds.

TABLE 20. RELATION OF BREED TO PERCENTAGE OF FAT AND TOTAL SOLIDS
(From Advanced Registry and Experiment Station Records)

BREED	AVERAGE FAT PERCENTAGE ADVANCED REGISTRY	EXPERIMENT STATION RECORDS	
		Per Cent Total Solids	Per Cent Fat
Holstein	3.41	12.29	3.45
Guernsey	4.95	14.70	4.98
Jersey	5.37	14.90	5.14
Ayrshire	3.97	12.98	3.85
Brown Swiss	4.00		
Shorthorn	3.94	12.85	3.80
Red Polled	4.32		4.03

Size within the Breed. In general those keeping dairy cows primarily for the production of dairy products for sale prefer a cow medium to large for the breed. Most breeders of pure-bred cattle have the same view.

The cows that have made the largest milk and fat records have been without exception large animals for their breed. It has been shown that the highest production is found with cows that are large for the breed to which they belong. The indications are that the stimulation to give large quantities of milk may be inherited independently of size. An undersized cow with a great stimulation to give milk is limited in her capacity to digest food and cannot compete with a larger animal that has stimulation to give milk to

the same degree and has also the capacity and strength to handle the feed necessary for high milk production. Size and strength then are desirable but alone do not indicate ability to produce milk. Selecting a dairy cow on the basis of size alone would be poor policy although high-producing cows usually have good size. There is no relation within the breed between the size of the animal and the richness of the milk.

Variation from Day to Day. When cows are milked twice a day at twelve-hour intervals the composition of the milk usually varies but little, although there is a tendency for the milk from the evening milking to be higher in fat content. Marked variations in the fat percentage often occur in the milk from the same cow from day to day. Sometimes the cause for such variations may be recognized, but our present knowledge of milk secretion is too incomplete to give a satisfactory explanation in many cases.

Seasonal Variation. Another factor causing variations in the composition of milk is the season of the year. Farmers selling milk according to the Babcock test generally note that the test is lower in summer than in winter. The decline in test usually begins in the spring, and the rise generally occurs in the fall.

The mistake has often been made of assuming that this decline in test during the summer months is the result of the food. The fact that the test is the lowest during the early summer when the grass is at its best but that the test shows a tendency to increase towards winter when grain feeding begins is frequently interpreted to mean that the grass is the cause of the depression. Experimental work has shown that this is an error. The same decline in test during the summer and the increase in the fall have been found to occur in the same manner with cows receiving a typical winter ration throughout the summer and having no access to pasture grass. The tendency is for the tests to reach the low point in early summer, usually June, and the highest point in December or January.

Stage of Lactation and Milk Yield. The point during the lactation period at which milk production normally reaches its highest level, and the rate of normal decline are of concern to the practical herdsman. Considerable individual variation from any average is inevitable. Certain cows, as the result of inheritance, do not hold up in milk as well as others. The important relation of feed should also be emphasized. Too often a cow is said to lack per-

sistency when she is really doing all she can with the feed received. The heavy-milking cow is often underfed when she is fresh because nature, to make sure the calf will not suffer, has arranged for the fresh cow to continue to give milk freely for a certain time even if deficient in feed, by making up the deficiency from her body. The normal rate of decline in milk during the lactation period can be observed only when the cow concerned has at all times sufficient feed to supply the nutrients for the milk she is producing.

In Fig. 54 one group includes cows under official test conditions and the other represents good farm conditions where the animals freshen again within twelve months. Official test conditions include three or four milkings daily and delayed breeding. As a result of these conditions this first group shows less decline as the lactation period advances.

It will be noted that the highest milk yield for both groups is reached the second month. From this point on to the eighth

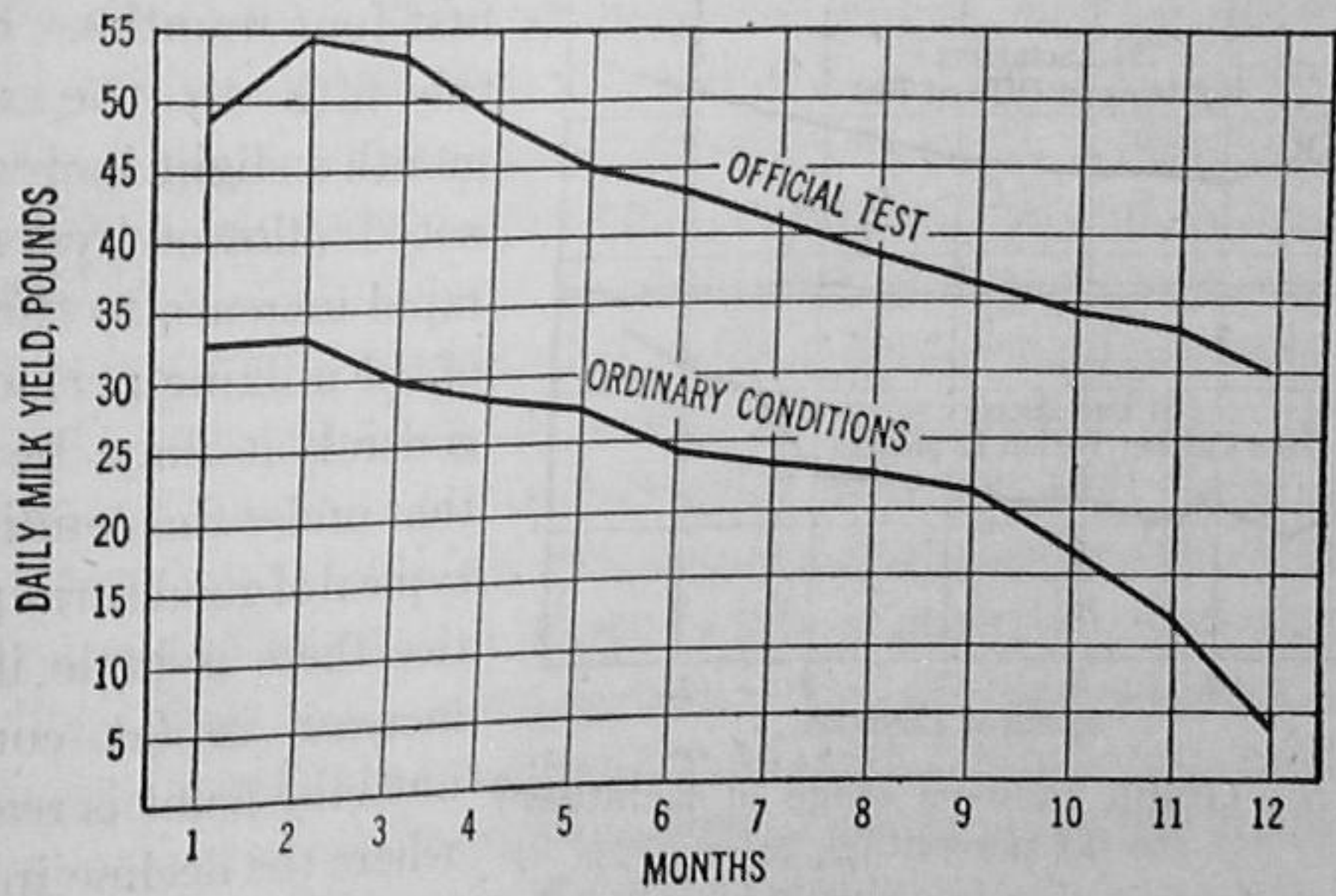


FIG. 54. Graph showing stage of lactation to milk yield.

month the decline is much the same. From the ninth to the twelfth month the decline is decidedly more rapid for the group which calved again within the 12-months' period. Cows that make high official records for a year generally hold up better during the last six months than indicated by the average figures given. By using the percentage figures given, it is possible to estimate what a certain animal will produce at different stages in her milking period. It should be kept in mind that these figures represent the special dairy breeds. Dual-purpose breeds are as

a rule less persistent milkers and the rate of decline for these breeds is more rapid.

Stage of Lactation and Fat Percentage. The influence of the stage of lactation upon the fat content of milk is often overestimated. Furthermore, it is influenced by several other factors. The data illustrated in Fig. 55 show the averages made up regardless of the month of freshening. The first group includes 34 cows representing four breeds, kept under conditions typical of the best farm practice, and all of which calved again within 12 months. The fat content of the milk from this group remained practically the same for the first four months. From the fifth to the ninth month a slight increase is noted followed by a more rapid increase to the end of the milking period. In general, it may be said that under the conditions typical of good farm practice there is little if any increase in fat content until the point is reached where the decline in milk production is rapid.

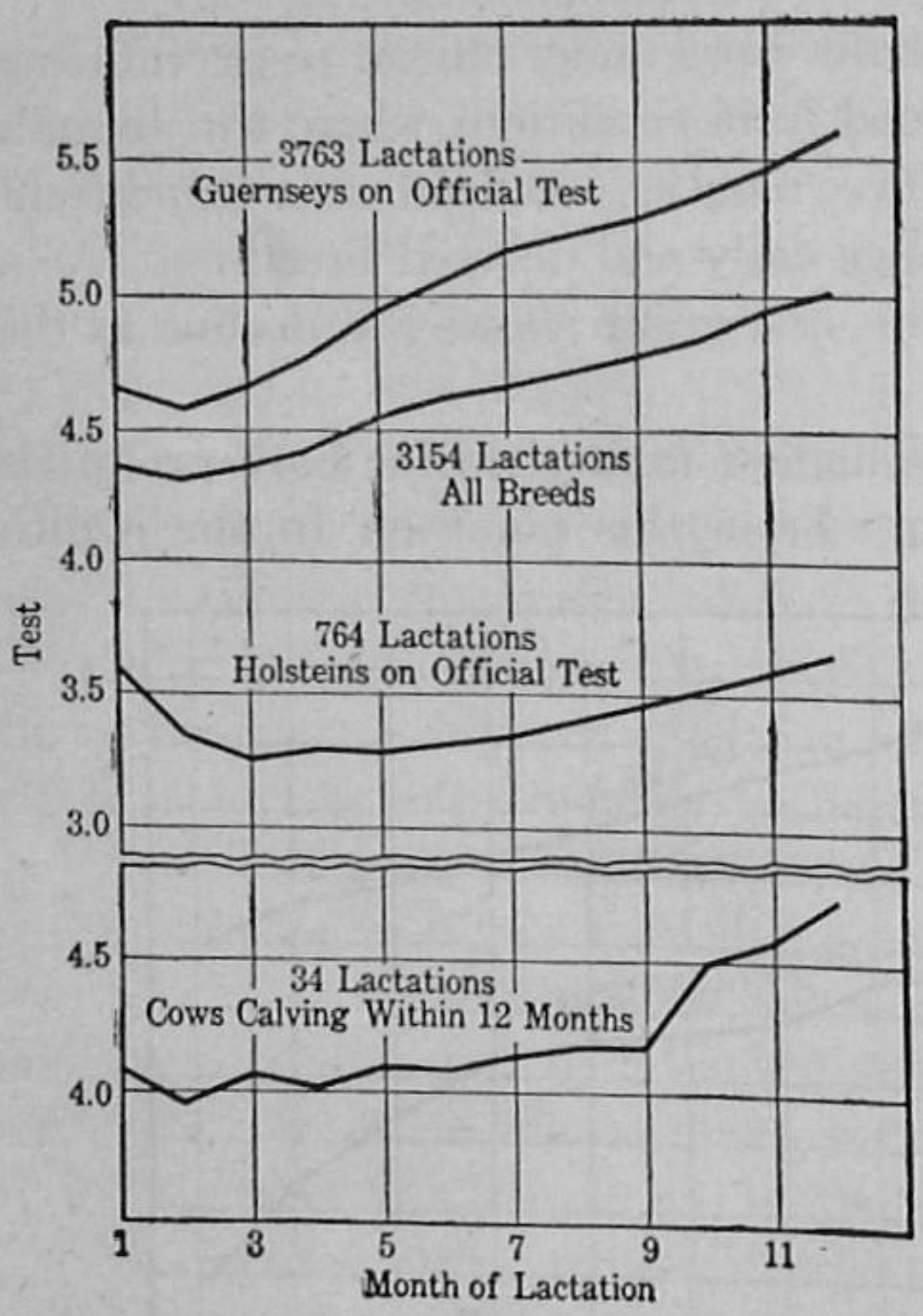


FIG. 55. Graph showing stage of lactation to fat percentage.

Cows under official test conditions show a somewhat different result. The Holsteins — and the same is true for the Ayrshires although no figures are given — show a marked decline from the first to the third months, running about the same to the eighth month, after which there is a tendency to rise until at the tenth month the fat percentage is about on a par with the first month. The high fat percentage in the beginning is the result of having the cows in high condition as explained in another paragraph. These same groups of animals would usually increase later to over four per cent during the period when the milk production is declining rapidly.

The Guernsey records made under official test conditions show only a slight decline after the first month. For some reason this breed and the Jerseys as well do not show an increase in fat content of milk as the result of high conditioning in preparation for official testing. The last column shows an average of all studied, 3,154 lactation periods, some under official test conditions, others not. These show a slight decline from the first to the second month, followed by a gradual increase to the twelfth month.

As pointed out in another paragraph, the seasonal influence modifies the variation in fat content of milk materially and, in fact, is a greater factor than stage of lactation except for the rapid increase as the cow is going dry.

Effect of Gestation. It is a matter of common observation that a cow that is not bred or that fails to become pregnant holds up in milk production better than one that is carrying a fetus. The cattleman usually attributes this falling off in milk to the tax upon the animal commonly assumed to accompany gestation. The decline in milk production after the animal reaches about six months in gestation is the result of the hormones produced by the ovaries which exert an inhibiting effect on the secretion of the lactogenic hormones produced by the pituitary gland.

The effect of gestation upon milk secretion begins to be noticeable when the period is about five months along.

Delayed breeding is justified when it is desirable to secure the maximum production, as when making official tests. When the production of market products is the object, the best plan is to have the cows freshen at intervals of about twelve months.

Feed in Relation to Yield and Richness. The amount of milk a cow produces depends upon two things: first there are the internal factors which are the result of inheritance, and second there are the factors of environment, that is, the feed and management. It should be kept in mind that feed alone cannot cause a cow to give milk beyond the limits of her inherited ability. The extent to which she can use feed for this purpose may be looked upon as the result of an internal stimulation. Within the limits of her inherited capacity the amount of milk is closely dependent upon the feed received and need not be discussed in detail here.

It would seem reasonable to assume that the richness of the milk would be influenced by the feed received by the animal. This question has received much attention by experiment stations in

this country and in Europe, and the evidence is conclusive that the fat percentage of the milk cannot be changed permanently by any method of feeding. Certain experiments have shown that sudden changes in the ration — for example, greatly increasing the protein or oil content of the ration — may result in a small fat increase for a few days with some individuals — with others no effect is produced, and in any case the results are only temporary. No ration or method of feeding has been found by means of which a Shorthorn or Holstein can be made to give milk as rich as that of a Jersey or Guernsey.

Good feed and care have resulted in nearly double the amount of milk produced under poor feeding conditions. The richness of the milk, however, was not increased to any appreciable extent by the better feed.

First and Last Milk Drawn. It is a well-established fact that the first milk drawn contains a very low percentage of fat and that the last or the strippings, as ordinarily termed, is very rich in fat.

Table 21 is a summary of data from 7 cows representing four breeds and gives the results of a complete chemical analysis.

TABLE 21. COMPOSITION OF FIRST AND LAST MILK DRAWN

	Total Protein Per Cent	Sugar Per Cent	Fat Per Cent	Ash Per Cent	Total Solids Per Cent
First milk .	3.58	5.30	1.87	0.75	10.67
Strippings .	3.38	5.33	6.28	.70	14.86

These figures show that the difference between fore milk and strippings is confined to the fat, and that this constituent shows a striking difference. It was also observed that the variation in fat content between fore milk and strippings is usually the greatest with heavy milking cows.

The milk of a Jersey cow producing 36 pounds daily contained 1.59 per cent of fat in the fore milk and 5.9 in the strippings, while the milk from a cow of the same breed producing seven pounds daily contained 3.07 per cent of fat in the foremilk and 4.91 in the strippings.

The practical value of these facts is to make it clear why the cow

should be stripped when milked in order to secure the maximum amount of the high testing milk. The last pint of milk drawn is equal to the first two quarts in fat contained.

Incomplete milking is also deterimental because if practiced continually it hastens the decline in lactation. Thorough massage of the udder before milking is begun decreases greatly the difference in fat test between the foremilk and the strippings.

Condition of Flesh at Calving. Good practice requires that the cow be in a strong, vigorous condition at time of freshening and have considerable surplus flesh as a reserve. The milk yield, especially in the early part of the lactation period, depends to a considerable extent upon this point.

Within the limits of ordinary practice the fat percentage is not influenced as much by the physical condition at this time as is the milk yield. However, when the conditions are rather extreme, a pronounced effect upon the fat percentage results. A cow which calves in a decidedly fat condition may for the first twenty to thirty days have a fat test very much above her normal for the year and, likewise, decidedly more than would be found if she were in a thin condition. In some cases the effect may continue for as long as three months. The possibility of influencing the test in this manner has been made use of as one of the abuses in forcing cows to abnormal records in official testing.

A single, rather extreme case will suffice to illustrate the possibilities. The author, in conducting the first experiments establishing this factor, secured an average fat percentage for seven days of 5.1 from a Holstein cow fattened to excess before calving. Her average for the year was 3.3. The following year the same cow, calving in moderate flesh, averaged 3.6 per cent of fat for seven days while for the year the average was 3.3 or the same as the preceding year.

Influence of the Heat or Estrum Period. The question is often raised whether the milk produced during the period of heat or estrum is suitable for human food, especially for infants or invalids. It is recognized that any unusual excitement or exercise may change the composition of the milk, especially in regard to fat content. However, the estrum is a perfectly normal function of the animal and should hardly be classed as unnatural or abnormal, and it is doubtful if any harmful effect would be produced upon the milk.

Relation between Daily and Yearly Production. The only

means of knowing what a cow will produce in a year is to keep systematic records. It is recognized that an estimate of yearly production based upon the results of a few days is certain to have at best a limited value. As is often the case an average can be determined that will represent reasonably well the results from a group. Individuals, however, will vary widely from the average due to the many factors determining milk production. However, in a herd where uniform conditions of feeding and care are maintained, there is a fairly definite relation between the highest point of the lactation period and the total production, and figures showing this relation have some value.

Table 22 brings together data showing this relation as expressed in averages. The figures given by breeds are averages compiled from the records of 250 pure-bred cows, milked twice a day and freshening again within twelve months. These animals all received good feed and care. In compiling these data the individuals were placed in groups according to their average daily production for the month having the highest total milk during the lactation period.

TABLE 22. RELATION OF DAILY MILK YIELD TO YEARLY PRODUCTION, TWICE-A-DAY MILKING, CALVING WITHIN TWELVE MONTHS

AVERAGE DAILY YIELD HIGHEST MONTH	AVERAGE YIELD FOR LACTATION PERIOD				PROBABLE YEARLY MILK PRODUCTION
	Holstein	Ayrshire	Guernsey	Jersey	
Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
15–20	3,787	3,985	3,914	3,600	3,000– 4,500
20–25	5,480	5,158	4,614	5,498	4,500– 5,500
25–30	6,864	5,577	5,996	6,172	5,500– 6,500
30–35	7,079	6,367	6,548	7,133	6,500– 7,500
35–40	7,880	6,913	8,052	8,010	7,500– 8,500
40–45	9,598	8,557	8,900	9,385	8,500– 9,700
45–50	10,190	10,800			9,700–11,000
50–55	11,435				11,000–12,000
55–60	12,693				12,000–13,000
60–65	13,118				13,000–14,000
65–70	14,851				14,000–15,000

An examination of the data in detail showed that about 90 per cent of the total records for each group came within the figures given in the column indicating the probable yearly production.

The table shows, for example, that a cow averaging between 25 and 30 pounds of milk daily at her best, should be expected to produce between 5,500 and 6,500 pounds for the year; a daily average, at the best, of 40 to 50 pounds indicates 8,500 to 9,700 for the year. The figures seem reasonably uniform for the four breeds included. It should be added that the animals supplying these data had excellent treatment, and the estimated yearly production in proportion to the daily yield is therefore higher than for many herds.

Official vs. Ordinary Milk Production Records. In recent years official testing of pure-bred dairy cows has become general and the

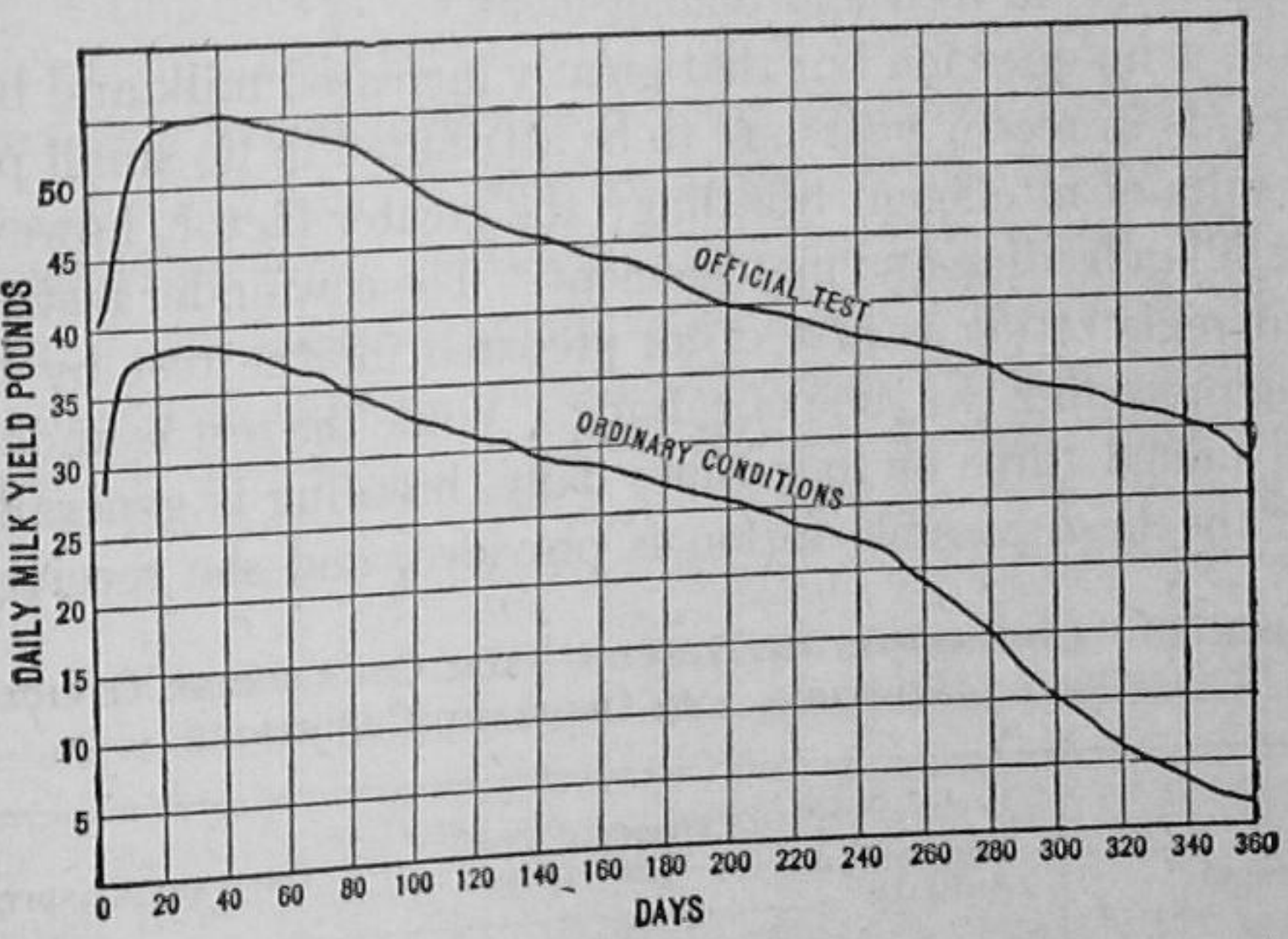


FIG. 56. Comparison of production under good farm conditions and official testing. This chart shows the average daily milk production during two years for a group of 41 cows, including four breeds. The curve marked "ordinary conditions" shows the production during the lactation period under good farm conditions, which includes twice-a-day milking, and freshening again within 12 months. The line "official test" represents the production of these same cows under official test conditions which include three or four milkings daily, extra care and delayed breeding. The official test conditions gave an increase of 70 per cent in milk over good farm conditions.

records of milk and fat production are given wide publicity. Such records are used as the basis of breeding. Fifty years ago a production of 14 pounds of butter in a week, or 500 pounds in a year, was sufficient to justify a widespread reputation for a dairy cow. Now records over 1,000 pounds in a year are too common to attract more than local interest. An important question arises in this connection as to what extent these greatly increased records of

recent years are the result of better breeding and to what extent they are to be attributed to more skill in feeding and management.

Important questions also arise in connection with the records from the cow-test associations and their relation to records from official test conditions. Cow-test associations are becoming an important factor in the improvement of dairy cattle. The records of these associations, however, are decidedly below those made under conditions of advanced register testing. The question arises as to how far it is fair to compare them, and if the wide range in records between the two is due to the quality of the animals or to a difference in feed and management.

There is no question but that greatly increased milk and butter-fat records in recent years are to be attributed in no small part to the results of intelligent breeding; the greater factor, however, is more skill in feeding and management. The cow under test for advanced registration is first of all prepared for the test by liberal feeding preceding the time of calving. While the test is under way she is milked three or four times daily, breeding is generally delayed, the best possible ration is provided, and she receives the

TABLE 23. COMPARISON OF RESULTS FROM COWS UNDER OFFICIAL TEST CONDITIONS AND ORDINARY CONDITIONS

BREED	NUMBER ANIMALS	OFFICIAL TEST CONDITIONS		ORDINARY CONDITIONS	
		Milk	Fat	Milk	Fat
		Lbs.	Lbs.	Lbs.	Lbs.
Jerseys . . .	17	10,213	531	6,554	331
Holsteins . .	18	18,928	618	10,456	366
Guernseys . .	3	12,197	552	6,983	328
Ayrshires . .	3	12,222	449	7,871	283
Average . .	41	14,331	564	8,395	343

most careful attention that a skilled herdsman can give. Under typical farming conditions, the milking is done twice daily, and the cow is expected to drop another calf within twelve months. The feed and care varies widely, but the cow at best receives far less attention than would be the case under official test conditions.

The results of a study made concerning the relation between milk production under official test conditions and ordinary condi-

tions are given in Table 23. An analysis of the records reported shows that the difference between records made under official test conditions and ordinary conditions is greatest with those making the highest records under official test.

Influence of Age upon Richness of Milk. A large amount of data are available on this point and the facts are well established.

Table 24 gives a compilation of data from official testing records. These figures are especially valuable because of the very large number included — over ten thousand for one breed alone. These data show no variation in fat percentage of any consequence due to age, within the limits usually included by cows on official test.

TABLE 24. RELATION OF AGE TO FAT PERCENTAGE (RESULTS FROM OFFICIAL TESTS)

AGE	HOLSTEIN	AYRSHIRE	GUERNSEY	JERSEY	BROWN SWISS
Years	Per cent	Per cent	Per cent	Per cent	Per cent
Over 5	3.42	3.91	5.00	5.27	3.93
4–5	3.39	3.95	4.01	5.36	4.02
3–4	3.39	4.00	5.04	5.45	4.06
2–3	3.42	4.05	4.98	5.37	4.01

The figures show that the richness of the milk remains fairly constant, fluctuating slightly with individuals from year to year until the animal is past her prime, when it slowly declines with advancing age. A cow of a high-testing breed averaging 5 per cent of fat as a young animal will decline to about 4.5 per cent if she continues to produce to 14 years of age.

A heifer having a low test as a two-year old is sometimes excused on the ground that she is young and will do better when mature. The data show there is no ground for such belief. The facts are that the richness of the milk is a matter of inheritance and is fixed even before the animal is born. Nothing can be done to change it. Selection of the breed and breeding stock from high-testing families and of individuals are the means to be used in securing a high-testing herd.

CHECK-UP 26

A. Match the following items in the right-hand column with the proper choices in the left-hand column. To do this insert the number or num-

bers of choices in the parentheses in front of the proper item or items. There may be items that cannot be matched. There may be others that can be matched with more than one choice.

Choices	Items
1. Breed of cow	a. ( ) Quantity of milk
2. Size of animal	b. ( ) Quality of milk
3. Intervals between milking	
4. Stage of lactation	
5. Seasonal variation	
6. Gestation	
7. Feed	
8. Strippings	

B. If the statement is true circle the letter T. Circle the letter F if it is false.

1. T F The estrum period of the cow has no effect upon her milk.

2. T F There is a fairly definite relation between the highest point of the lactation period and the total production.

3. T F Skill in feeding and management is a greater factor than breeding in achieving the milk and butterfat records of recent years.

4. T F The age of the cow has no appreciable effect on fat percentage.

5. T F A heifer with a low test as a two-year-old is likely to produce milk with a higher test when she is four or five years old.

C. Having read this chapter it is clear to you that there are a number of factors, both internal and external, that influence the quantity and the quality of the milk among breeds and between individual cows within the breeds. Examine the figures in the following table. Consider carefully factors discussed elsewhere in this course concerning milk production. Then cross out all items in each of the groups below that are either false or that need not be considered in connection with the case under discussion.

AVERAGE ANNUAL YIELDS UNDER FAIR FARM CONDITIONS

Breed	Weight of Cow	Pounds Milk	Per Cent Fat
Holstein	1300	8500	3.45
Jersey	900	5500	5.14
Guernsey	1000	5500	5.00–
Ayrshire	1000	6500–7000	4.00
Brown Swiss	1200	6000–7000	4.00

1. Holsteins are generally the best choice of the breeds if you are dairy farming for the average whole milk market.
   a ( ) Holsteins are larger than the other well-known breeds.
   b ( ) Most people prefer Holstein milk to that of the other breeds.
   c ( ) Holsteins average higher production than do other breeds.
   d ( ) Holstein fat percentage is relatively low.

2. Jerseys and Guernseys are the best breeds if you are dairy farming for the butter market.
   a ( ) These breeds are smaller than Holsteins so their initial cost is lower.
   b ( ) Jerseys and Guernseys have a higher percentage of fat than other breeds.
   c ( ) These breeds generally have better dairy conformation than do other breeds.
   d ( ) Because of their size and temperament Jerseys and Guernseys are the easiest of all breeds to handle.
   e ( ) Milk of the Jerseys and Guernseys is more yellow than that of other breeds.

3. Selection of the individual cow is a more difficult matter than choice of breed.
   a ( ) Cows vary in size within breeds and high-producing cows are usually large for the breed.
   b ( ) Breed and size are not sufficient evidence upon which to select a good dairy cow.
   c ( ) Dairy conformation and high-producing immediate ancestry are evidences of high production.
   d ( ) Milk composition regardless of yield varies little within breeds although the percentage of fat produced by the individual cow may vary from day to day.

4. The milk production of the individual cow varies in the course of the year.
   a ( ) Milk tests lower in fat during the summer.
   b ( ) Milk tests highest in fat in the mid-winter months.
   c ( ) Grass in the ration causes a decline in fat production.
   d ( ) Undernourishment, through lack of sufficient, proper ration, or during pregnancy, may cause a decline in milk production.
   e ( ) There is a normal variation of yield during lactation periods.

5. Under normal dairy farming conditions milk production tapers off during the lactation period.

a ( ) Peak yield is reached during the second month.
b ( ) Under official test conditions cows give a greater average yield.
c ( ) An average decline of two or three pounds of milk yield may be expected monthly from the second through eighth month.
d ( ) Fat content of milk tends to rise as decline of milk yield speeds up.
e ( ) Although a cow that is not pregnant holds up in milk production better than one that is carrying a fetus, cows should be bred every twelve months.

6. Although no cow can produce milk beyond her inherited capacity for milk production, proper feed and management increase production.
a ( ) By special feeding the richness of milk can be increased permenently.
b ( ) Stripping is important because the last milk in the udder contains much more fat than the first milk drawn.
c ( ) Some milkers are able to get considerably more milk from a cow than other milkers.
d ( ) Regularity as to the time of feeding and milking is necessary.
e ( ) Irregularity or neglect of milking tends to dry off the cow.
f ( ) Delayed breeding assures a greater milk yield for the following year.
g ( ) A cow needs feed to produce milk as well as maintain her body.
h ( ) The more milk a cow produces the more she should be fed.
i ( ) The more a cow is fed the more milk she will produce.

D. Good care, high production, and profitable returns usually go together in dairying. In order to give cows the best possible care it is necessary to know that the quantity and quality of the milk is affected by certain natural conditions.

Herb Russell has a dairy farm near Des Moines, Iowa. He is selling whole milk to a milk buyer in Des Moines who pays a premium for high-testing yellow milk and who wants a steady supply of milk the year round.

Which of the following will help Russell meet these requirements. Cross out any item that would handicap him in meeting these special market conditions.

(a) High-producing Guernsey cattle.
(b) High-producing Holstein cattle.
(c) Succulent feed in winter.
(d) Spring freshening of three-quarters of the herd.
(e) Pure-bred Shorthorn cattle.

(f) Milking each cow twelve months before breeding.
(g) Milking each cow up to the time of freshening.
(h) Breeding cows every other year.
(i) Sudden changes in feeding during the summer.
(j) Stripping the cows.
(k) Having the cows carry extra flesh at calving time.
(l) Milking three times daily.
(m) Keeping the average age of the herd at nine years.
(n) Keeping the average age of the herd at two years.
(o) High-producing Brown Swiss cattle.
(p) Good pasture throughout spring, summer, and fall.

CHAPTER XXII

STABLES FOR COWS

The dairy cow, unlike the fattening steer that is protected by layers of fat, needs to be comfortably housed if she is to do good work. Exposure to cold — and especially to cold winds and rains — results in much larger losses than the actual amount of feed required to maintain the animal heat under the unfavorable conditions. The importance of housing is generally understood and practiced in the colder climates. As a rule, more losses from exposure occur in those regions where, from the usual mildness of the climate, sufficient provision is not made for occasional severe weather.

Barns a Human Food Factory. Where the importance of proper stabling is recognized, the conditions existing are, on the average, far from what they should be. It must be recognized that the stable is a place in which human food is produced, and, further, that the health and even the lives of the children of the country depend to a large extent upon the conditions existing in the stables where the milk, which serves as their main food, is produced. There is a strong and growing demand on the part of milk consumers and officials who have to do with the health conditions of the cities for better sanitation in the barns and dairies. Laws and regulations regarding this matter are becoming more stringent, and an immense improvement has been brought about within the past few years, but there is still a great deal to be accomplished along the line of more sanitary and comfortable housing of dairy cattle.

Better Barns Mean Cheaper Production. There is another phase of the subject that must be emphasized as well. There is no doubt that it pays as a financial proposition to have well-arranged, sanitary barns which make the cow more productive by making her more comfortable; which make labor more efficient because of being better satisfied; and which lessen the expense of labor by their convenience in arrangement. A sanitary barn is not necessarily an expensive one. Many an inexpensive structure is or may

be more sanitary than some ill-arranged, badly kept, but expensive barn.

In considering the matter of barns, it is well to study carefully how closely the conditions of early summer may be maintained throughout the year. The dairy cow does her best in the early part of the summer when on a good pasture. The maximum production reached at this season possibly is due largely to the excellence of the food, but at the same time the animal enjoys a moderate temperature and clean, comfortable surroundings. There is an abundance of fresh air and sunlight, and the cow has perfect freedom of movement. Keep as near to these conditions as possible in the barn, and good results will follow. A cow housed in a dark basement barn, surrounded by foul air, with her head fast in a rigid stanchion and her body more or less filthy is as far from summer conditions as her milk production is below that of early summer.

Types of Barns. There are various styles of barns, but they may be divided into a few rather distinct types, which are as follows:

1. The basement barn
2. The two-story or loft barn
3. The one-story or shed barn
4. The round barn
5. The pen type barn

The basement barn. The basement or bank barn is a favorite type in the northern part of the United States, especially in the Eastern states. It cannot, by any means, be recommended as an ideal dairy barn. It is built by excavating into the side of a hill sufficiently to bring the top of the first story on one side, and usually on two sides, at the level of the ground outside, the south and east sides commonly being full height above ground. This type of barn is warm, but usually very unsanitary, because of lack of light and ventilation. It can be ventilated, but rarely is this done. Space for storage is usually provided above the animals, with a driveway running directly into the loft.

The two-story or loft barn. This style of barn allows for the stabling of the stock on the first floor, with a second story for storage above. The walls of the first story may be of stone or wood, but are all above ground. This style is well adapted to the general

farm where considerable room is required to store the loose hay and other feeds grown on the farm for winter use. Storage room is secured more cheaply in this manner than by building a one-story cow barn and a separate storage barn. This style may be

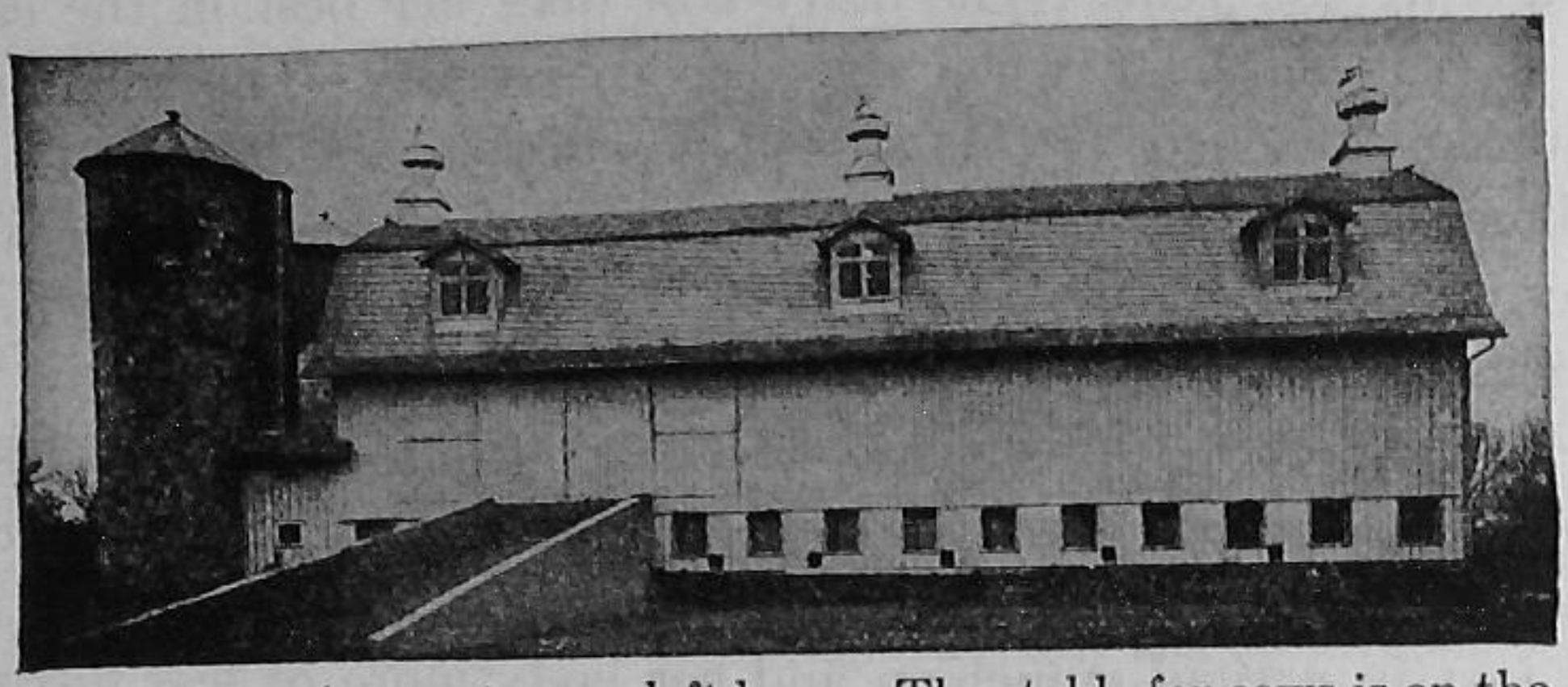


FIG. 57. A two-story or loft barn. The stable for cows is on the ground floor with a loft above for hay storage. This style is well adapted for general farm use where a large loft is needed for storing loose hay. Note the numerous windows, also the ventilator outlets on the roof and the intakes near the bottom of the windows.

entirely sanitary in its construction, if properly arranged. It should have plenty of light and a good ventilating system. The ceiling above the cows should be tight to prevent dust from falling, and so contaminating the milk, and to avoid the odor from the stable and the breath of the animals from injuring the palatability of the feed above.

The one-story or shed barn. This is one of the best types of barn from the standpoint of sanitation and convenience. It usually is

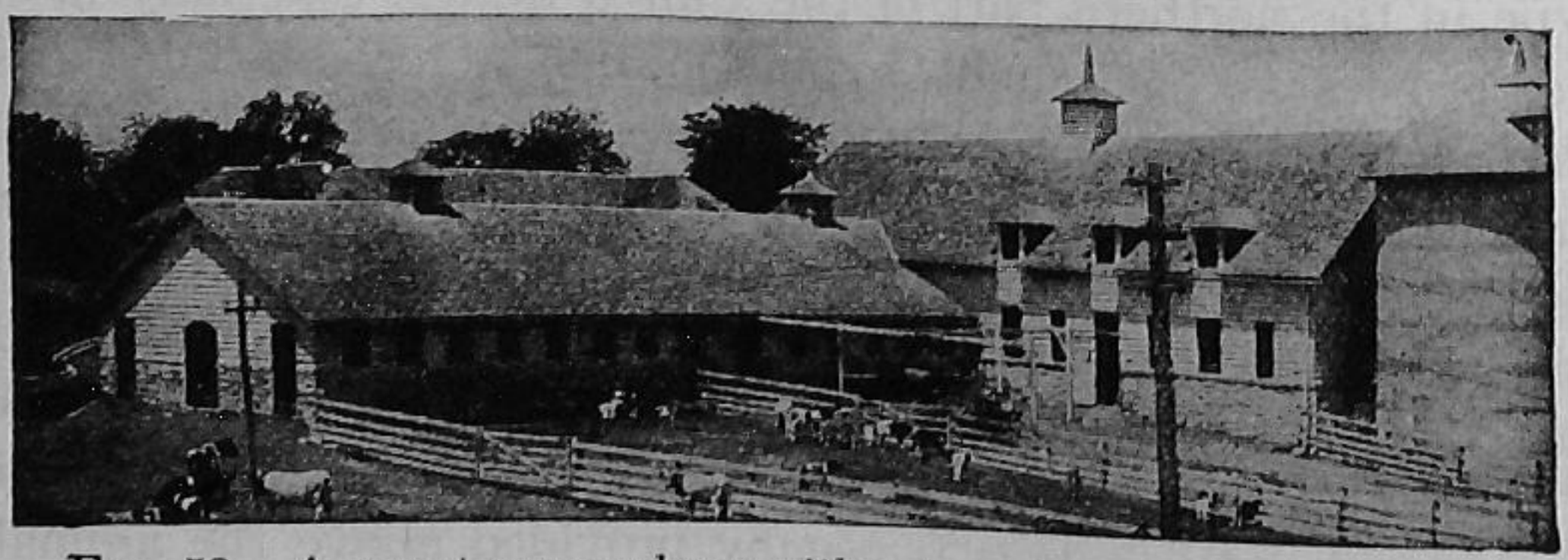


FIG. 58. A one-story cow barn with a two-story portion attached for storage of hay and grain.

built wide enough for two rows of cows. This plan is especially adapted for use where it is not necessary to have any large amount of storage room for unbaled hay or bedding. It is often used, how-

ever, where ample storage room must be provided; and in such cases a portion of the barn is usually built two stories high, and serves for storage and general purposes, while one or more single-storied wings are provided to house the cattle. Single-storied barns usually have a tight ceiling, although some are open to the roof and have a monitor top to admit light from above. The objection to having the space open to the roof is that in cold climates this space is so great that the barn is too cold in winter.

The advantages of the one-story barn are that it may be well lighted and ventilated and its construction made sanitary in every way. Additional room can be easily had by extending the wings at any time.

The round barn. The economy of construction in the round barn lies in the fact that a round barn requires 25 per cent less wall to enclose it than does an ordinary rectangular type.

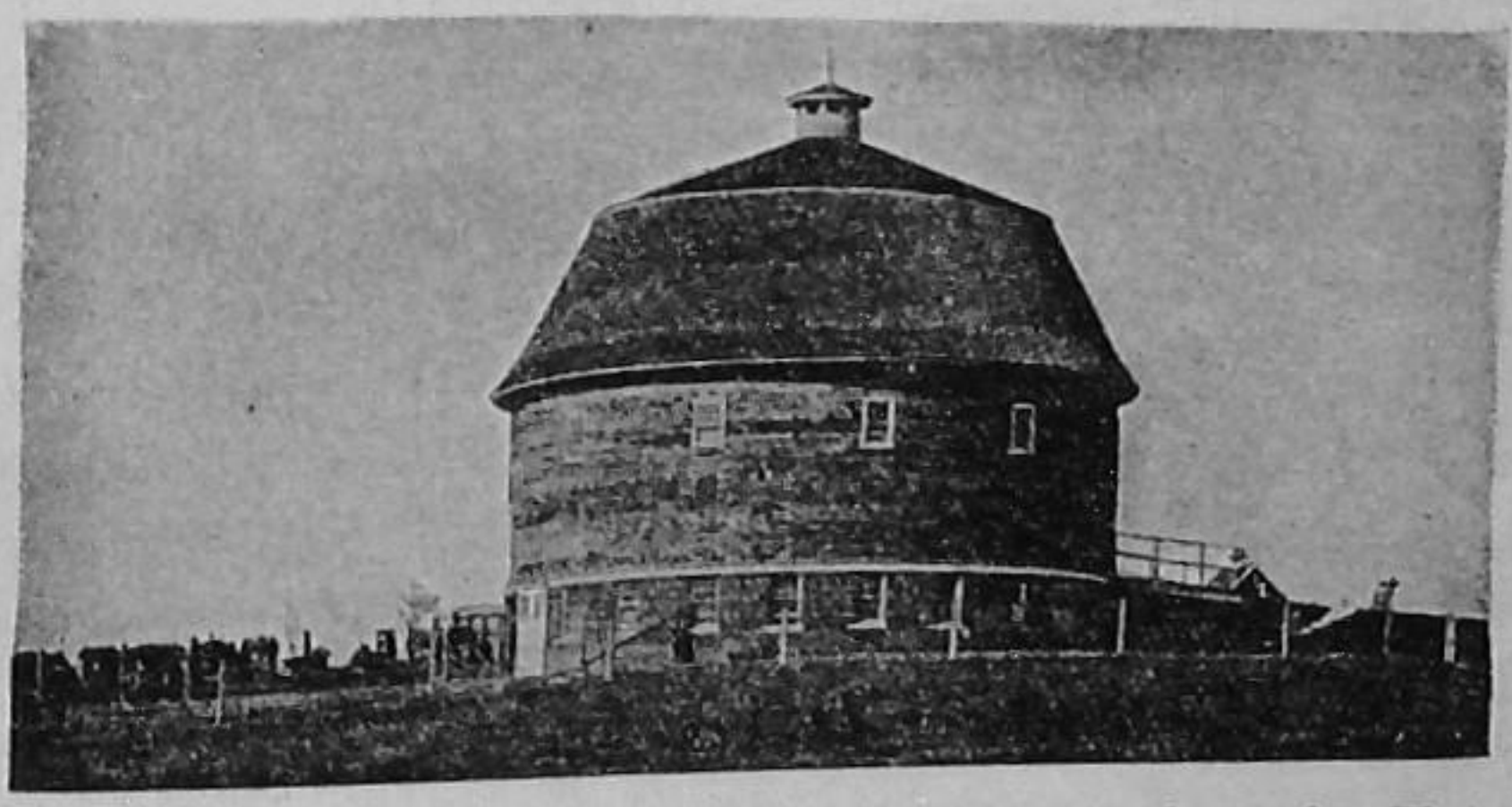


FIG. 59. A round barn. This barn is used at the University of Illinois. A round barn is economical to build, but the silo located in the center is inconvenient to fill, the barn is dark in the center and the space difficult to use to the best advantage.

A round barn with room for 40 cows requires 22 per cent less walls and from 34 to 58 per cent less material than a rectangular building with accommodations for the same number of animals. The silo is built in the center, and the cows are usually arranged in a single row around the barn, headed toward the center, except where the barn is too large, when a double row is used. The round barn has not won its way into popular favor. Its disadvantages are difficulty in filling the silo, and the impracticability of increasing its size by building additions.

Location of the Barn. The barn should be located where there is good drainage, making it possible to keep the yards in good condition. Convenience in location as well as in plan should receive careful consideration, since the expense for labor depends to no small degree upon proper location and internal arrangements of the barn.

A rectangular barn should stand perferably north and south, or with long axis northwest and southeast, making it possible to get sunlight on both sides at some time during the day.

Lighting. One of the most serious defects in most barns, particularly the older ones, is lack of sufficient light. Windows cost

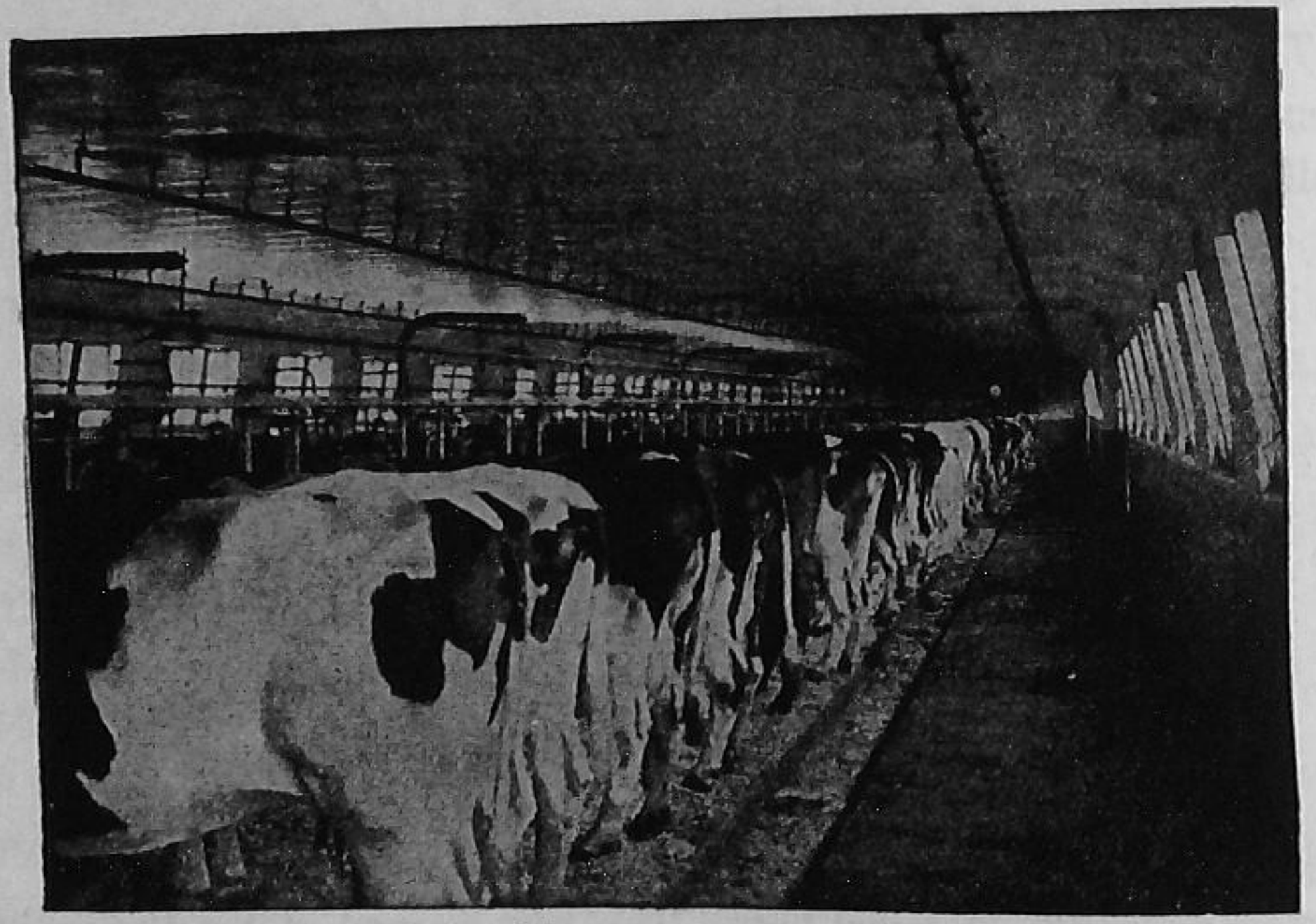


FIG. 60. A well-lighted barn. An abundance of light is the first requirement for a sanitary barn. A light barn is usually kept clean, a dark barn seldom. Note the windows extend to the ceiling leaving a high wainscoting below.

little if any more than other wall materials, and cannot be objected to on this account. Plenty of light is one of the most essential things about a good barn. It is necessary to keep the animals in a healthful condition, and is of the greatest importance in a sanitary way. Not only does sunlight destroy germs, but where there is plenty of light, unclean conditions are easily seen and corrected. A dark barn is almost always a dirty barn.

Floor Construction. One of the most important points to be considered in planning a barn is the material to be used for floors. Material for a floor should have the following characteristics:

1. Impervious to moisture
2. Sanitary and easily cleaned
3. Comfortable for the cows
4. First cost not too great
5. Durable

The floors in common use are as follows:

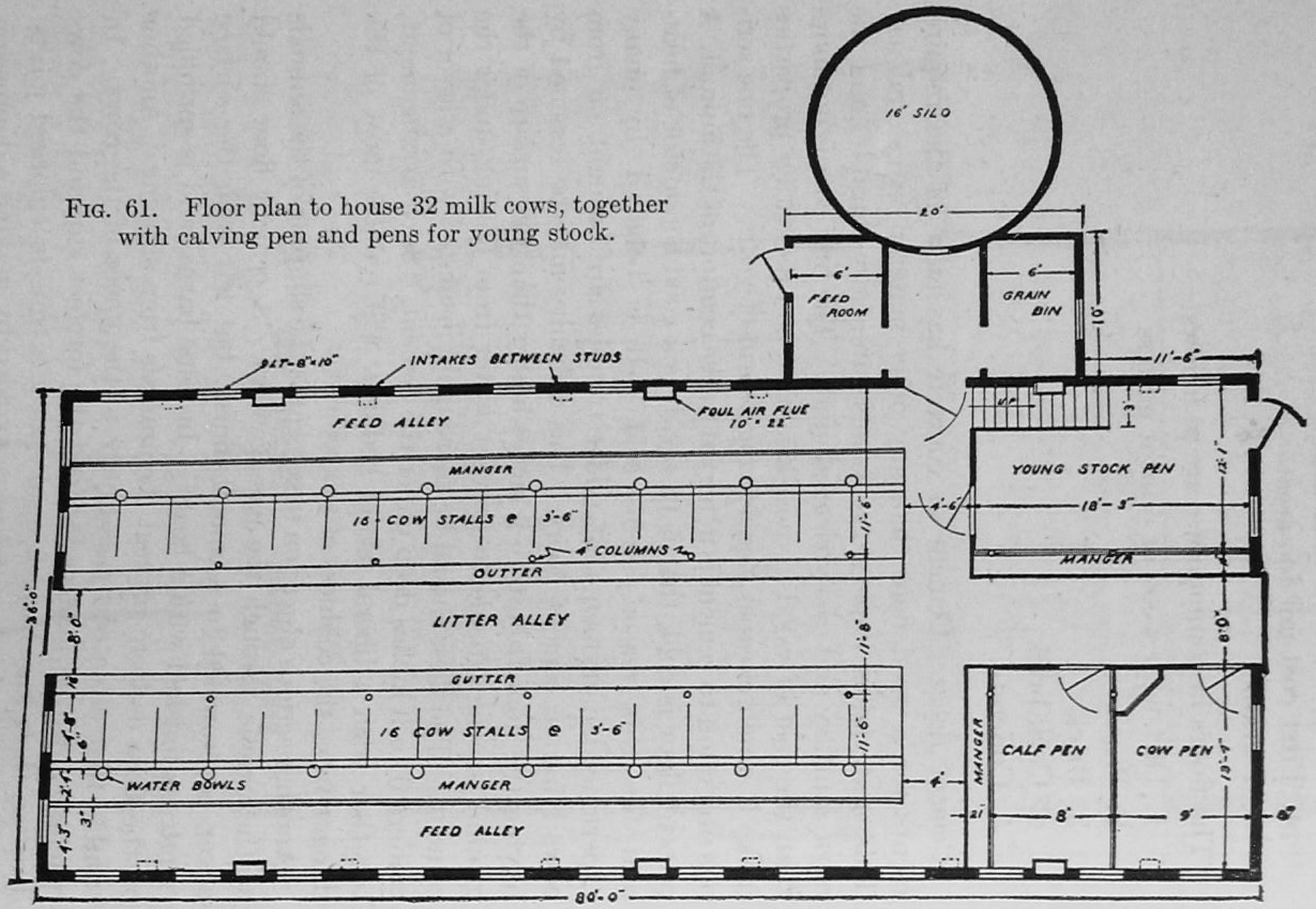
1. Dirt with wood or cement gutters
2. Wood
3. Brick
4. Cork brick
5. Concrete.

Cement floors. Cement or concrete has more of the requirements for a good floor than any other material in general use. This material is impervious to moisture, very durable, and the most sanitary and easily cleaned of all. The first cost is not more than the cost of wood in most localities, and its lasting properties make it much cheaper, considering a term of years. The one serious objection to cement is in regard to the comfort of the animal. A cement floor is cold, that is to say, it is a good conductor of heat, and for this reason seems cold. It is believed by many experienced dairymen that udder troubles are brought on from cows lying on cement floors. This difficulty may be lessened by having the floor from 6 to 9 inches higher than the surface of the ground on the outside to prevent water from flowing under the cement. The floor should be thoroughly insulated with a layer of cinders 6 to 9 inches deep under the cement. Such arrangement, together with a liberal use of bedding, will remove most of the danger from the coldness of the cement.

Another serious objection to cement is the slipping of the animals as they come through the passageways. A cement floor should never be troweled to a smooth finish, but left with the surface rough, as finished with a board. In some barns sand is sprinkled on the floor daily to prevent the animals from slipping. Another trouble that often occurs is injury to the knees of the cows. In reaching into the manger for food the forefeet slip and the cows drop on their knees which results after a time in enlarged joints. This trouble is in a large measure avoided by making a depression of an inch where the forefeet stand.

Probably the best plan is to construct the entire floor of the

FIG. 61. Floor plan to house 32 milk cows, together with calving pen and pens for young stock.



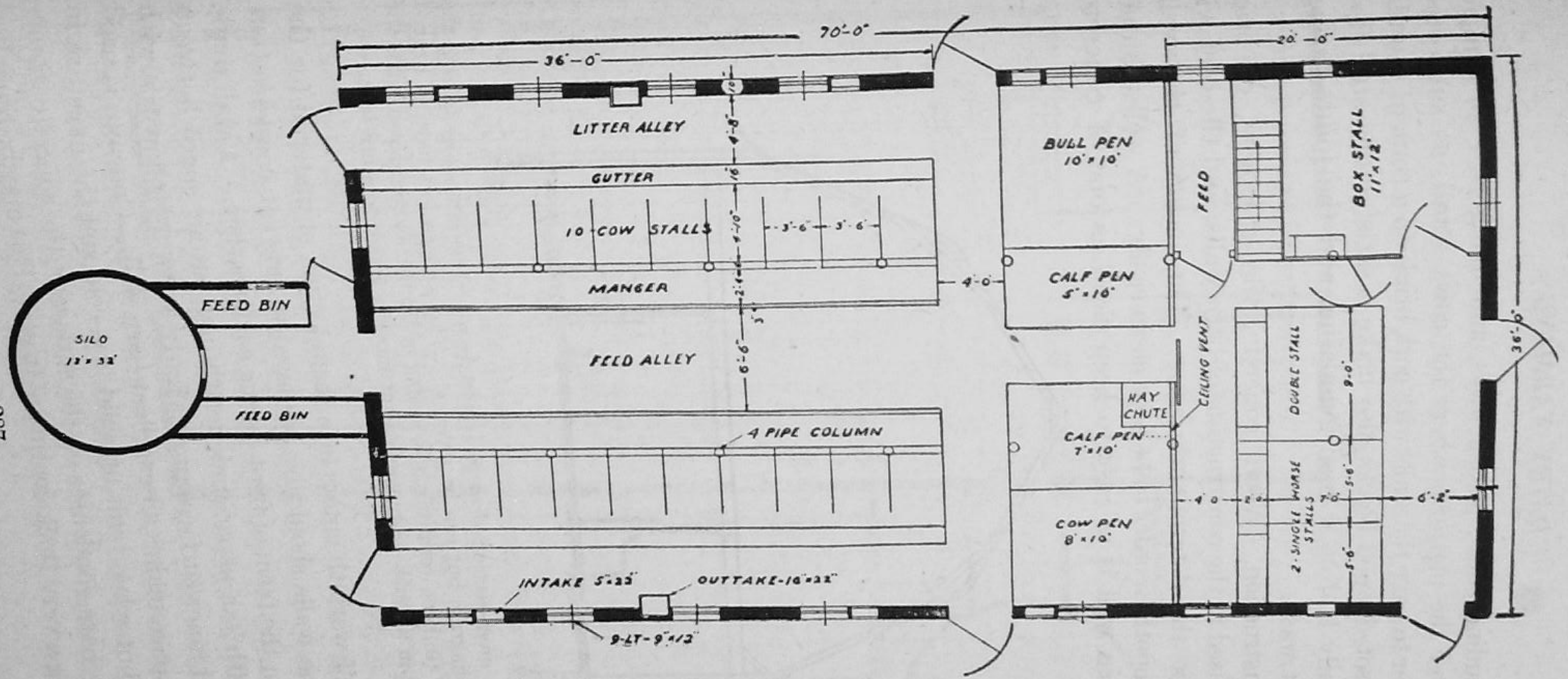


FIG. 62. Typical floor plan of a general barn in common use.

barn — including stalls, passageways, and mangers — of cement, then to cover the platform where the cows stand, as suggested, with wood, or to pave the stalls with cork brick on a cement foundation. Creosoted wood blocks also make a satisfactory stall floor when carefully laid on a good foundation and the joints flushed with cement wash.

Wall Construction. Wood, concrete, tile, masonry, or brick may all be used in the construction of barn walls, and the cost will ordinarily be the determining factor. The inside of the walls should be smooth in order to be kept clean easily. A well-painted, tight, wooden wall is as easy to keep clean as one of concrete.

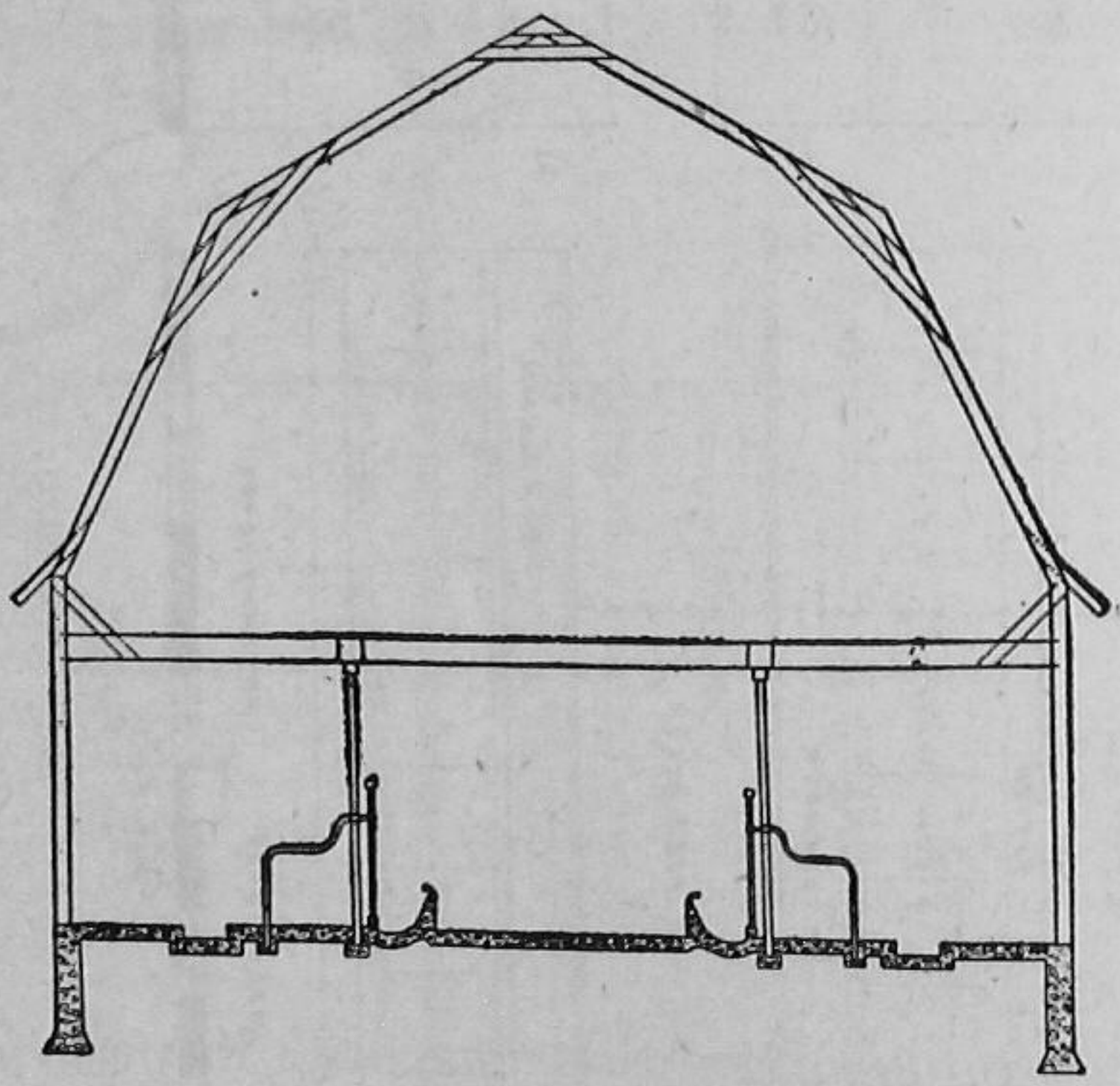


FIG. 63. A cross-section of a two-story barn. The cows are facing the center in this diagram but can be reversed. The modern loft barn is braced without heavy timbers, resulting in a saving of timber as compared with the older style and in a much more convenient mow in which to store hay.

The matter of warmth enters into the selection of material for the walls, and the walls should be insulated to prevent condensation of moisture in the form of frost during cold weather. A wall made of lumber with tar paper underneath, and an air space between the outer and inner surfaces proves fairly warm. Hollow tile with its dead air space makes an excellent barn wall. Concrete is used extensively, but when built up solid it is cold and the moisture in the air of the barn condenses on the surface of the concrete, sometimes forming a very thick coating of frost. This may be remedied

to a large extent by a double wall with an air space between; but this entails additional cost of construction. In localities where winters are mild, concrete is unquestionably the best material for at least the lower section of the barn walls because of its durability and the ease with which it can be kept clean.

Arrangement of Cattle in Barn. The best and most commonly used plan is to stand the cattle in a double row, thus making it possible to light the entire stable readily and to feed and remove the manure conveniently. There is much discussion as to the comparative advantages of placing the cows with their heads together or with heads outward. There are some advantages in favor of each. When facing the center, both rows may be fed by

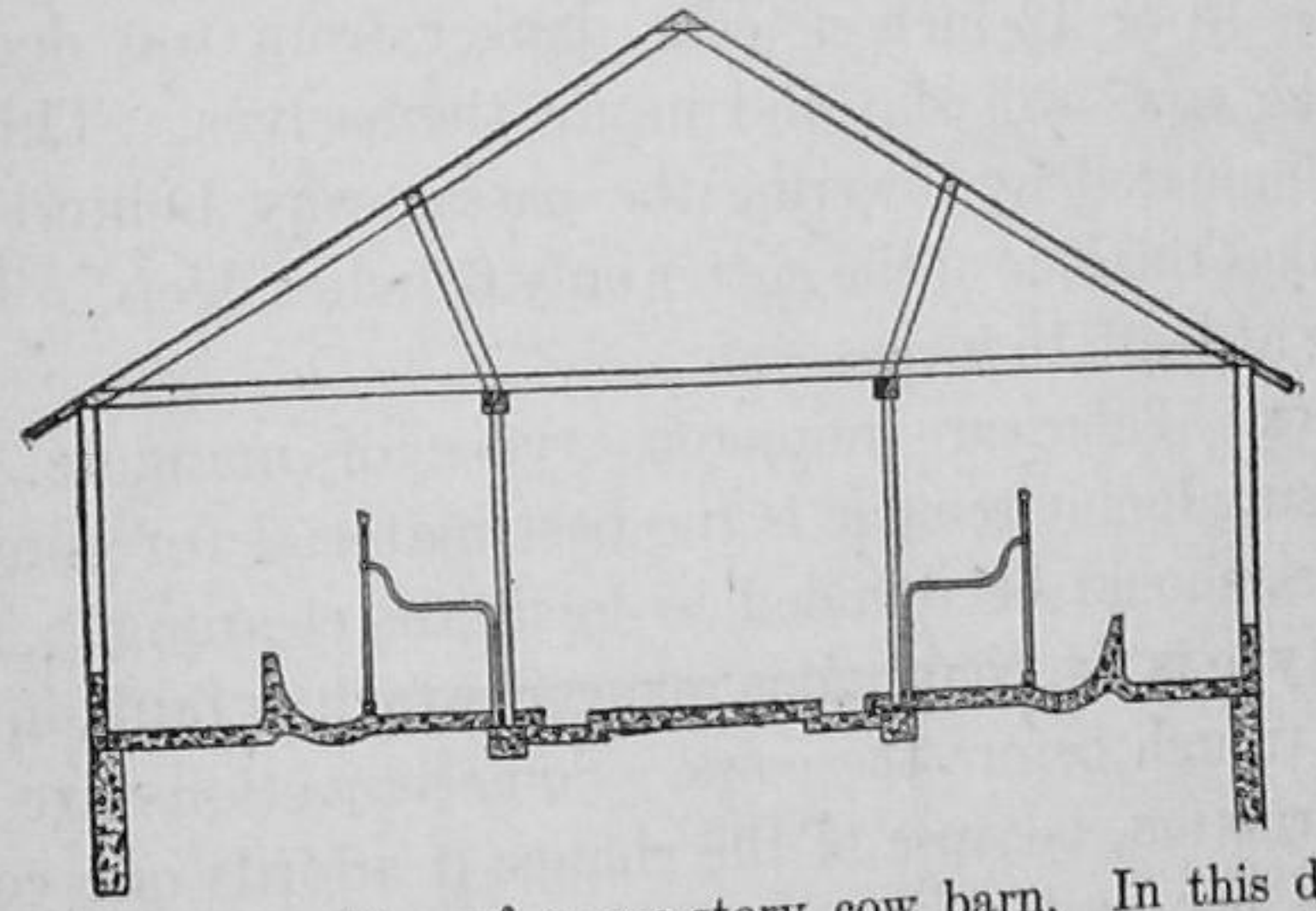


FIG. 64. A cross-section of a one-story cow barn. In this diagram the cows are faced outward. They may be faced toward the center if preferred. This type of barn is suitable where storage for hay is not needed.

making one trip down the passageway with the feed truck, distributing the feed on both sides. The removal of the manure is most convenient when the animals are headed out, since by driving through with the manure spreader and loading directly from the trenches, considerable labor is saved, or if a track carrier is used, it may be loaded readily from both gutters. The walls of the barn do not become splashed with manure, and there is some advantage in regard to ventilation, since the fresh air usually enters along the outside wall. Facing inward brings the milker nearer to the light and enables him to see if the udder is clean. However, the opposite arrangement is more convenient when milking machines are used. The greatest difficulty that is usually experienced in heading the animals outward is the construction of the barn without the use of center posts that obstruct the passageway behind the animals.

When the cows are headed toward the center, the posts for support are made part of the stanchion manger supports, and are not in the way. However, with more expense it is possible to support the longer span required with trusses when the cows are headed outward. Figures 63 and 64 show cross-sections of barns conveniently arranged. The width of the barn is 36 feet. The walls should have cement plaster 3 feet high made with a rounded corner to prevent accumulation of dirt. The passageways should be of ample width to facilitate feeding and cleaning.

Gutters. The gutter is highly important in connection with keeping the cow clean. It should be of ample depth, as otherwise cows are apt to stand with the hind feet in the gutter. The depth should be 10 or 12 inches. The danger from too deep gutters is that the cows will slip and injure themselves. This may be largely eliminated by lowering the passageway behind the cows which makes this side of the gutter only 6 inches deep. The gutter should be at least 16 inches wide.

Mangers. There are numerous types of mangers. From a sanitary standpoint cement is the best material for construction. All corners should be rounded to facilitate cleaning. The most common type is the continuous manger, which is built in the form of a long trough before the cows. Some objections are raised to this construction, because of the chance it affords one cow to rob another of her feed. In case of contagious diseases like tuberculosis, there is also much more danger of communication from one animal to another in such a manger. Partitions of sheet iron are sometimes used. The special advantage of the continuous manger is the ease of cleaning by sweeping out refuse feed. It may also be used as a means of watering the cows in the barn with advantage; but here again lies the danger of spreading contagious diseases. Figure 65 shows a cross-section of a barn from the middle of the feedway to the outer wall, giving the proper dimensions. The width of the manger should be not less than 2 feet, and preferably it should be 2 feet 6 inches. The bottom of the manger should be 1 or 2 inches higher than the platform where the cows stand. The curb next to the platform on which the cows stand should be 6 or 8 inches above the level of the bottom of the manger.

The comfort of the cows and the success in keeping them clean depend largely upon the construction of the platform. It is highly important that it be of proper length and of suitable material.

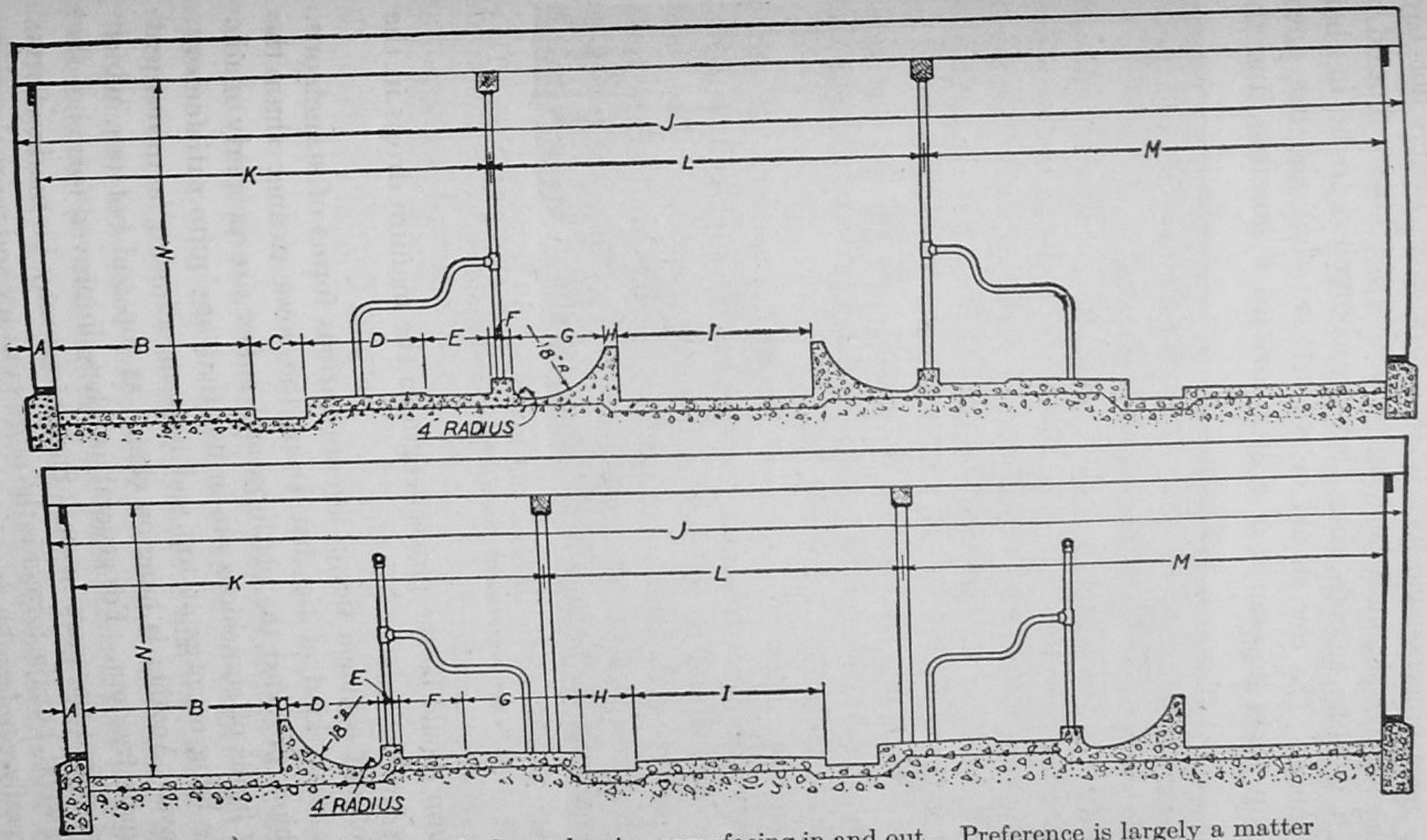


FIG. 65. Cross-sections of a barn showing cows facing in and out. Preference is largely a matter of personal opinion.

Ties and Stanchions. There is a great variety of ties in use. The most objectionable way to tie a cow is to fasten her to a manger where she must back up to lie down. This is bound to result in filthy animals, since they are compelled to lie in their droppings. The cow should be so fastened that she lies down exactly where she stands, or a little forward if possible, and the

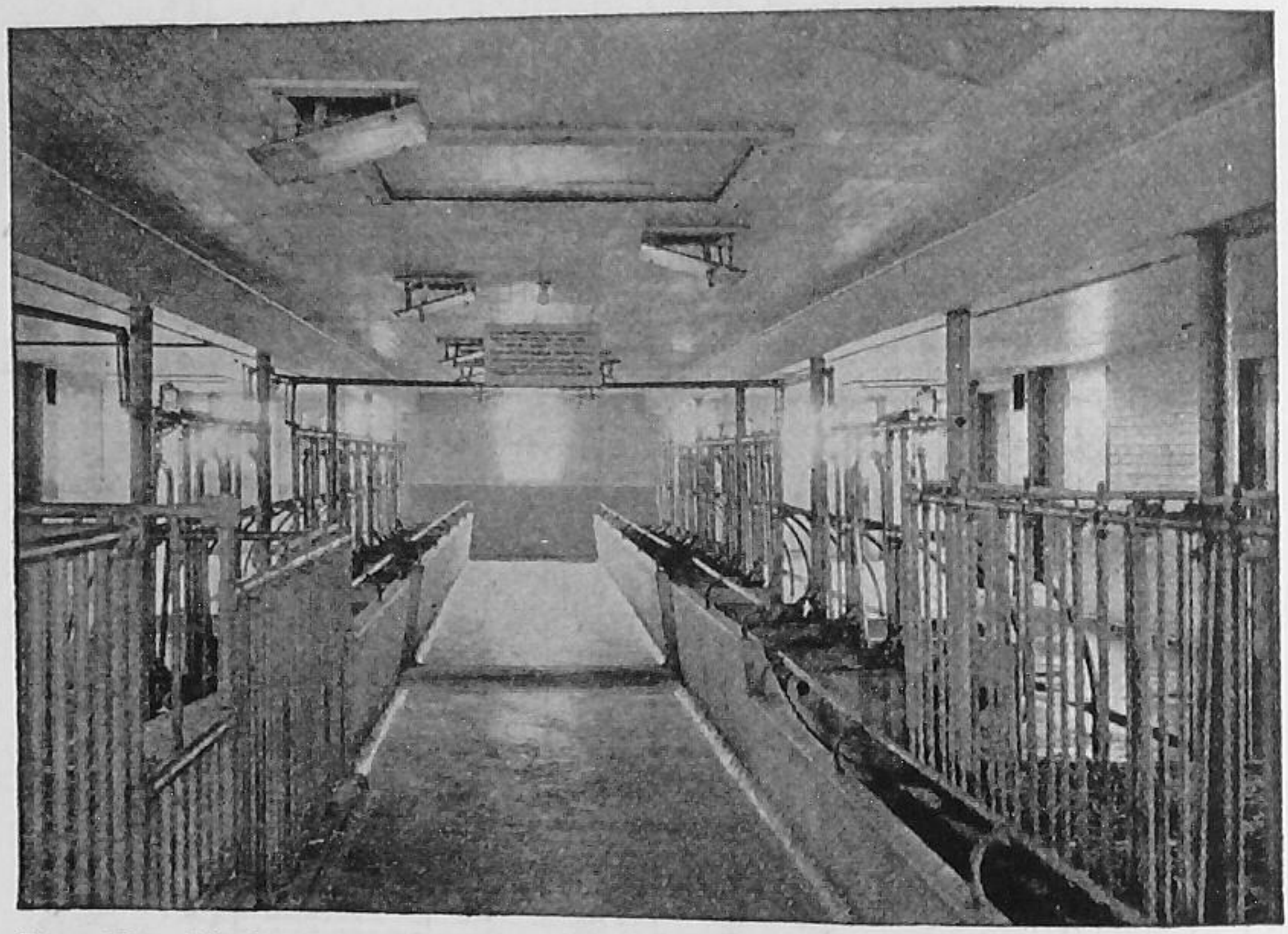


FIG. 66. Modern steel stanchions and box stalls of approved type. They are convenient, comfortable, and sanitary.

platform should be the proper length so the manure drops in the gutter.

The most common ties in use are various forms of stanchions. There is no kind of tie that keeps the cows cleaner than the stanchion, provided the platform and gutter are properly made. Many forms of stanchions are in use that are quite satisfactory. One is hung on pegs at top and bottom, allowing a movement sideways. Another is hung on chains at top and bottom, which gives more freedom. For general use these improved forms of the stanchion find the most favor. Stanchions may be made of iron pipe or wood, but the former is the more sanitary and more durable, and equally comfortable for the animal.

The double-post slip chain tie is equally comfortable for the animal, but not quite so convenient for use.

Stanchion or chain ties may be attached to either iron or wooden framework as supports. The iron is most sanitary, and has the additional advantage of being more sightly. An iron pipe partition made of gas pipe, with the bottom set in the cement floor, is to be recommended.

Box Stalls. Box stalls to be used for maternity cases and for stabling sick animals should be provided, but these, along with

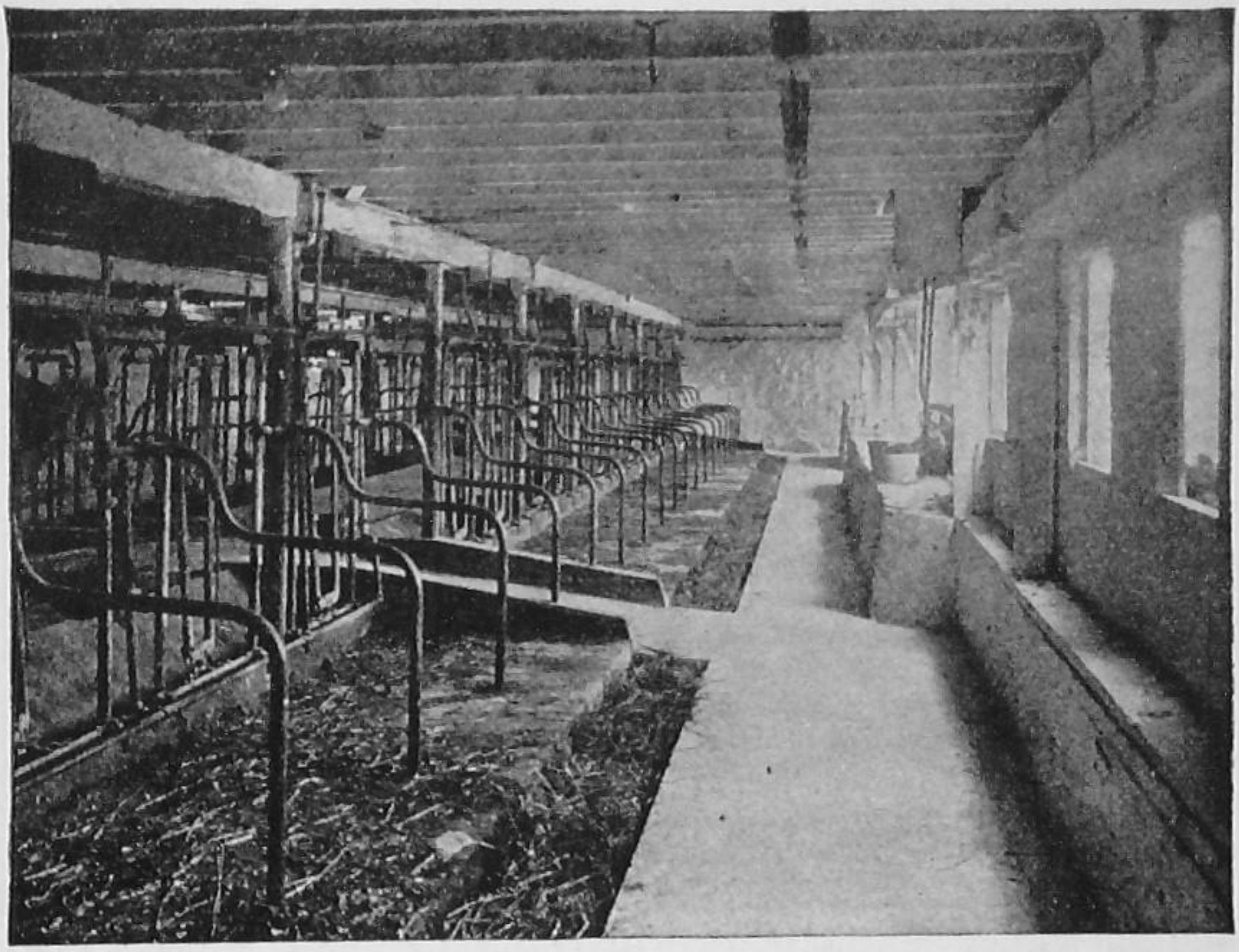


FIG. 67. Modern steel stalls with concrete mangers, platform, and alley. Notice that the depth of the gutter is about 4 to 6 inches lower alongside the passageway.

pens for calves, should preferably be located in a part of the barn separate from the main herd. The wing or section used for housing the milking herd should be used for that purpose alone, as this insures the least amount of noise and confusion. High-producing dairy cows can only do their best work in a peaceful environment.

Water Supply. Running water is a necessity in the cow barn, both for watering the cows and for cleaning purposes. The individual drinking cup is now regarded as the most satisfactory method of keeping a continuous supply of water before the cows,

and results in their drinking more water, especially in cold weather when the water in outdoor tanks approaches freezing temperature.

Ventilation. An abundance of pure air for animals of all kinds is scarcely less important than are proper methods of feeding. It is only within recent years that the full significance of an abundant supply of oxygen to animal life has been appreciated. While

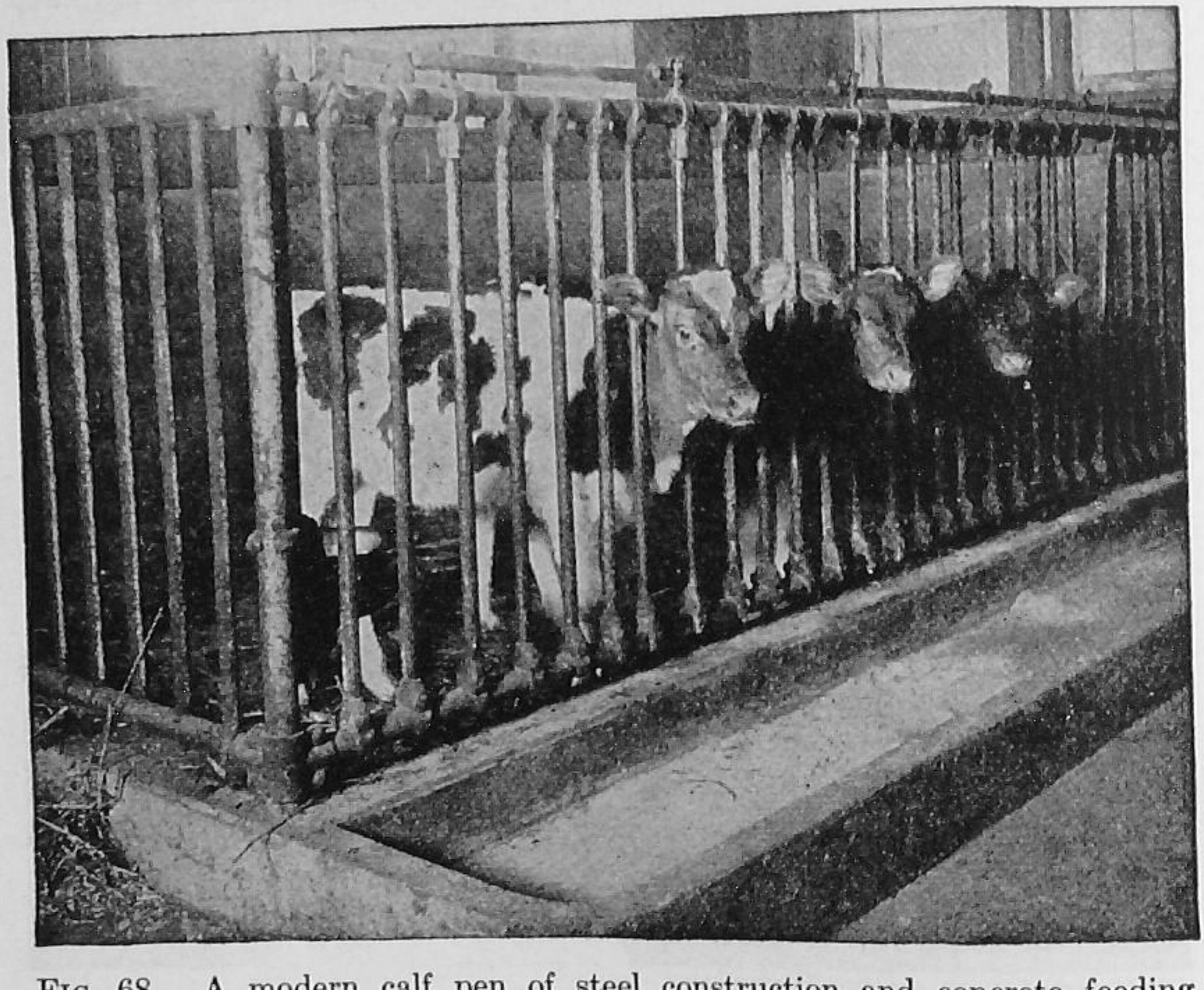


FIG. 68. A modern calf pen of steel construction and concrete feeding manger. Steel construction of this type is also used for box stalls.

there may be some excuse at times for insufficient or improper feeding of animals, there is none for failure to supply plenty of air.

Good ventilation for dairy barns is not only necessary from the standpoint of the health of the animals, but it is necessary for the most economical production of milk. The air breathed by an animal is as indispensable as the hay and grain eaten, for neither assimilation of food nor generation of energy can take place without the consumption of a proportionate amount of pure air. The important question is the amount of fresh air provided.

Forces producing ventilation. There are three main forces that cause movement of air in a stable.

1. The wind pressure against the side of the building, which tends to force air into the building and out on the opposite side or upward through the ventilators.

2. The wind in blowing across the top of a ventilating flue produces an outward suction.

3. The difference in temperature between the air in the barn and that on the outside is due to the heat radiated by the animals, and also the increased moisture content of the expired air. This causes an upward movement in a ventilating shaft by a force equal to the difference in weight of the air outside and within.

The King system. This is the system in general use in modern dairy barns. The main features consist of a large flue opening near the floor and extending above the roof of the stable for the escape of the air. A series of smaller openings are arranged on either side for the air to enter.

The object in taking the air from near the floor rather than at the ceiling is to remove the coldest air. The warmest air is found at the ceiling. The ventilating flue should be smooth inside, practically air-tight and, for good results, with no turns. The flue must have ample cross-section. If too small, the friction is sufficient to prevent free movement of the air. In many cases poor results in using this system are to be credited to a ventilating flue of too small size. None should be built less than 2 by 2 feet.

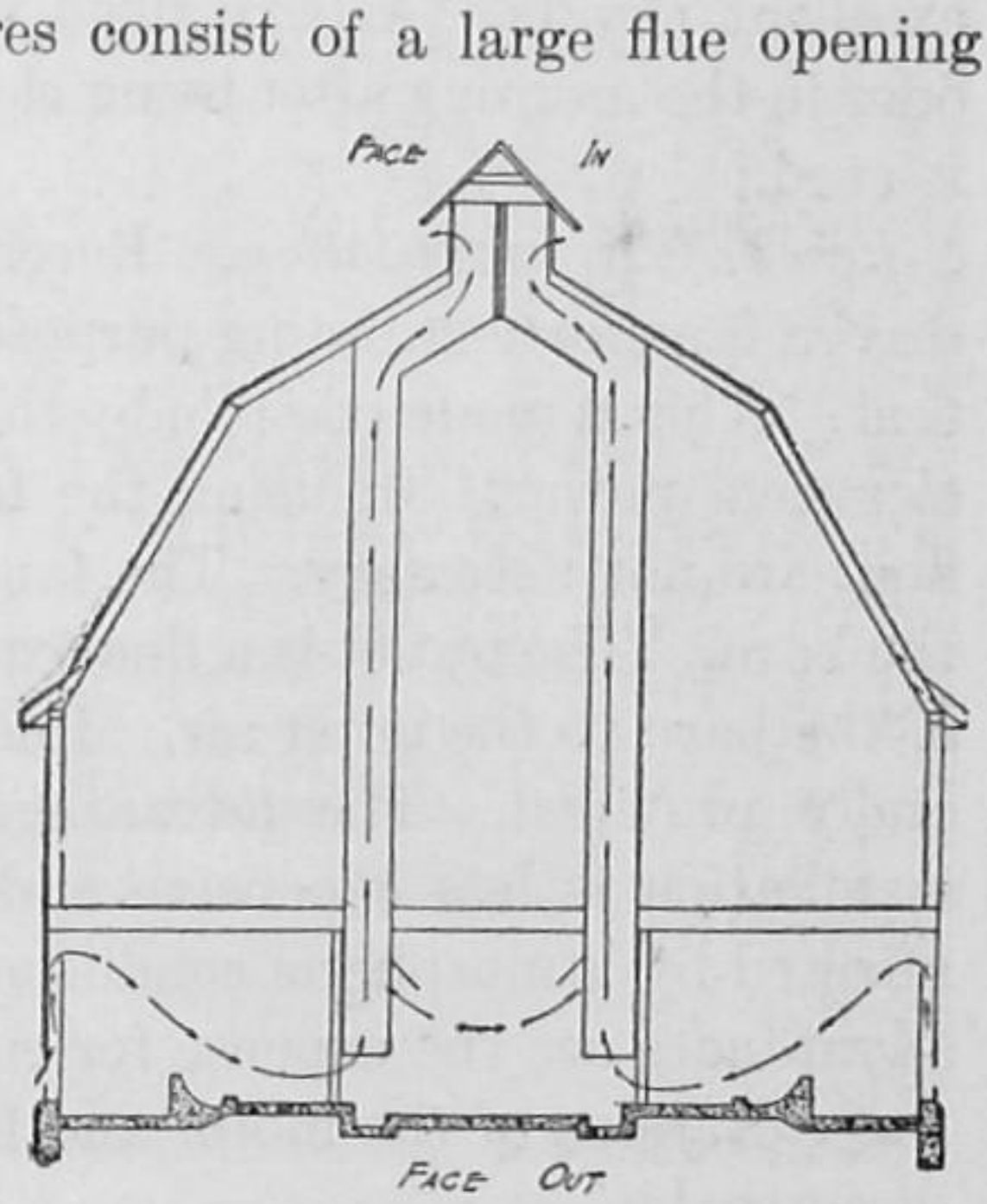


FIG. 69. Ventilating flues according to the King system.

The ventilator flue should have an opening near the ceiling that may be opened when it is desired to increase the draft, and in warmer weather when there is no reason for conserving the heat of the stable. This opening should be regulated with a register.

Entrance for fresh air. Provision must be made for the entrance of outside air. This is taken in at the ceiling and mixes with the warm air. The intakes should extend downward in the wall, with the opening to the outside three feet or more lower than the opening

in the barn. This is to prevent the warm air in the stable from flowing out. These intakes should be on all sides of the barn, to take advantage of all wind pressure. They should not be over 4 or 5 by 16 inches in size, and provided with registers to regulate the air passage.

The King system works only while the stable is closed. At such time as it is not desirable to close the barn, the air should be allowed to enter the ventilating flue through the opening near the ceiling. The King system cannot be expected to work in a barn which is not so tightly constructed that the air cannot find entrance or exit at other places. When properly installed, this system gives excellent results. A barn filled with animals will have no barn odor in the morning after being closed overnight where this system is used.

Fan or forced ventilation. Recently the plan of using electrically driven fans for ventilating purposes has come into use to some extent. This is made possible by the equipment of many farms with electrical power. In using the fan system elaborate ventilating flues are not necessary. The fans are located near the ceiling of the barn. The outlet is a flue extending directly through the wall of the barn to the outer air. Inlets with damper control are generally provided. The advantages of this system are that the installation is less expensive and the successful operation is not affected by atmospheric conditions as the King system. The disadvantages are the expense for current to operate the motors and the vibrations of the motor and fan, which in time become rather disagreeable.

Window ventilation. Some well-constructed barns depend upon hinged windows for ventilation. These are usually hinged at the bottom, so that the top may be tilted inward to the desired extent. Careful, constant attention to this plan may give fair results. The movement of air in this case is dependent upon wind pressure and, furthermore, the warmest and not the coldest air is removed. Windows are not a satisfactory means of ventilation in the winter season, as cross drafts are developed between windows, and much warm air escapes

Planning to Save Labor. In planning a modern barn, due consideration should be given to the installation of modern labor-saving devices. Manure is now removed from the barn in a litter carrier or truck and the same system is employed in

carrying feed from the feed room to the cow barn. A carefully planned arrangement of feed rooms, silos, and milk house will result in more efficient handling of the barn work. It must be remembered that the barn man will spend approximately two thousand hours per year in a barn housing the average herd of ten to fifteen cows. These hours should be pleasant and enjoyable or dairying becomes drudgery.

CHECK-UP 27

No doubt you realized, even before you read this chapter, that proper stables for cows repay construction costs in many ways. It is clear that well-designed, properly built and equipped barns are important. What are some of the points you should have in mind in judging what makes a good stable for cows?

A. Below is a list of items that refer to cow stables. Cross out all items except the ones that refer to desirable characteristics of cow stables.

1. Moderate temperature
2. Comparative darkness
3. Natural ventilation
4. Controlled ventilation
5. Basement barn
6. Round barn
7. One-story or shed barn
8. Single-storied barn open to the roof
9. Long axis of the barn running east and west
10. Hard-packed earthen floor
11. Insulated cement floor
12. Cement gutters
13. Continuous mangers

If you have completed the above exercise you are aware that there are many "ifs" and "buts" about proper stables for cows. In other words, there are only a few characteristics that are universally desirable. Therefore it is necessary to understand the relative advantages and disadvantages of cow stable structure and equipment. Do you? Try yourself out on the following.

B. Underscore the phrase or expression that best completes each of the following items.

1. Losses of milk from exposure of dairy cattle are more likely to occur in regions where temperatures generally are mild because: (a) cold winds and rains are apt to strike occasionally in such areas; (b) cattle are more apt to be outside; (c) the importance of adequate stabling is not so clearly understood in milder climates.
2. A well-designed, properly constructed barn is more economical than one that is not because: (a) good layout and construction contribute to comfort of the cows and lessen labor costs; (b) comfortable cows produce more; (c) such stables can be kept clean.

3. The basement barn is unsatisfactory largely because it: (a) is cold; (b) lacks adequate light and ventilation; (c) is damp.

4. The principle advantage of the two-story or loft barn is that: (a) it is the most sanitary type of barn; (b) storage space in the loft is provided without the need for a separate building; (c) feed and cattle are located in the same structure.

5. The one-story or shed barn is considered desirable because: (a) it is cheaper to build; (b) light and ventilation may be provided readily; (c) building maintenance costs are low.

6. The advantage of the round barn is: (a) its low construction cost; (b) an even distribution of light; (c) the centrally located silo.

7. Gutters are needed because they are an aid to: (a) keeping cattle clean; (b) draining the barn; (c) keeping cows in position for milking.

8. The best kind of manger is made of cement with all corners rounded and is: (a) continuous; (b) partitioned; (c) covered.

C. In the following groups place the letter L in the parentheses in front of each item that indicates a limitation or disadvantage or bad practice. Place the letter A in the parentheses in front of each item that indicates a specific advantage.

1. Cement or concrete floors meet more of the requirements for a good floor than do dirt, wood, brick, or cork brick floors.
a ( ) Dirt floors; b ( ) Wood floors; c ( ) Brick or cork brick floors; d ( ) Rough-finish cement floors; e ( ) Cement floors flush to outer ground level; f ( ) Cement floors raised above outer ground level; g ( ) Use of bedding on cement floors; h ( ) Inch-depth depression in cement-floored stalls where forefeet stand; i ( ) Cement paved stalls with floors of wood or cork brick; j ( ) Rounded joints and corners on all cemented areas.

2. Satisfactory, easily cleaned walls may be of wood, cement, tile, masonry, or brick dependent upon comparative costs.
a ( ) Walls roughened on the inside; b ( ) Double wooden walls with tar paper and air space between; c ( ) Hollow tile walls; d ( ) Solid cement walls; e ( ) Double cement walls with intermediate air space.

3. Facing cattle in has some advantages and some disadvantages.
a ( ) Both rows of cattle may be fed from center passageway; b ( ) Removal of manure; c ( ) Appearance to visitors; d ( ) Ventilation; e ( ) Natural lighting for milking; f ( ) Use of milking machines; g ( ) Use of structural supporting columns for stanchion manger supports.

4. Proper ties and stanchions add much to the comfort of the cow.
a ( ) So tied that cow must back up to lie down; b ( ) Stanchions hung on pegs at top and bottom; c ( ) Stanchions hung on chains at top and bottom; d ( ) Wooden stanchions; e ( ) Iron stanchions; f ( ) Double-post slip chain tie; g ( ) Iron framework to support stanchions or ties.

5. Adequate ventilation is essential.
a ( ) Natural ventilation; b ( ) Ventilating flues should open near the floor; c ( ) Controlled opening near ceiling in ventilator flue; d ( ) Exterior ventilator intakes below their interior opening; e ( ) Ventilator intakes on south side of barn only; f ( ) Tight construction of barn; g ( ) Fan or forced ventilation; h ( ) Hinged window ventilation.

CHAPTER XXIII

MANURE AND BEDDING

Composition of Manure. In all countries where agriculture has been highly developed, the value of barnyard manure is fully appreciated. It is saved with great care, and applied to the soil in the best condition possible. In many of the older dairy sections of Europe the size of the manure pile is a measure of success of the dairy farmer. In purchasing feeds, the probable fertilizing value is taken into account, as well as the feeding value because about 80 per cent of the fertilizing value of the feed is voided by the animal.

Large quantities of succulent feeds increase the proportion of liquid manure, and nitrogenous diets produce a manure rich in nitrogen.

Table 25 shows approximately the quantities of urine and dung excreted by cows per thousand pounds of live weight; the distribution of the various fertilizer elements; and value of the manure based on 15 cents per pound for nitrogen, 4 cents per pound for phosphoric acid, 5 cents per pound for potash, and 20 cents per hundred pounds for organic matter.

TABLE 25. AMOUNT AND COMPOSITION OF MANURE EXCRETED BY A 1,000-POUND DAIRY COW

	URINE	DUNG	TOTAL
Pounds produced per year	8,000	18,000	26,000
Pounds dry matter contained	560	3,600	4,160
Pounds of nitrogen	64	63	127
Pounds phosphoric acid	trace	36	40
Pounds potash	80	45	125
Value plant nutrients	$13.60	$13.10	$26.70
Value of organic matter	1.10	7.20	8.30
Total commercial value	14.70	20.30	35.00
Value one ton manure	3.65	2.25	2.70

It is a fact often lost sight of in practice that the urine of animals contains by far the most valuable fertilizing constituents of the excreta. That point is brought out by the figures given above,

where it is shown that 8,000 pounds of urine excreted contain practically the same amount of nitrogen as the 18,000 pounds of dung, and that of the total of 125 pounds of potash excreted, 80 pounds pass off in the urine. On the basis of the values quoted, the value of the plant nutrients contained in the urine is $13.60 as compared with $13.10 for the dung, and one ton of liquid cow manure has a total value of $3.65, or $1.45 more than a ton of cow dung. These figures emphasize the necessity of preventing the loss of this valuable part of the excrement.

Value of Manure as Measured by Crops. It is recognized that the fairest valuation of barnyard manure is to measure the increase in crops resulting from its application. An abundance of data are available on this subject. The Minnesota Experiment Station secured a return of from $2 to $3 a ton when manure was applied to the soil, the larger figure being realized when the soil was one of low fertility. This value represented the actual increase in crops produced in tests covering five years. At this rate the manure from a dairy cow would be worth $25 to $30 a year.

Experiments by the Ohio Experiment Station covering fourteen years showed an average value of $3.31 to the ton of manure.

Losses in Manure. Not all the manure produced by an animal reaches the field, and losses are due principally to leaching, fermentation, failure to save the liquid, and dropping outside the barn. Unless the manure is hauled immediately to the fields there is bound to be some loss of fertilizer constituents, regardless of what method of storage is used; but every effort should be made to handle the manure in such a way as to reduce the losses to a minimum. The New Jersey Experiment Station found that when solid cow manure was exposed to ordinary leaching for 109 days, it lost 37.6 per cent of its nitrogen, 51.9 per cent of its phosphoric acid, and 47.1 per cent of its potash. Mixed dung and urine lost in the same time 51 per cent of its nitrogen, 51.1 per cent of its phosphoric acid, and 61 per cent of its potash. Over one-half of the total value was lost in less than four months' exposure to ordinary weather. The loss in fertilizer by the leaching of one cow's manure would amount to $12.50 per year. It would add 25 cents per 100 pounds to the cost of milk from cows producing 5,000 pounds per year. These losses, especially of nitrogen, are partly accounted for by fermentations which set the ammonia free and make the other constituents more soluble. One of the greatest

losses in fertilizing value results from the failure to save the liquid excrement of the animal. To prevent this loss the floor, including the gutter behind the animals, must be water-tight. Besides, enough litter must be used to absorb the urine so none escapes when the manure is recovered from the barn, or drains must be provided to conduct the liquids to a cistern.

Preservation of Manure. The fermentations in manure are checked by using plenty of litter to absorb the liquid manure. A small amount of gypsum may be sprinkled on the moist manure as a means of helping to fix the ammonia. The most important things to be done to preserve the manure are to use sufficient litter for absorbents and where it is necessary to store the manure some time before application to the soil, to keep it compact, moist, and protected from leaching.

It is believed by some authorities that if an impervious floor is provided, sloping toward the center or built in the form of a pit with sides, a roof is not needed and that the rain is beneficial rather than harmful, since leaching cannot occur, and the necessary moisture to help prevent the escape of ammonia is provided. The throwing of manure out under the eaves of the barn results necessarily in the loss of much of its value by excessive leaching, and at the same time it is very objectionable to have a large accumulation of manure through which cows must wade and in which flies will breed. A barnyard cannot be kept in good condition unless such accumulation of manure is avoided.

Handling Manure. One of the difficult problems in disposing of manure is handling the urine. As already pointed out, it is the most valuable part of the manure, but is often allowed to go to waste. The preservation of the liquid manure by means of a cistern and spreading it on the field involves some serious difficulties, and is not to be recommended if it is practicable to supply sufficient amounts of bedding to absorb the liquid, or to run the liquid manure through a drain into a manure pit.

The method of handling manure which has met with the greatest favor among dairymen in recent years is loading it directly from the barn into a manure spreader. The barn is so arranged that the spreader may be driven through the barn and loaded from the gutters, or an overhead carrier is used, with the track extending into the yard, so arranged that the load may be dumped into the spreader.

When a load has accumulated, it is hauled to the field and scattered. One objection to this plan is that in freezing weather the manure must be unloaded daily to prevent freezing. At times the ground is soft, so it is not desirable to drive over it with a load. It often happens that the ground where it is intended to apply the manure is not ready for the application. There is also some difference of opinion regarding the extent to which losses occur from the washing of recently spread manure when snow melts or rain falls on frozen ground. Analyses made by the Ohio Experiment Station show that manure handled in the usual manner by piling

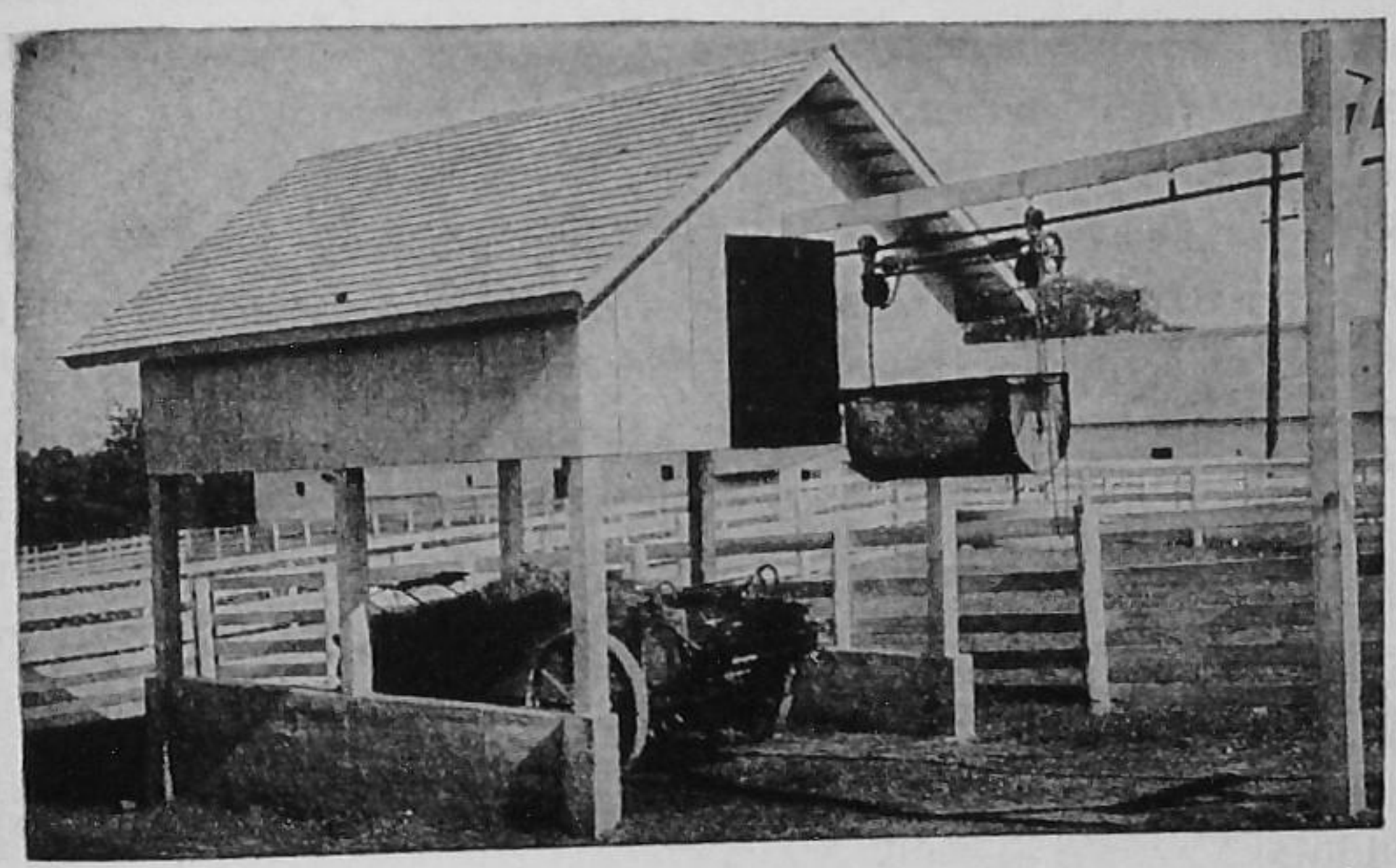


FIG. 70. Loading manure from the carrier into the manure spreader. A plan widely followed is to drop the manure directly into the spreader and haul it to the field as soon as a load has accumulated. This plan saves labor, but has some disadvantages.

in the barnyard lost over one-third of its value by exposure to three months of winter and spring weather. Manure applied directly to a field from the stall showed a value of $2.96 a ton measured by increase in crops grown, while manure taken from the yard after three months' exposure showed a value of $2.15 a ton, a loss in value of 27 per cent.

Taking everything into account, the plan of spreading the manure directly from the stable is to be recommended, but it may be impossible or impracticable to do this at all times.

The Litter Carrier. A valuable part of modern barn equipment is the litter carrier. It makes possible a decided saving in the time

required to care for a herd of cattle and lessens the disagreeable features connected with the handling of the manure. The advantages are that the carrier is easily loaded and moved, and that it is possible to haul the manure as far from the barn as desired or to place the spreader on a lower level and dump into it directly.

Bedding. No satisfactory plan has been devised to do away with the necessity of providing bedding of some kind. Bedding is used primarily to keep animals warm and clean and the material that will do this most satisfactorily and at the same time contribute to the comfort of the animals must be considered the best.

Another purpose, and almost as important as the one of keeping the animals clean, is as an absorbent for urine.

Materials for Bedding. Good material for bedding should be itself clean — which means primarily free from dust. The material to be used on a certain farm will depend upon what is available, and when it is purchased, upon the comparative cost. The problem of a suitable supply of bedding at a reasonable cost is a serious one in regions such as the Eastern states where the growing of cereals is limited and as a result little home grown straw is available. Wheat straw ranks first as a bedding material. It is clean and has fair powers of absorbtion. Oat straw usually contains some dust but otherwise has about the same value. Sometimes corn fodder is either shredded or run through a cutting machine and fed in the barn, the refuse making satisfactory bedding.

In localities where peat is common it is sometimes dug in the summer, allowed to dry in the field, and stored under cover when dry. It is found to make good bedding, having especially good absorptive powers. In the Eastern states shavings and sawdust are largely used. From a sanitary standpoint sawdust stands high as bedding material, followed by shavings. These materials are free from the large number of bacteria and molds which often accompany straw. However, bedding of this class does not add any fertility to the soil, as is the case when wheat or oat straw is used. Some objections have been raised to the use of sawdust and shavings as bedding material. Sawdust makes manure so light that loss of ammonia occurs. Sometimes decomposition is so rapid that the manure actually becomes heated. It turns gray in color and dust-like in texture. This is called fire fanging. Applied in large quantities to the soil it may be injurious from the

effect of the acids set free, particularly tannic acid in the case of oak sawdust. The reasonable use of sawdust on most soils, however, is not injurious, and may even be beneficial.

CHECK-UP 28

A. What are some important factors to keep in mind about bedding and manure?

Underscore the phrases or expressions that correctly complete the following statements. There may be more than one correct response to a statement.

1. The most valuable fertilizing constituents of cow manure are in: (a) the urine; (b) the dung; (c) the bedding.
2. The favorite method among modern dairymen for handling manure is: (a) dumping directly into the manure spreader; (b) dumping out the windows for storage under eaves of the stable; (c) dumping into a pit.
3. Bedding is needed to: (a) keep cows warm; (b) keep cows clean; (c) absorb urine.
4. A good bedding material must be: (a) clean; (b) absorptive; (c) cheap; (d) yellow.
5. First among good bedding materials is: (a) wheat straw; (b) oat straw; (c) barley straw; (d) shavings; (e) shredded stover.

B. Perhaps you realized even before reading this chapter that the successful dairy farmer makes efficient use of manure. It is also clear that some types of feed will produce more valuable manure than some other types of feed. Therefore the efficient dairy farmer not only uses manure effectively but he considers the probable fertilizing value of feeds as well as their food value.

1. Compute the fertilizer values per 1000 pounds of five of the following crops assuming that nitrogen is worth 20 cents a pound; phosphorus, 5 cents; potassium, 5 cents.

FERTILIZING CONSTITUENTS PER 1000 POUNDS OF CROP

CROP	POUNDS NITROGEN	POUNDS PHOSPHORUS	POUNDS POTASSIUM	FERTILIZER VALUE
1. Alfalfa hay	21.9	5.1	16.8	$5,475
2. Wheat	23.6	7.9	5.0	
3. Wheat bran	26.7	28.9	16.1	
4. Corn	18.2	7.0	4.0	
5. Corn fodder	17.6	5.4	8.9	
6. Oats	20.6	8.2	6.2	
7. Wheat straw	5.9	1.2	5.1	
8. Red clover hay	20.7	3.8	22.0	
9. Timothy hay	12.6	5.3	9.0	

2. Edward North has a herd of 25 dairy cows. How many tons of manure will the herd void in a year's time? See Table 25. _____ tons. What would be the total commercial value of the manure? See Table 25. $_____. To obtain an equal amount of fertilizing value how much money would North have to spend for commercial fertilizer? See Table 25. $_____. If the accumulated manure is exposed for four or five months about how much of its value in terms of cash is leached away? $_____. Assuming 100 per cent efficiency in the preservation and use of manure from his herd, how much ahead is North in cash money if he requires no commercial fertilizer? $_____.

C. What is the dairy cow population in your state? In the state where you plan to farm? Consult the appendix in back of the book, p. 311.

D. To prevent loss in manure the following practices should be followed. Place a D in the parentheses in front of each desirable practice; cross out those that are usually either undesirable or impractical.

1. ( ) Haul manure to fields and spread immediately unless weather or ground conditions prevent.
2. ( ) Drain off and discard liquid manure.
3. ( ) Drain off liquid manure into storage system for preservation until ready for use.
4. ( ) Use absorbent litter to take up liquid manure.
5. ( ) Storage of manure under barn eaves.
6. ( ) Keep stored manure dry.
7. ( ) Provide water-tight gutters.
8. ( ) Provide a litter carrier or conveyor for manure or load directly on spreader.
9. ( ) Keep stored manure at some distance from stables in moisture-proof pit.
10. ( ) Keep stored manure moist and compact.

CORRESPONDENCE OR CLASS ASSIGNMENT 8

1. Describe what you think is the best type of barn for your community touching upon: (a) layout; (b) construction materials for foundations, roof, floors, walls, and mangers; (c) provision for ventilation; (d) provision for watering stock; (e) provisions for handling manure.

2. Dairy farming enables the far-sighted farmer to build a permanent kind of agriculture on his farm. Why is this so? Why is this an important fact for the farmer to consider?

REVIEW CHECK-UP 2

Each statement below is either true or false. If a statement is true, circle the T and do nothing else with it. If a statement is false, circle the F. Then correct it by crossing out the word or words in italics and substitute the right word or phrase in the blank space at the end of the statement.

1. T F There is a *constant* tendency to reversion to type. _____
2. T F Competent judges *can readily* select very good cows from poor ones by observation. _____
3. T F Fat percentage is *more* important than total fat production in selecting a cow. _____
4. T F *All* pure-bred cows are profitable producers. _____
5. T F A large herd *always* produces more milk than a smaller herd. _____
6. T F Good feeding *can overcome* inherited variation in milk secretion. _____
7. T F The owner of grade cows *does not need* to keep production records of his cows. _____
8. T F High milk yield goes with a *low* test. _____
9. T F Among individual cows of the same breed there is *more* variation in fat percentage than in milk yield. _____
10. T F Records of production are of *greater* value than the judgment of the milker. _____
11. T F A Dairy Herd Improvement Association is an organization for *raising* better cows. _____
12. T F *Frequently* a calf from an inferior cow, sired by a good pure-bred bull, will be a satisfactory producer. _____
13. T F *All* cows are good when born. _____
14. T F *The bull* is half the herd. _____
15. T F Only *pure-bred* herds need pure-bred bulls. _____
16. T F It is a good idea to use a pure-bred *Jersey* bull on Holstein

cows to increase the fat percentage in the milk of the offspring. _____

17. T F *All* pure-bred bulls are prepotent. _____

18. T F The better a herd is the *easier* it is to improve it further. _____

19. T F An exceptional bull from a family of low producers is *more* prepotent than one from a family of high producers. _____

20. T F A pedigree *is a guarantee* of excellence. _____

21. T F An aged bull is *more* prepotent than a young one. _____

22. T F A proved sire is a bull that has thrown *six bull calves*. _____

23. T F A bull should be kept *fat*. _____

24. T F Dairy-breed bulls *are gentler* than beef-breed bulls. _____

25. T F Mendel's law explains how an individual *can influence* his inheritance. _____

26. T F An individual possesses *all* the characteristics normal to his race whether or not the characteristics are evident in him. _____

27. T F In breeding animals it *is possible* to mate individuals which are identical. _____

28. T F The *greatest aid* to livestock improvement is judicious selection. _____

29. T F Galton's law explains why the parents of the animal are of *more interest* to the breeder than the remoter ancestors. _____

30. T F The offspring of high-producing cows are *sometimes* mediocre. _____

31. T F In-breeding is the *most rapid* means of advancement in breeding. _____

32. T F In-breeding is *the same* as line-breeding. _____

33. T F Mating of entirely unrelated individuals is called *nicking*. _____

34. T F *Out-crossing* is mating animals of different breeds. _____

35. T F Skim milk differs from whole milk *only* in having most of the fat removed. _____

36. T F Butterfat is the *most valuable* part of milk for a calf. _____

37. T F Butterfat is *the same* as colostrum. _____

38. T F Good veal *can be* raised on calf meal and grass alone. _____

39. T F Succulent feeds add to the *palatability* of the ration. _____

40. T F The age at first calving is of *no importance* with reference to the development of the milking function in the cow. _____

41. T F Pedigreed stock, pure-bred stock, and registered stock are terms *correctly* used interchangeably. _____

42. T F *Pure-bred* animals are admitted to Advanced Registration on the basis of individual merit. _____

43. T F The bulk of dairy products on the market comes from *pure-breds*. _____

44. T F The purpose of official testing is to produce records that increase *the market value* of the stock. _____

45. T F A high-producing cow does *more work* without much walking than a horse that is working all day in the fields. _____

46. T F Cows calving in the spring produce *more milk* than those calving in the fall. _____

47. T F A high-producing cow should be kept as long as she continues *to breed*. _____

48. T F Many *high-producing* cows will milk continuously unless intentionally dried up by the owner. _____

49. T F A dry cow *needs* exercise. _____

50. T F A cow needs about *three pounds* of water for every pound of milk she produces. _____

51. T F The secretion of milk is *voluntary*. _____

52. T F The intervals between milkings should be *as nearly equal* as possible. _____

53. T F A cow's teats should *always be dry* when milking. _____

54. T F A milking machine *cannot* spread infectious udder trouble. _____

55. T F Most dairymen prefer *small cows* for the breed. _____

56. T F *Marked variations* in the fat percentage often occur in the milk from the same cow from day to day. _____

57. T F Milk generally tests *lower* in winter than in summer. _____

58. T F Feed *can cause* a cow to give milk beyond the limits of her inherited ability. _____

59. T F The first milk drawn contains *most* of the fat. _____

60. T F Richness of milk remains *fairly constant* regardless of the cow's age. _____

61. T F A good dairy cow *is protected* from the cold by layers of fat. _____

62. T F The dairy barn *is* a human food factory. _____

63. T F A cement floor higher than the ground level *is colder* than one on the ground. _____

64. T F Facing cows *inward* tends to keep the barn walls cleaner. _____

65. T F *Wood* is the best material for mangers. _____

66. T F It is *objectionable* to tie a cow so that she backs up to lie down. _____

67. T F Fresh air *is more* moist than expired air. _____

68. T F The *fairest valuation* of barnyard manure is to measure the increase in crops resulting from its application. _____

69. T F Plenty of bedding *checks* the fermentations in manure. _____

70. T F A *disadvantage* of bedding is that it absorbs the urine. _____

This final over-all self-check cannot cover all of the items you should know. Review all of the chapter check-ups in addition to completing this Review Check-up. Are you ready for your End-of-Course Test? See "What the Book Is About and How to Use It." in the front of the book, pages iii-v.

APPENDIX

TABLE 26. NUMBER OF MILK COWS, TWO YEARS OLD AND OVER ON FARMS. JANUARY 1, 1943, BY STATES AND GEOGRAPHIC DIVISIONS[1]

STATE AND DIVISION	NUMBER OF COWS
	Thousands
Maine	123
New Hampshire	70
Vermont	293
Massachusetts	134
Rhode Island	23
Connecticut	131
New York	1,413
New Jersey	154
Pennsylvania	906
North Atlantic	3,247
Ohio	1,105
Indiana	800
Illinois	1,168
Michigan	1,018
Wisconsin	2,452
East North Central	6,543
Minnesota	1,863
Iowa	1,560
Missouri	1,062
North Dakota	608
South Dakota	545
Nebraska	702
Kansas	833
West North Central	7,173
North Central	13,716
Delaware	38
Maryland	212
Virginia	460
West Virginia	246
North Carolina	380
South Carolina	181
Georgia	395
Florida	123
South Atlantic	2,035
Kentucky	612
Tennessee	640
Alabama	438
Mississippi	579
Arkansas	536
Louisiana	342
Oklahoma	912
Texas	1,547
South Central	5,606
Montana	173
Idaho	266
Wyoming	71
Colorado	249
New Mexico	83
Arizona	53
Utah	117
Nevada	22
Washington	384
Oregon	290
California	794
Western	2,502
United States	27,106

[1] Bureau of Agricultural Economics, U. S. D. A.

Table 27. Number and Kinds of Cattle in United States, 1930[1]

State	Total Number Cattle All Kinds	Total Pure-breds All Kinds	Total Pure-Bred Dairy Cattle All Breeds	Major Dairy Breeds			
				Ayr-shire	Jersey	Guern-sey	Hol-stein
Alabama	799,523	9,274	6,764	23	6,386	212	143
Arizona	695,118	11,815	3,427	166	1.014	276	1,956
Arkansas	812,590	8,754	6,532	5	5,737	264	514
California	2,103,261	41,929	23,113	951	5,617	3,041	13,302
Colorado	1,454,352	41,916	8,155	403	1,277	764	5,669
Connecticut	166,654	13,692	12,239	1,798	2,208	3,084	5,073
Delaware	53,914	3,100	2,896	86	388	877	1,545
Florida	431,488	3,364	2,841	50	2,017	436	318
Georgia	783,063	10,528	8,432	2	7,092	947	388
Idaho	622,170	19,898	9,537	194	2,917	1,577	4,842
Illinois	2,342,125	92,992	59,615	625	10,179	5,241	39,060
Indiana	1,446,747	49,225	35,751	535	16,094	6,429	12,103
Iowa	4,136,156	133,423	43,702	1,066	6,711	6,569	26,211
Kansas	3,223,772	103,539	27,556	2,297	8,649	2,144	14,121
Kentucky	1,086,310	27,118	16,903	32	13,281	616	2,953
Louisiana	729,690	5,567	4,234	1	3,679	123	431
Maine	257,048	20,066	16,021	1,096	6,134	4,003	4,613
Maryland	318,779	20,773	19,294	661	2,885	6,093	9,553
Massachusetts	207,389	22,112	19,552	2,753	3,013	5,491	8,187
Michigan	1,528,161	83,520	71,750	777	15,844	11,736	41,786
Minnesota	3,156,181	117,570	78,650	1,066	5,141	15,147	54,072
Mississippi	1,008,672	17,248	15,168	77	14,232	403	456
Missouri	2,782,400	89,922	31,584	160	21,030	2,289	7,875
Montana	1,290,353	34,309	4,551	111	495	653	3,167
Nebraska	3,150,187	81,114	11,933	420	2,250	1,240	7,865
Nevada	308,482	4,554	1,033	84	159	27	753
New Hampshire	135,827	13,561	11,179	2,115	1,301	2,555	5,153
New Jersey	174,699	17,906	17,075	316	2,397	3,925	10,232
New Mexico	1,055,327	22,188	1,322	13	777	54	463
New York	2,220,139	165,160	156,625	14,881	13,799	19,390	106,311
North Carolina	532,631	13,924	11,788	362	7,054	3,393	978
North Dakota	1,454,146	38,614	9,354	118	493	1,454	6,950
Ohio	1,772,856	98,079	82,102	1,441	32,253	12,440	35,027
Oklahoma	2,097,576	42,770	16,130	233	11,167	867	3,770
Oregon	805,120	33,312	21,755	328	14,360	3,190	3,577
Pennsylvania	1,511,202	116,370	108,353	5,387	15,024	23,601	63,552
Rhode Island	31,633	3,415	3,182	429	388	796	1,555
South Carolina	270,171	6,663	5,969	——	2,776	2,430	763
South Dakota	1,974,050	43,332	9.141	312	595	1,203	6,516
Tennessee	1,073,898	26,717	18,869	34	17,729	210	894
Texas	6,602,702	148,727	39,981	77	36,875	501	2,456
Utah	441,650	14,246	6,848	35	2,427	485	3,901
Vermont	472,183	27,075	25,716	4,065	10,045	3,468	7,986
Virginia.	832,946	20,927	14,150	82	2,989	5,283	5,756
Washington	634,737	26,309	19,597	691	6,681	3,960	8,125
West Virginia	556,257	15,662	6,863	293	3,682	1,112	1,668
Wisconsin	3,536,603	165,871	152,114	1,917	7,434	30,522	105,792
Wyoming	824,039	21,177	1,596	1	262	194	1,127
Total U. S.	63,895,826	2,149,363	1,280,161	48,236	354,939	200,721	649,739

[1] U. S. Census, 1930.

INDEX

Abortion, 115, 118, 119–120, 201
Acquired characteristics, 127, 185
Advanced registry, and Babcock test, 52
  and herd improvement tests, 229
  how conducted, 228
  official testing by, 228
  pure-breds vs. grades in, 230
  purpose of, 51–52, 229
  and Register of Merit, 61
  relation between daily and yearly records, 271
  table of results of, 52
  tests, for Ayrshires, 76
    for Brown Swiss, 83–84
    for Dutch-Belted, 88
    for Guernseys, 68
    for Holsteins, 52
    for Jerseys, 61
    for Red Polled, 103–104
    for Shorthorns, 99–100
Afterbirth retention, 254
Agencies, educational, 4
Alderneys, 54
American Dairy Science Association, 37
American Devon Herd Book Association, 91
American Guernsey Cattle Club, 66, 68, 69
American Jersey Cattle Club, 35, 55, 56, 62
American Shorthorn Breeders' Association, 99
Ancestral inheritance, 181, 184
Anglo-Swiss Condensed Milk Company, 83
Arrangement of cattle in barns, 289
Ayrshire Breeders' Association, 77
Ayrshires, advanced registration of, 76
  American type of, 73
  birth weight of, 201
  breed characteristics of, 59, 73
  breeders' association for, 77
  butterfat characteristics of, 76
  calves of, 75
  compared to Holstein, 73, 75
  to Jersey, 73, 75
  to Red Polled, 103
  conditions in Ayr, Scotland, 72
  dairy characteristics of, 75
  dairy temperament of, 74
  fat yield of, 76, 268
  grazing efficiency of, 47, 75
  herd test for, 76
  importation and distribution of, in U.S., 72
  influence of other breeds on, 18, 44, 71
  milk characteristics of, 75–76
  origin of, 16, 71

Babcock test, 3, 23, 52, 143, 148, 156, 228
Bakewell, Robert, 18, 96, 179, 180
Bang's disease. *See* Abortion
Barns, arrangement of cattle in, 289
  better, for cheaper production, 280
  box stalls in, 293
  cleanliness of, 207
  floor construction of, 284–285
  fly control in, 248–249
  gutters in, 290
  as human food factory, 280
  labor-saving devices in, 296–297
  lighting of, 284
  location of, 284
  mangers in, 290
  ties and stanchions in, 292–293
  types of, 281–283
  ventilation of, 294–296
  wall construction of, 288–289
  water supply in, 257, 293
    for young stock, 286
Barnum, P. T., 88
Bates, Thomas, 96, 180
Bedding, importance of, 304
  materials for, 304
Beet pulp, 223
Bible, references to dairy products in, 1
Booth, Thomas, 180
Borden, Gail, 3
Bos longifrons, 15

Bos primigenius, 15–16, 44
Bos sondaicus, 15–17, 54, 79
Breed selection, adaptation of, to region, 107
and characteristics in use of roughage, 111
choice of breed in, 105–120
and classification of cattle, 19–21
and community breeding, 11–112
and community breed organizations, 113
and cost of fat production, 109
and exchange of breeding stock, 114–115
factors determining, 105
and feed required for milk production, 108, 110
general considerations in, 110
and herd building through purchase, 117
and maintenance requirements, 108
markets a factor in, 106
preference in, 107, 112
and relative efficiency of stock, 113
and sale of surplus stock, 113
by size, 265
and stimulation for improvement, 114
and testing and disease eradication, 115
Breed type, 34, 35
Breeding methods, birth of art of, 17–18
breeders' business code of, 233
bull associations for, 195–196
of Colling brothers, 18, 180
community, 111–112
for cross breeding, 193–194
ill effects of, 194
and Galton's Law, 184
of in-breeding, 188–190
of line-breeding, 191
and Mendel's Law, 181
of outcrossing, 191–192
by pioneer cattle breeders, 179–180
prehistoric, 179
reputation an asset in, 18–19, 232
and sex determination, 186
successful, a gradual development, 232
suggestions on, to breeders, 237
Breeds, classification of, 19, 20, 21
distribution of, U.S., 314
inheritance value of, 18–19
market value of, 18–19
natural, 17
origin of, 17
relation of, to fat yield, 268–269
relation of, to milk yield, 265
variation of, in milk yield and richness, 142
Brown Swiss, advanced registration of, 83
age of, at maturity, 82
best records of, 84
breed characteristics of, 81
breeders' associations for, 84
calves, birth weight of, 201
compared to Holstein, 48
spring born, 80
conditions for, in Switzerland, 79
dairy characteristics of, 82
fat production of, 109
importation and distribution of, U.S., 80
oldest domesticated breed, 79
origin of, 15, 54, 79
register of production of, 84
representative of *Bos sondaicus*, 79
slow maturity of, 82
Brown Swiss Breeders' Association, 84
Bulls, age a factor in selection of, 171–172
age of, for breeding, 173
associations, 195–196
and basis of sire selection, 165–166
dehorning, 173
exercise for, 174–175
feeding, during growth, 172
feeding, when mature, 173–174
handling, 175
handling vicious, 176
housing, 174
and importance of sire selection, 158, 163
need of pure-bred, 117, 161
noted, 163–165, 170
optimum growth of, 172
pedigree uncertainty of, 167, 169
pens, 174
prepotency of, 160, 186
prepotent, in all breeds, 164
and proved sires, 169–171
pure-bred, in grade herds, 162
and relation to dam's age, 172
and relative importance of sire and dam, 186

Bulls (*Cont.*)
results in use of, 159, 162
ringing, 173
value in pure-bred, 159
value of dam in pedigree of, 167
value of pure-bred herds, 161
variation in prepotency of, 165
why few pure-bred, 196
Butter, average production of, per cow, 128, 129
and butterfat, 148
early use of, 2
production of, by Ayrshires, 76
per herd, 4
by Jerseys, 55, 56
by Shorthorns, 99
and soil fertility, 9
See also Butterfat, Fat yield
Butterfat, chemical contents of, 9
production of, by Ayrshire, 76, 77
by Brown Swiss, 82
by Devons, 91
by dual-purpose cows, 93
by Dutch-Belted, 88
by Guernsey, 60, 67, 69
by Holstein, 49–50, 61
by Jersey, 61
by type, 27
variation of, in individual cows, 128–130

Calcium, for calves, 207
and growth, 222
Calf raising, clean milk pails for, 206–207
economic considerations in, 200
by hand, 202
importance of colostrum in, 204
and pneumonia, 207
sanitation important in, 214–215
with skim milk, 202
without skim milk, 208–209
taking calf from mother in, 204, 256
and veal production, 212–214
Calves, birth weight of, 201
buying, 118
calcium needed by, 222
care of new-born, 255
changing, to skim milk, 205
disadvantages of replacements of, 200
diseases of, 214–215
fall vs. spring, 208, 243–244
farm-separator and skim-milk, 206
feeders for, 209–210
fresh milk for, 205
Jersey, 60
milk substitutes for, 209
minerals required by, 207
pens for, 207, 210–211
roughage for, 204
Shorthorn, 97
stanchions for, 211
watering, 207
weaning, 208, 209
Calving, care after, 255
care at, 253
condition of flesh at, 253
effect of, on richness of milk, 271
fall, advantages of, 244
milking before, 253
preparation for, 253–254
retention of afterbirth in, 254
spring, 243
Carbohydrates, functions of, 220–221
Cattle, *Bos longifrons*, 15
Bos primigenius, 15–16, 44
Bos sondaicus, 15
breeding of, 17–19, 179–197 *See also* Breeding
breeds, 21
dual-purpose, 21. *See also* Dual-purpose cattle
origin of, 15
classification of, 19
cross-bred, 20
dairy, amount of land used for 1
breeds in America, 20, 21
importation, first, 2
of improved blood, 2
improvement in, 4
meat from, 11–12
native, 2
number by breeds and states, 314
point scales for, 23. *See also* Score card
domestication of, 15
identifying, 245–246
influence of migration on, 19
market value of, 19
number of, on farms, 4, 5
wild forms of, 15
See also Breeding; Cows, dairy
Cement floors, 285
Channel Island breeds, 54
Cheese, developed by Swiss, 2
early use of, 1, 2
first factory, 3

Cheese (*Cont.*)
increased consumption of, 5
production, by Ayrshires, 72, 76
in Holland, 45
by Jerseys, 56
in Switzerland, 79
Clark, H. M., 80
Cold storage, effect of, on industry, 4
Colling brothers, 18, 96, 164, 180
Color, of Ayrshires, 73
of Brown Swiss, 82
of Devons, 90
of Dexter, 90
of Dutch-Belted, 87
of French-Canadian, 89
of Guernseys, 66
of Holsteins, 46–47
of Jerseys, 56, 58
of Kerry, 89
of Red Polled, 102
of Shorthorns, 97
of Simmerthaler, 79
Colostrum, importance of, to calf, 204
Community breeding, 111–112
Cows, dairy, breeds of, 21
calving of, *see* Calving
care of, 242–250, 252–258
compared to other livestock, 10
to steer, 10, 24, 25
in feed consumption, 10
dehorning, 244
drying off, 252–253
effect on, of estrum, 271
and fly annoyance, 248
grooming, 243
kicking, 262
management of, 242–250, 252–258
manure, value of, 9
and milk fever, 255
number of, 5, 11, 313, 314
performance of, early colonial, 2
points in judging, 36
as producers of human food, 10
rest for, 252
and roughage, 11
salt requirements of, 258
shelter for, 246
as source of beef, 11
tags for, 246
types of, 21
water for, 256
Cow testing associations, 23, 115, 131, 155–156, 195, 229, 274. *See also* Dairy herd improvement associations
Cross-bred, definition of, 20
Cruikshank, Amos, 96, 180
Dairy cattle, *see* Cattle; Cows
Dairy cattle breed associations, Ayrshire, 77
Brown Swiss, 84
first established, 3
Guernsey, 68, 69
Holstein-Friesian, 35, 44, 51
Jersey, 35, 55, 56, 62
point scales of, 23
Dairy form, *see* Dairy type
Dairy herd improvement associations, advantages of, 156, 195
need for, 154–155
organization of, 155
origin of, 155
progress by, 23
Dairy industry, and distribution, 4, 5
early centers of, 2
and erosion, 10
history of, 1–4
importance of, 1
and labor, 12, 13
permanence of, 7
proper management of, 242
a safe business, 12
and science, 3
and soil fertility, 8–10
a year-round job, 12
Dairy organizations, history of, 3
Dairy products, and bacteriology, 4
distribution of, 4, 5
history of, 1–3
increased consumption of, 5, 6, 7
and soil fertility, 9
yearly values of, 5
Dairy type, barrel development of, 24, 28, 38
body form of, 25, 37
circulatory system of, 29–31
and conformation, 25, 37
dairy temperament of, 25, 26, 158
general characteristics of, 23–24, 37–38
selection of, 140
Dams, and bull selection, 167–168
Dauncey, Philip, 57, 180
Dehorning, 173, 244
Devons, characteristics of, 91
origin of, 54, 90

Dexter, characteristics and origin of, 90
compared to Kerry, 90
Disease, abortion, 115, 118, 119–120, 201
Bang's, *see* Abortion
of calves, 205, 214–215
eradication of, 115
foot and mouth, 80
guarding against, 118–119
mastitis, 118, 120, 201, 252
milk fever, 255
pneumonia, 207
revealed by records, 146
scours, 205, 211
tuberculosis, 115, 117, 118, 119, 201
Drying up cows, 252–253
Dual-purpose cattle, adaptation of, 93
definition of, 92
difficulties in fixing type of, 95
for general farm, 93–94
milk yield of, 267–268
Red Polled as, 102
Shorthorns as, 92
standards of, 92
Duncan, W. G., 57
Durham breed, 71. *See also* Shorthorns
Dutch-Belted, characteristics of, 88
compared to Holstein, 87
importation and distribution of, U.S., 87–88
origin of, 87
registration and advanced registry of, 88
Dutch Friesian Association, 44
Duthie, William, 180

Electrical fly screens and traps, 249
English Red Polled Herd Book, 101
Environmental effect, 17, 184
Erosion, controlled by dairy farming, 10
Estrum, or heat period, 271
Exercise, 243
Exhibiting cattle, 234

Factory system, introduced, 3
Families, of Guernseys, 68
Governor of the Chene, 68
Imp. Glenwood Girl, 68
Masher, 68
May Rose King, 68, 164, 190
of Holsteins, 51
De Kol, 51, 52, 164, 170, 192
Johanna, 51, 52
Ormsby, 51, 52, 164, 192
of Jerseys, 56, 57, 62
Eminents, 62
Favorite, 164
Golden Glow, 57, 62
Majestys, 62
Owl-interests, 62
St. Lambert, 56, 62, 180
St. Mawes, 57, 62
Sophie's Tormentor, 57, 62, 189
Stoke Pogis, 62
Stoke Pogis 3d, 62, 164
Fat globules, color and size, of Ayrshire milk, 76
of Guernsey milk, 68
of Holstein milk, 50
of Jersey milk, 61
of Shorthorn milk, 99
Fat yield, of Ayrshire, 76
breed variations in cost of, 109
of Brown Swiss, 83, 109
calcuation of, 141, 148, 150
of Dexter, 90
of Dutch-Belted, 88
and economy of high production, 131
of French Canadian, 89
of Guernsey, 109, 269
of Holstein, 49–50, 61, 109
of individual cow, 128, 129, 130
of Jersey, 60–61, 109, 269
of Kerry, 89
of Red Polled, 104
of Shorthorns, 97
and relation to costs, 131–132
and relation to milk yield, 142–143
seasonal variation in, 266
and stage of lactation, 268
Fats, function of, 221
Feed, and barrel capacity, 28–29
breed differences in digestion of, 108, 110
in feed for milk produced, 110
of Brown Swiss, 80
for calves, *see* Calf raising
consumed by cow or steer, 10–11
half total expense of milk production, 136–137
of Jerseys, 55

Feed (*Cont.*)
relation of, to yield and richness, 269–270
Feeders, calf, 209–210
Feeding, aided by records, 145
as factor in improved breeds, 183
See also Growth
Fertilizers, barnyard manure as, 8
commercial, 9
Floor construction, 284–288
Fly, annoyance, 208, 248
repellants, 248
screens and traps, 249
Food, cow cheap producer of, 10
importance of milk as, 5–7
Foot and mouth disease, 80
in Holland, 45
Freemartin, definition of, 187
French-Canadian characteristics, 89
origin, 88–89
French-Canadian Herd Book, 89

Galton's Law, 184, 191
Garget, *see* Mastitis
Genetics:
body cell, 181
dominancy, 181–182
environment, 184
heredity, 182, 183
influence of sire and dam, 186
inheritance of acquired characters, 127, 185
Mendel's Law, 181
nicking, 193
outcrossing, 191
pedigree misuse, 193
pedigrees, 183, 188
prepotency, 186–187
sex determination, 186
Gestation, effect of on milk yield, 269
period of, 243
Gowen, 29
Grade, definition of, 20
Grand Rapids, Minn., Substation, 161, 162
Greece, use of butter and cheese in, 1
Grooming, 243
Growth, calcium and, 222
conditions necessary for, 220
effect of nutrition on, 220
factors in, 218–219
functions in, of carbohydrates, 220–221
of fats, 221
of minerals, 221–222
of proteins, 221
of vitamins, 222–223
internal cause of, 219–220
limits of, 219
measuring, 219
nature of, 218
normal, 219
and size at birth, 201
Guernseys, birth weight of, 201
butterfat characteristics of, 60, 67
compared to French-Canadian, 89
dairy characteristics of, 67
dairy temperament of, 66–67
distribution, in Europe, 64
in U.S., 66
families, 68
fat, color, 68
yield of, 269
form and characteristics of, 66
importation of, 66
origin of, 16, 64
results of advanced registry testing of, 68
Guernsey Island, conditions on, 64–66
Gutters, 290

Heifers, birth weights of, 201
economic considerations of, 200
fall birth of, 208
milking, 260
purchase of, in herd building, 118
rations for, 223–224
Herd books, of Ayrshires, 73
of English Red Polled, 101
of English Shorthorn, 227
first establishment of, 2
of French-Canadian, 89
and grade cattle, 20
registration in, 227
Herd building, importance of bull in 158–159, 163
importance of calf raising in, 200
numbers and herd profit in, 133
to start the herd, 116
through purchase, 117–118, 200–201
See also Selection
Herd Improvement Registry, 61, 69
History of dairy farming, 1–4
Holderness, 71
Holland, dairying conditions in, 44–45
history of cattle in, 44

Holstein-Friesians, advanced registry of, 51–52
age of, at maturity, 49
American vs. Holland, 46
barrel development of, 28, 29
beef possibilities of, 48
breed organization, 46. *See also* Holstein-Friesian Association of America
calves, birth weight of, 201
compared to Brown Swiss, 48
to Jersey, 48
reversion in, 183
characteristics and adaptation of, 59
and climate, 49
color markings of, 46–47
compared to Ayrshires, 73, 75
to Dutch-Belted, 87
to Jersey, 17
to Red Polled, 103
cross breeding of, 194
distribution of, 45–46
dual-purpose, 91
families of, 51
fat globules of, 50
fat yield of, 49–50, 61, 109, 268
handling of, Holland, 45
importation and distribution of, U.S., 45–46
influence on other breeds, 44
milk of, characteristics, 50
production, 49–50, 61
origin of, 16, 17, 44
pasturage of, 47
as representative of *Bos primigenius*, 16, 44
reproduction by, 48
roughage for, 111
size and type of, 46
Holstein-Friesian Association of America, and Advanced Registry, 51
fee required by, 45
formation of, 46
office of, 52
score card published by, 35
Hormones, and milk secretion, 135, 269
Horns, desirability of dehorning, 244
type of *Bos primigenius*, 16

Illinois Experiment Station, 128, 129
"Improved blood," definition of, 2
Improvement in live stock, 18
In-breeding, 186
advantages of, 189
ill effects of, 190
and selection, 191
Individual identification, methods of, 245–246
Individual production and costs, 132
Individual variation, 128, 134
Inheritance of acquired characters, 127, 185
Inheritance value of breeds, 18
Inherited stimulation, 136, 265
Iowa Experiment Station, 159, 163

Jerseys, advanced registration of, 61
beef possibilities of, 59
breed characteristics and adaptations of, 47, 58
butterfat, characteristics of, 61
as producers of, 56
calves, birth weight of, 201
compared to Holstein, 48
and climate, 49, 59
color of, 56
compared to Ayrshire, 73
to French-Canadian, 89
to Holstein, 17, 109
to Kerry, 56
cross breeding of, 194
dairy characteristics of, 60, 67
families of, 57, 62
a family cow, 61
fat yield of, 60–61, 109, 269, 270
production of, 60
importation and distribution, U.S., 55
in-breeding of, 57
influence of early English breeders on, 57
Island vs. American type of, 56
milk characteristics of, 60
nervous temperament of, 58
numbers and popularity of, 55
origin of, 16, 17
pasturage for, 47, 54–55
and register of merit, 61
as representative of *Bos longifrons*, 17
score card for, 55
size and type of, 56
tattooing of, 228
temperament of, 58

Jersey Island, cattle on, 54
conditions on, 54
intensity of farming on, 55
point scale, 23, 35

Kent, S. C., 66
Kerry, characteristics of, 56, 89
origin of, 54, 89
Kicking cows, 262

Labor problem, 12, 13
Labor-saving suggestions, 296–297
Lactation, stage of, and fat percentage, 268
and milk yield, 266
Land, used for dairy cattle, 1
Like begets like, 180
Lime, found in milk, 6
Line-breeding, 191
Litter carriers, 303

Management, of dairy cows, 242–250, 252–258
Mangers for barns, 290
Manure, composition of, 300
fertility returned by, 9
handling, 302
litter carriers for, 303
losses in, 301
materials for bedding, 304
preservation of, 302
source of soil elements, 8
value of, 9, 301
Marking and tattooing, 246
Mastitis, 118, 120, 201, 252
McCollum, 5, 6
Meat, and cheese consumption, 5
from dairy cows, 11–12
Mendel, Gregor, 5
Mendel's Law, 181
Migration, influence of, on breeds, 17, 18
Milk, characteristics of Brown Swiss, 83
of Guernsey, 67
of Holstein, 80
of Jersey, 60
and colostrum, 204, 254
comparison of whole, and skim, 203
composition of, 203
variation of, seasonal, 266
successive days, 266
condensed, 3
consumption of, increase in, 4
effect on, of age of cow, 275
of breed, 265
of estrum, 271
of gestation, 269
factors influencing quality and quantity of, 265–275
first, and last drawn, 270
fresh, for calves, 205
history of use of, 1–3
and human nutrition, 4
importance of, to civilization, 1
minerals in, 6
production of, *see* Milk production
protein in, 5–6
relation between daily and yearly production of, 271, 272
shipping of, first, 3
skim, for calves, 202
composition of whole and, 203
nutritive ingredients in, 203
source of vitamin A, 204
substitutes, for calf feeding, 209
taking samples of, 147
vitamins in, 6
Milk fever, 255
Milk production, by Ayrshires, 75–76
by Brown Swiss, 82–83, 84, 109
cause of, 135–136
per cow, 4, 128–131
by Devons, 91
by Dexter, 90
by dual-purpose cows, 93
by Dutch-Belted, 88
economy of high, 131–132, 136
and exercise, 243
by French-Canadian, 89
by Guernseys, 67, 109
by Holsteins, 47, 49–50, 109
importance of individual selection in, 127, 143
influence of heredity on, 135–136
by Jerseys, 60, 109
by Kerry, 89–90
and lactation stage, 266
length of, 249–250
under official test vs. ordinary conditions, 244
persistency of, 247
and prepotency, 187
profitable, 249
records of, *see* Records
by Red Polled, 103, 104
relation of, to costs, 131–133
by Shorthorns, 97, 99, 100
variation of, in individuals, 128

Milk secretion, cause of, 135–136
heredity in, 135
hormones and, 269
Milk train, first, 3
Milking, before calving, 253
difficulties in, 261–262
frequency of, 261
of hard-milking cows, 261
of heifers, 260
by machine, 262–264
methods of, 260–261
Minerals, for calves, 207
functions of, in growth, 221–222
Morrison, F. B., 10

Nicking, 193
Nitrogen, important soil element, 8
Norfolk Polled, *see* Red Polled
Normans, use of cheese by, 2
Nutrition, effect on growth, 220

Ohio Experiment Station, 9, 203
Outcrossing, 191

Palatability, of ration, 223
Pan-American Exposition, 1901, 88
Pastures, for Ayrshires, 47, 75
for Brown Swiss, 80
for French-Canadian, 89
for Holsteins, 47, 75
for Jerseys, 47, 54–55, 75
for Kerry, 89
rotation of, Holland, 45
Pedigree, acquiring knowledge of, 234
as aid to sales, 238
in bull selection, 167
consideration of, 188
misuse of, 193
no guarantee in, 169, 184
value of, 183
Pennsylvania State College, 230
Pens, for calves, 207, 210–211
Phosphorus, 8
Pneumonia, 207
Potassium, 8
Prices, stabilized by distribution, 3–4
Prince, 66
Prolactin, 135
Protein, functions of, in growth, 220, 221
importance of proper supply, 5–7
Pure-breds, advertising, 233
breeders of, classes, 231
code of, 233
suggestions to, 237
business side of, 228
culling, 236
definition of, 20, 227
exhibiting, 234
fads in, dangers of, 236–237
vs. grades, 230
gradual development of, 232
naming, 235
number of, 229
possibilities of, 231
registration of, by breeds, 227, 228
selling, on consignment, 239–240
by mail, 237
by public sale, 239
Purdue Experiment Station, 9

Rations, for calves, 204, 209, 223
after calving, 255
for dry cow, 253
liberality of, 224
palatability of, 223
in relation to milk production, 136
Records, adding, 148–150
as aid in feeding, 145
of ancestry, 227
of cow's profitability, 250
for evaluating milkers, 147
of fat yield, 148
forms of, 148, 149, 152, 153
in herd building, 116–117
interest in, 147
official vs. ordinary, 273
overestimating, 194
permanent, 150
plans for, 144–145
purpose of official, 229
reasons for, 145–147
reveal sickness, 146–147
use of, in bull selection, 169
in cow selection, 140
of yearly production, 272
Red Polled, advanced registry of, 103
as beef producers, 103
characteristics of, 102
compared to Ayrshire, 103
to Holstein, 103
to Shorthorns, 103
development of Polled character, 100–101
importation and distribution of, U.S., 101
leading cows of, 104
milk production of, 103
origin and development of, 100

Red Polled Cattle Club of America, 102, 103
Register of Merit, 61
Registration, 227. *See also* Advanced registry
Roughage, breed differences in use of, 111
for calves, 204
utilization of, by livestock, 11

Sales, consignment, 239–240
individual public, 239
of Jerseys, 56
by mail, 237–238
of surplus stock, 113–114
use of pedigree in, 193, 238
Salt, for calves, 207
requirements of cows, 258
Sanitation, importance in calf raising, 214–215
Score card, approved by American Dairy Science Association, 37–38
for Ayrshires, 35
for Guernseys, 35, 65
history of, 34, 35
for Holsteins, 35
for Jerseys, 35
use of, 35–38
Scours, in calves, 205, 211
Scrub, definition of, 20
Seasonal variation in production, 266
Secretion, *see* Milk secretion
Selection, factors in individual, 143–144
fallacies of, 141
importance in sire, 158
importance of, 183
methods of, 140
necessity of, 127
by records, 140, 157
of sire, 165–169
by type, limits of, 140
Separator, centrifugal, 3, 206
Sex determination, 186
Sheds and shelters, 246
Shorthorns, advanced registration of, 99
breed characteristics of, 97
breeders' association, 99
calves of, 97
birth weight of, 201
compared to Red Polled, 103
cross breeding of, 194
dual-purpose, 92
early American development of, 96
early breeders of, 96
Bakewell, 18, 96
Bates and Booth, 96
Colling brothers, 18, 96
Cruikshank and Duthie, 96
English breeders of, 96
history of, 44, 95–96
in-breeding of, 189, 190
in England, 99
influence of other breeds on, 18, 44, 71, 97
milk records of, 100
origin of, 16, 95
persistency of production of, 99
Silos, in round barns, 283
Simmenthaler breed, 17, 79
Sires, breed history made by, 163–164
importance of, 158, 163
one-half the herd, 158–159
proved, 169–171
See also Breeding
Skim milk, changing calves to, 205
composition of, 203
pasteurizing, for calves, 205–206
Society for the Promotion of Agriculture, 72
Soil, fertility of, and agricultural cycle, 7–8
important elements of, 8–9
relation of dairying to, 8
Stables for cows, 280–297. *See also* Barns
Stanchions for calves, 211
State experiment stations, and record keeping, 148
Steer and cow compared, 10–11
Stephen, S. S., 55
Suffolk Polled, *see* Red Polled

Teats, of Ayrshire, 74
chapped, 262
score-card points for, 38
Teeswater breed, 44, 71
Testing, advanced and official, 228
of cattle, 194–195
by dairy herd improvement associations, 154–156, 229
experiment stations' records of, 229
limitations of individual, 154
methods of milk, 147
at monthly intervals, 144
most satisfactory plan of, 145
purpose of official, 229

Testing (*Cont.*)
value of, 194
See also Advanced registry
Ties and stanchions, 211, 292
Tuberculosis, 115, 117, 118, 119, 201
Type, dairy, *see* Dairy type

Udder, of Ayrshire, 74
of Brown Swiss, 81–82
caked, 204. *See also* Mastitis
condition of, at calving, 254, 255
description of, 31–34
development of, in dairy type, 24, 27
of Jersey, 56, 57
milk veins and wells of, 24, 30, 31, 38
score-card points for, 38
U.S. Dept of Agriculture, 196, 263

Veal, classification of, on market, 213
feeding for, 214
production costs of, 212
returns in, 212
suitability of Holstein calves for, 49
Ventilation, fan or forced, 296
King system of, 295
window, 296
Vitamins, A, D, 6, 204, 205, 222–223
function of, in growth, 222
in milk, 6

Water, amount of, 256–257
in barns, 257, 293
for calves, 207
individual drinking cups for, 257
sources of, 256
warming, 257
Waukesha Guernsey Breeders' Association, 113
Weaning calves, 208, 209
World's Fair, Chicago, 1893, 56
St. Louis, 0904, 56

Year Book of Agriculture, 1936, 5

KEY TO CHECK-UPS AND REVIEWS

See instructions on page iv of "What the Book Is About and How to Use It."

Check-Up 1

1, d; 2, c; 3, a, b, c, d; 4, c; 5, a; 6, b; 7, a, b, c.

Check-Up 2

1, a; 2, b; 3, b; 4, a; 5, d.

Check-Up 3

A: 1, T; 2, F (two); 3, T; 4, F (large); 5, T; 6, T; 7, F (1700's); 8, F (not to develop); conclusion, c.

B: 1, circle; 2, underscore; 3, underscore; 4, no mark; 5, circle; 6, circle; 7, no mark; 8, no mark; 9, no mark; 10, underscore; 11, underscore.

C: 1, D–P; 2, D; 3, D; 4, X; 5, D–P; 6, X; 7, D; 8, D–P; 9, D; 10, X; 11, B; 12, B; 13, D; 14, B.

Check-Up 4

A: 1, a; 2, a; 3, a, b, c; 4, a, b; 5, b, c; 6, a, d; 7, a, b, c; 8, a; 9, a, b; 10, a, b; 11, a, c; 12, a, c; 13, b, c; 14, a, b; 15, b, c.

B: see page 36.

C: Fig. A, perfect score; Fig. B, 0 score; Fig. C, I. A. 1, 2; 2, 4; 3, 3; 4, 3; 5, 4; B. 6, 4; 7, 2; 8, 3; 9, 3; II. 10, 8; 11, 2; 12, 4; III. 13, 1; 14, 4; 15, 10; IV. 16, a, 6; b, 5; c, 2; 17, 7; a, 3; 18, 2.

Check-Up 5

A: 1, Holland; 2, largest; 3, best; 4, larger; 5, lower; 6, Shorthorn; Ayrshire; 7, New York, Wisconsin, Pennsylvania; 8, rich, level; 9, veal production; 10, 345 lbs.; 11, small; 12, small.

B: 1, N; 2, Y; 3, N; 4, Y; 5, N; 6, N; 7, Y; 8, Y; 9, N.

Check-Up 6

A: 1, T; 2, T; 3, F; 4, T; 5, T; 6, F; 7, F; 8, T; 9, T; 10, F; 11, F; 12, T.

B: 1, Y; 2, Y; 3, N; 4, Y; 5, N; 6, Y; 7, N; 8, Y; 9, Y.

Check-Up 7

A: 1, a, b; 2, b; 3, b; 4, a, b; 5, b, c; 6, b; 7, c; 8, c.
B: 1, Y; 2, N; 3, N; 4, Y; 5, Y; 6, Y; 7, N; 8, N; 9, N.

Check-Up 8

A: 1, T; 2, T; 3, T; 4, T; 5, T; 6, F; 7, T; 8, F; 9, F; 10, T; 11, F; 12, T.
B: 1, Y; 2, Y; 3, Y; 4, N; 5, Y; 6, Y; 7, N; 8, Y; 9, N; 10, N.

Check-Up 9

A: 1, a; 2, b; 3, a, b, c; 4, c; 5, c; 6, a; 7, c; 8, c.
B: 1, Y; 2, Y; 3, N; 4, Y; 5, Y; 6, N; 7, Y; 8, N.

Check-Up 10

A: a, 2; b, 4, 8; c, 1; d, 1; e, 3; f, 5; g, 2; h, 6; i, 7; j, 7.
B: 3.

Check-Up 11

A: 1, b; 2, c; 3, a; B: draw line through 2, 3, 4. C: 1, 3, 7.

Check-Up 12

1, T; 2, F; 3, T; 4, F; 5, T; 6, T; 7, F; 8, T; 9, T; 10, T; 11, T; 12, F.

Check-Up 13

A: 1, b; 2, a, b; 3, b, c, d; 4, b.
B: 1, a, b, c; 2, a, c, b; 3, a, b, c; 4, c, a, b.

REVIEW CHECK-UP 1

1, T (6); 2, T (6); 3, F, higher (6, 7); 4, F, cows (10); 5, F, last (7); 6, T (7); 7, F, roughage (11); 8, T (11); 9, F, year-round (12); 10, F, Holland (16); 11, T (17); 12, F, England (18); 13, T (18); 14, T (19); 15, F, is not (24); 16, T (25); 17, F, natural (26); 18, F, bad (28); 19, T (30); 20, T (31); 21, F, poor (32); 22, F, oldest (44); 23, T (44); 24, T (46); 25, T (46); 26, T (47); 27, F, good (49); 28, F, 3.45 (49); 29, T (50); 30, T (54); 31, T (54); 32, F, east and south (56); 33, T (57); 34, F, poor (59); 35, T (60); 36, T (64); 37, T (64); 38, F, pink (66); 39, T (71); 40, T (73); 41, F, long (73); 42, F, is not noted (75); 43, F, often (79); 44, T (83); 45, T (95); 46, T (99); 47, F, beef (97); 48, T (102); 49, T (107); 50, T (106); 51, T (110); 52, T (110); 53, T (111); 54, T (115).

Check-Up 14

A: Cross out 1, 4, 5, 8, 12.
B: 1, b, c; 2, a, b, c; 3, b, c.

Check-Up 15

1, a; 2, b; 3, c; 4, a; 5, b; 6, a; 7, c; 8, a; 9, c; 10, c; 11, a; 12, c.

Check-Up 16

1, T; 2, T; 3, T; 4, F; 5, T; 6, T.

Check-Up 17

A: 1, a; 2, a; 3, a, b, c; 4, a, b; 5, c; 6, a, c; 7, a; 8, a; 9, b; 10, b; 11, c; 12, a, b; 13, b; 14, a; 15, b.

B: 1, VI; 2, VI; 3, SI; 4, VI; 5, SI; 6, VI; 7, VI; 8, U; 9, VI; 10, U; 11, U; 12, SI; 13, VI; 14, U.

Check-Up 18

1, T; 2, F; 3A, T; 3B, T; 3C, T; 4, T; 5, T; 6, T; 7, F; 8, T; 9, T; 10, F; 11, F; 12, F; 13, F; 14, F.

Check-Up 19

1. Mistakes a, k, c; Remedies c, g, i. 2, d, c, f; f, a, l. 3, j, h, c; l, g, m.

Check-Up 20

A: 1, a, b; 2, a; 3, c; 4, a, b, c, d; 5, c; 6, a, b, c; 7, a; 8, a, c; 9, c; 10, b; 11, a; 12, a, b, c; 13, a; 14, c; 15, a.

B: first year, b, c, d, f, g, h, m, n; second year, c, d, e, f, g, h, i, k, m, n, o.

Check-Up 21

A: 1, growth; 2, weight, height at withers; 3, internal, external; 4, feeding; 5, carbohydrates, proteins; 6, green pasture, sunlight; 7, liberality of the ration, age at calving.

B: 1, b, a, c; 2, b, c, a; 3, c, b, a, x; 4, x, x, a.

Check-Up 22

A: 1, b; 2, c; 3, a, b, c; 4, c; 5, a, b, c, d.

B: characteristics, a, P; b, P; c, N; d, N; e, N; f, N; g, UN; h, N; i, P; j, N; Aptitudes, a, UN; b, N; c, UN; d, N; e, N; f, N; g, UN; h, UN; Attainments, a, UN; b, UN; c, UN; d, UN; e, N; f, N; g, N.

Check-Up 23

A: 1, AT; 2, AT; 3, X; 4, X; 5, AT; 6, UC; 7, AT; 8, UC; 9, AT; 10, AT; 11, UC; 12, AT; 13, UC; 14, AT; 15, UC; 16, AT; 17, UC; 18, AT; 19, X; 20, AT.

B: 1, 1½; 2, 1½; 3, 2–6; 4, 4–5; 5, 4–5; 6, 6; 7, 3; 8, 10; 9, 8.

Check-Up 24

A: 1, b, c; 2, b, c, d; 3, a, b; 4, a, c; 5, a, b, c; 6, a, b, c.

B: e, x; f, x; k, x.

Check-Up 25

1, a, c, d, f; 2, a; 3, a; 4, c; 5, a.

Check-Up 26

A: a, 1, 2, 3, 4, 5, 6, 7; b, 1, 4, 8.

B: 1, T; 2, T; 3, T; 4, T; 5, F.

C: cross out 1, b; 2, a, d; 6, a, f, i.

D: cross out b, d, e, f, g, h, i, m, n, o.

Check-Up 27

A: cross out 2, 3, 5, 9, 10, 13.

B: 1, c; 2, a; 3, b; 4, b; 5, b; 6, a; 7, a; 8, b.

C: 1, a, L; b, L; c, A; d, A; e, L; f, A; g, A; h, A; i, A; j, A; 2, a, L; b, A; c, A; d, L; e, A; 3, a, A; b, L; c, A; d, L; e, A; f, L; g, A; 4, a, L; b, A; c, A; d, L; e, A; f, A; g, A; 5, a, L; b, A; c, A; d, A; e, L; f, A; g, A; h, A.

Check-Up 28

A: 1, a; 2, a; 3, a, b, c; 4, a, b, c; 5, a.

B: 2,650,000 lbs.; $875; $875; $312.50; $875. D, 1. D; 2, X; 3, X; 4, D; 5, X; 6, X; 7, D; 8, D; 9, X; 10, D.

REVIEW CHECK-UP 2

1, T (127); 2, T (140); 3, F, less (141); 4, F, some (130); 5, F, frequently (133); 6, F, cannot overcome (134); 7, F, does need (141); 8, F, there is no relation between yield and test (142); 9, F, less (142); 10, T (143); 11, F, is an organization for testing milk production of the members' cows (154); 12, T (159); 13, F, at birth a cow has her inheritance for better or worse (158); 14, T (159); 15, F, all herds should use pure-bred bulls (162); 16, F, it is a very bad idea and frequently results in both low yield and low test (193); 17, F, are not (165); 18, F,

the more difficult (165); 19, F, less, the bull's off-spring is likely to revert to the family average (168); 20, F, is no guarantee but an indicator (169); 21, F, age does not affect prepotency (171); 22, F, a proved bull is one whose daughters have made good records (169); 23, F, a bull used for breeding should never be fat (173); 24, F, more vicious (175); 25, F, Mendel's law explains the mode of inheritance (181); 26, T (183); 27, F, impossible, no two individuals are identical (183); 28, T (183); 29, T (184); 30, T (183); 31, T (188); 32, F, inbreeding is breeding closely related animals; line-breeding, more distantly related animals (191); 33, F, outcrossing (191); 34, F, cross-breeding (191); 35, T (203); 36, F, least (204); 37, F, colostrum is the first milk after a cow freshens (204); 38, F, cannot, good veal requires milk (214); 39, T (223); 40, T (225); 41, T (227); 42, T (228); 43, F, grades (230); 44, T (229); 45, T (243); 46, F, less milk (244); 47, T (249); 48, T (252); 49, T (253); 50, T (256); 51, F, involuntary (260); 52, T (261); 53, T (261); 54, F, often does (263); 55, F, medium or large (265); 56, T (266); 57, F, higher (266); 58, F, cannot cause, inherited ability is an absolute limit (269); 59, F, the least (270); 60, T (275); 61, F, is not protected, a good dairy cow is thin when milking (280); 62, T (280); 63, F, warmer (285); 64, F, less clean (289); 65, F, cement (290); 66, T (292); 67, F, drier (295); 68, T (301); 69, T (302); 70, F, an advantage (304).